

SPECIAL ARTICLE

ESMO/ASCO Recommendations for a Global Curriculum in Medical Oncology Edition 2023

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The European Society for Medical Oncology (ESMO) and ASCO are publishing a new edition of the ESMO/ASCO Global Curriculum (GC) with contributions from more than 150 authors. The purpose of the GC is to provide recommendations for the training of physicians in medical oncology and to establish a set of educational standards for trainees to qualify as medical oncologists. This edition builds on prior ones in 2004, 2010, and 2016 and incorporates scientific advances and input from an ESMO/ASCO survey on GC adoption conducted in 2019, which revealed that GC has been adopted or adapted in as many as two thirds of the countries surveyed. To make GC even more useful and applicable, certain subchapters were rearranged into stand-alone chapters, that is, cancer epidemiology, diagnostics, and research. In line with recent progress in the field of multidisciplinary cancer care new (sub)chapters, such as image-guided therapy, cell-based therapy, and nutritional support, were added. Moreover, this edition includes an entirely new chapter dedicated to cancer control principles, aiming to ensure that medical oncologists are able to identify and implement sustainable and equitable cancer care, tailored to local needs and resources. Besides content renewal, modern didactic principles were introduced. GC content is presented using two chapter templates (cancer-specific and non—cancer-specific), with three didactic points (objectives, key concepts, and skills). The next step is promoting GC as a contemporary and comprehensive document applicable all over the world, particularly due to its capacity to harmonize education in medical oncology and, in so doing, help to reduce global disparities in cancer care.

Keywords: Global curriculum, medical oncology, training requirements, learning objectives, didactic principles

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decades, medical oncology gained an important and independent role in multidisciplinary cancer care. With the increasing internationalisation of health care as well as the increased exchange of specialists and knowledge across borders, the European Society for Medical Oncology (ESMO) and ASCO identified the need for a set of international recommendations for the clinical training of physicians to qualify them as medical oncologist. Patients, wherever they live, should have a chance of receiving the best possible, evidence-based treatment from well-educated physicians.

In 2004, a joint ESMO/ASCO Task Force produced the first outline for a Global Core Curriculum (GCC) for training in medical oncology. This outline was subsequently distributed to universities as well as medical oncology societies and was simultaneously published in the *Annals of Oncology* and the *Journal of Clinical Oncology*.^{2,3} The GCC was updated in 2010 with the change in the title from “Global Core Curriculum” to “Global Curriculum.”^{4,5} This was based on the observations that all curriculum recommendations might not be implementable in some countries, due to different priorities, needs, and resources around the globe. In 2016, the third edition of Global Curriculum (GC) was developed and published by the Global Curriculum Working Group (GC WG) which evolved from the GC Task Force.⁶ Each of the GC editions introduced updated information and skills that medical oncologists need to know and master, to be able to implement them in their everyday clinical practice.

The GC Task Force also produced a Log Book as a support tool for medical oncologists in training and their supervisors with the purpose of keeping a record of oncology trainees’ educational programmes and their progress, at the same time providing mentors a tool to assess the mentees’ performance. Each edition of the GC was accompanied by a corresponding Log Book. The third Log Book (edition 2017) corresponds to the 2016 GC and is available on the ESMO and ASCO websites.^{7,8}

Interest in using the ESMO/ASCO GC outline has increased considerably since its inception, as evidenced by translations in 11 languages. It is also used as a model for the development of the speciality of medical oncology in several countries around the world. In 2011, the European Commission based its formal recognition of medical oncology as a medical speciality on the recommendations of the ESMO/ASCO GC.⁹

A global survey conducted by ESMO/ASCO GC WG in 2019 identified a high rate of medical oncology recognition and GC adoption worldwide.¹⁰ Based on this survey, medical oncology has been recognised as a standalone speciality or sub-speciality in 75% of responding countries, without major differences observed around the globe. GC has been adopted, either fully or partly, into training programmes of two thirds of countries with recognised medical oncology specialisation. In addition, GC has also been adapted in some countries with mixed training in haemato-oncology or clinical oncology. It is encouraging that despite being ambitious and complex, GC remains highly applicable at global level. One of the main reasons for this is that it has been updated in close collaboration with the colleagues working on medical oncology

training programmes worldwide. Many of them provided significant contributions to all ESMO/ASCO GC editions as co-authors and editorial board members.

Significant advances in medical oncology continue to occur at a very rapid pace. Since publication of the 2016 edition of the GC, there has been an explosion of new therapies: new targeted agents, increasing indications for immunotherapy, advances in cellular therapy, as well as continuing refinements in molecular pathology and imaging. The increased personalisation of cancer therapy, introduction of multidisciplinary treatment approaches, and widespread adoption of digital technology, as well as recognition of the need to reduce barriers to cancer care delivery, have necessitated changes in how we train future generations of oncology specialists. The standard and special requirements for training in medical oncology stemmed on previous GC editions²⁻⁶ have been updated. While many of the disease state chapters required only minor revision, others needed significant revisions reflecting a substantial shift in the way patients are diagnosed, treated, and followed.

In order to simplify and standardise each disease chapter, the format was reorganised based on three didactic principles (objectives, key concepts, and skills) and separated templates for cancer-specific or non-cancer-specific chapters were used. It is anticipated that this new format will provide clarity for both the faculty and trainees regarding topics that are important to understand and master. For cancer-specific chapters, a common objective on ability to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment, and counsel patients with particular cancer will be outlined in the preface. Each chapter will provide updated key concepts with the references to supplement the key concepts and skills. At the completion of their training, it is expected that the trainee will be able to perform specialist assessment and guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with each type of cancer along the disease continuum.

With regard to content, multiple changes and innovations have been incorporated in the GC 2023, including:

- updating the sections on educational programme to reflect the techniques and teaching environment used by users of the GC;
- updating and expanding sections on cancer epidemiology and prevention;
- expanding the therapy sections to include options which have only recently become available;
- significantly revising sections on pathology, molecular pathology, laboratory medicine, imaging, translational research, and principles of personalised cancer medicine, which acknowledges the substantial advances in each of these areas;
- combining and expanding the sections in prior versions dealing with unique populations of patients into one unified chapter discussing the management and treatment of specific populations;

- adding a section on emergencies in oncology;
- adding a section on patient education to the standalone chapter on psychosocial aspects of cancer, which acknowledges the important role patients play in the management of their cancer;
- adding an entirely new section on cancer research with subsections on translational and clinical research, research ethics, and statistics;
- adding a new section on cancer control which broadly covers health care systems, technology, team-based care, access to health care, equity principles, and global cancer control;
- cancer care in low resource environments was deleted as a stand-alone chapter—aspects of this content were included in other existing chapters, such as cancer control, cancer prevention, and cancer epidemiology.

Several basic skills exist that are of importance to all clinicians and patients; therefore, separate chapters/sections have been revised and enhanced:

- integration of palliative or supportive care measures;
- consideration of psychosocial aspects of care including communication skills;
- survivorship issues.

Core references provided for each chapter in the GC 2023 will be basic or review articles and are not intended to be all encompassing. Faculty and trainees are encouraged to take full advantage of the extensive medical literature available from many sources, including ASCO and ESMO. In addition to the chapter-specific references, a link to ESMO, ASCO, or NCCN guidelines and some other online ESMO and ASCO educational materials will be provided.

Although the GC 2023 is very comprehensive, it does not claim to be a textbook. Moreover, it is the intention of the GC to represent a meticulously structured collection of requirements to be fulfilled in order to qualify as medical oncologist. A corresponding Log Book for the documentation of the assessment of the learning progress according to the GC 2023 will follow.

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2. STANDARD REQUIREMENTS FOR TRAINING IN MEDICAL ONCOLOGY

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The training requirement to specialise in medical oncology encompasses a minimum of 5 years of clinical and didactic activities, beginning with training in internal medicine for 2-3 years, followed by a training programme in medical oncology for an additional 2-3 years. Structured rotations within different internal medicine disciplines allow trainees to acquire basic knowledge and skills in internal medicine, which is an essential foundation for speciality training. The subsequent medical oncology training programme should be conducted with a well-defined curriculum in medical oncology and committed faculty.

The training programme in medical oncology must include full-time clinical activities in the diagnosis and management of a broad spectrum of neoplastic diseases comprising solid tumours and haematologic malignancies. Trainees should have access to a wide variety of disciplines in oncology, including general surgery and surgical subspecialties, radiation oncology, pathology, laboratory medicine, diagnostic radiology, psycho-oncology, palliative and supportive care, as well as epidemiology, molecular biology, and rehabilitation.

Full-time clinical training means that the trainee's professional time and effort during a standard working week is

dedicated to clinical activities, defined as patient care and education. These may include the primary care of patients with cancer on the general medical or on designated medical oncology inpatient units, oncology outpatient clinics and day care units, regular oncology rounds, oncology consultations, and performance of interventional procedures as well as a review of imaging, pathology, molecular pathology, and other diagnostic materials. Trainees should actively take part in multidisciplinary tumour board meetings on a regular basis. Attendance of national and international meetings and exchange of evidence-based knowledge between peers should be encouraged. Reading relevant literature and active participation in journal clubs should be part of the curriculum. Sufficient access to all these activities should be provided.

Clinical activities should also include care for patients enrolled on clinical trials. To ensure adequate understanding of medical evidence, active involvement in clinical and translational research activities should be included, whenever possible. Dedicated time for clinical research activities of a maximum of 6 months may be counted toward the total training period of at least 5 years. Research experience of longer duration, including international training, is strongly recommended, especially for oncologists who wish to pursue an academic career.

3. SPECIAL REQUIREMENTS

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Kathryn Bollin

Jill Gilbert

on behalf of the ESMO/ASCO GC Working Group

3.1. Programme Leader/Director of Medical Oncology Training Programme

The medical oncology programme leader (or director of medical oncology training programme) must be qualified to supervise and educate trainees in medical oncology. Thus, the leader must be certified in medical oncology or possess equivalent qualifications. The leader will have a major commitment to the training programme and related activities, and must be based at the primary training site of the medical oncology programme.

The programme leader will document completion of medical oncology training by the trainee. The trainee will maintain a record of his/her training that the programme leader will countersign, as appropriate, to confirm the satisfactory fulfilment of the required training experience and the acquisition of the competencies that are gained in the speciality curriculum. The record will remain the property of the trainee and must be signed at the annual reviews by the responsible programme leader/director of the medical oncology training programme.

3.2. Faculty

3.2.1. Faculty Members

The medical oncology programme faculty must include a minimum of three full-time, qualified teaching faculty

members, including the programme leader. All faculty members must be certified in medical oncology or possess equivalent qualifications. Each of the faculty members must devote a minimum of 10 hours per week to teaching, clinical work, or other scholastic activities. Faculty must actively participate in the critical evaluation of performance, progress, and competence of the trainees.

3.2.2. Faculty Standards

The teaching staff must demonstrate an interest in teaching and set an example for trainees by documented engagement in the following pursuits: actively sharing the personal experience of working in a medical oncology clinical practice and multidisciplinary team; continuing his/her own medical education; active membership in regional, national, and international scientific societies; ideally active participation in scholarly activities; and presentation and publication of scientific studies.

3.3. Educational Programme

The educational programme in medical oncology must be organised to provide training and experience at a level high enough for the trainee to acquire the competency of an independent specialist in the field. The programme must emphasise scholarship, self-instruction, development of critical analysis of clinical problems and the ability to make appropriate decisions, in addition to active involvement in regularly scheduled conferences and multidisciplinary clinics and/or tumour boards. The educational goals set by the programme should be formalised into a curriculum which is routinely updated and provided to trainees by the programme leader.

The curriculum should at least cover all aspects of cancer care, from basic oncology science, epidemiology, diagnostics, multimodality treatment, supportive and palliative care to genetic counselling, psycho-oncology, cancer research, and cancer control principles.

The programme should foster all aspects of the roles required of an oncologist, including being an effective communicator with patients, a collaborator in the treatment team, a manager of the health care system, a health advocate not just for the patient but for the community, and a scholar with lifelong commitment and high professional ethics and standards. Appropriate supervision of the trainees must be provided for the duration of their educational experience. Evaluation of trainees, in addition to evaluation of faculty, the training programme, and training facilities is strongly recommended.

The following principles require special emphasis:

3.3.1. Educational Environment

Medical oncology training programmes must provide an intellectual environment for acquisition of the knowledge, skills, clinical judgement, and attitudes essential to the practice of medical oncology in the context of multidisciplinary care. This objective can only be achieved when appropriate resources and facilities are available. Service

commitments must not compromise the achievement of educational goals and objectives.

3.3.2. Professionalism

Professionalism must be fostered during medical oncology training. In addition to mastering the comprehensive clinical and technical skills of the consultant medical oncologist, trainees are encouraged to participate in the educational activities of professional organisations, community programmes, and institutional committees. By the end of training, trainees should be able to intervene and use appropriate resources to prevent and manage professionalism lapses and dilemmas in self and others. The program should foster accountability and conscientiousness. This includes the ability to perform tasks in a timely manner with appropriate attention to detail. Professionalism training should also include the ability to develop a plan to optimise personal and professional well-being.

3.3.3. Responsibility

Lines of responsibility must be clearly delineated for the trainees in medical oncology. Specifically, the programme must delineate trainee responsibility for patient care, progressive responsibility for patient management and graded supervision. This encourages the transition from an early to an advanced learner.

3.3.4. Update of Skills and Knowledge

Having obtained certification in medical oncology, the specialist is expected to update the acquired skills and knowledge by participating in continuing medical education programmes such as courses, symposia, or self-learning processes on a regular basis.

3.3.5. Interdisciplinary Teamwork

It is also essential to have the support of oncology nursing, pharmacy, emergency medicine, intensive care, rehabilitation medicine, palliative care medicine, and dietetic and psychosocial services so that the trainee can perceive the role of other specialties in the total care of the patient with cancer. Specifically, the trainee should be able to coordinate care of patients in complex clinical situations effectively using the roles of their interprofessional teams.

3.3.6. Institutional Requirements

3.3.6.a. Clinical setting. The clinical setting must include opportunities to observe and manage patients with a wide variety of neoplastic diseases on an inpatient and outpatient basis. The trainee must be given the opportunity to assume the continuing responsibility for acute and chronically ill patients in order to learn the natural history of cancer, the extent of the effectiveness of the various therapeutic programmes and how to impart information to the patient, including bad news. The scenario should include everything from prevention, treatment, to the long-term follow-up of patients with cancer and survivorship.

3.3.6.b. Hospital facilities. Modern inpatient, ambulatory care and laboratory facilities necessary for the overall educational programme must be available and functioning. Specifically, at the primary site, there must be adequate pathology services, modern diagnostic radiology services, resources for nuclear medicine imaging, blood banking and blood therapy facilities, and facilities for clinical pharmacology and tumour immunology/biology. A general surgical service and its support must be available, in addition to access to radiation therapy. The programme must also include a set-up for multidisciplinary tumour conferences and preferably participation in clinical trials according to guidelines on good clinical practice.

3.3.7. Facilities

It is the responsibility of the teaching institute to oversee that these facilities are available before a graduate medical education programme is initiated.

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4. COMPETENCIES REQUIRED IN THE CURRICULUM

4.1. Basic Science

4.1.1. Cancer Biology

Bently Doonan
Julia Lee Close
Joan Seoane

Objectives	To describe the cellular components, molecular mechanisms, and alterations in basic cell biology involved in the development of cancer and apply these concepts as they relate to disease, modes of action of specific drugs, significance of biomarkers, and the basis for adverse effects and acquired resistance to treatment
Key Concepts	Describe the process of cell division and tissue regeneration starting from the precursor stem cell to progenitor cell and finally to differentiated cells and how this process is under tight intracellular control Summarise the concept of a cancer stem cell/cancer-initiating
Continued	

Continued	
	cell and how a cell capable of regeneration, resistance to cell death, and endless replication leads to tumour development, relapse, and metastasis and how this poses difficulty in tumour eradication Recognise the importance of increased and unchecked cell division in tumours as it relates to available anti-cancer therapeutics which target various aspects of this process Explain that each tissue is comprised of a heterogenous amalgam of cells undergoing cell division or apoptosis at various stages depending on innate cellular mechanisms and environmental stressors Determine that these environmental stressors can lead to aberrations in cell division oversight, resistance to apoptosis, and loss of function in tumour suppressor genes that provide an evolutionary advantage for clonal selection of tumour cells over normal cells Recognise that response to therapy, likelihood and pattern of metastasis, and aggressiveness of disease are related to both site of origin and tumour histology, among other factors Demonstrate an understanding that the tissue of origin of tumours is also important to pathologic identification of cancer and that there is overlap between shared normal cell surface and intracellular proteins between cancer cells and normal cells Determine that interactions between tumour cells and the surrounding tumour stroma (extracellular matrix, fibroblasts, fatty tissue, vasculature, and immune cells) are vital to tumour survival, resistance to treatment, and development of metastasis Distinguish that cell-cell interaction between tumour tissue and surrounding microenvironment (including immune cells) utilize natural existing mechanisms for cell survival, communication, and metabolism which makes targeting these features difficult and results in off target toxicity to treatment Recognise that epithelial to mesenchymal, as well as other trans-differentiation changes related to changes in cell surface receptor and cell adhesion expression can lead to tumour migration and metastasis and that the reverse of this process leads to tumour establishment in new locations Explain that selective pressure induced by tumour targeted strategies (chemotherapy, radiation therapy, immunotherapy) leads to selection of resistant clones within the heterogenous tumour leading to resistance and treatment failure
Skills	Demonstrate the ability to: - Use information technology and data sets to understand the landscape of disease and patients' care - Critically discuss mechanisms of pharmacologic interactions within the cell and the potential adverse effects based on intracellular pathways of signalling and metabolism - Critically discuss the heterogeneous nature of tumours and selective environmental stress that results in tumour evolution, metastases, and therapy resistance

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4.1.2. Cancerogenesis

Bently Doonan

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Joan Seoane

Objectives	To be able to: - Critically interpret the process of transformation of a normal cell into a malignant cell through a series of genomic alterations and epigenetic modifications of oncogenes and tumour suppressor genes - Recognise interactions between oncogenes and tumour suppressor genes and the processes they control, and the impact on tumour biology, epidemiology, and molecularly targeted therapies
Key Concepts	Recognise oncogenes and tumour suppressor genes and their association with hereditary cancer and that the same genes can be responsible for malignant development of sporadic cancers Determine that proto-oncogenes are normally functioning genes that when subjected to genomic alterations or epigenetic modifications are converted to oncogenes altering their normal function or expression levels Recognise that alteration of a single oncogene works in a dominant fashion and can result in malignant transformation, whereas tumour suppressor genes work in a recessive fashion, so they require loss of two copies of gene for malignant transformation Demonstrate an understanding of Knudson's hypothesis of two-step loss of tumour suppressor function in retinoblastoma as a model for cancerogenesis Recognise that the tumour suppressor TP53 is the gatekeeper of the normal cell function and interacts with more than 500 intracellular proteins and that activation in normal cells results in apoptosis and that loss of function is seen in multiple malignancies and is correlated with aggressiveness and resistance to therapy Identify the common tumour suppressor genes associated with familial cancer syndromes, retinoblastoma (RB), Li-Fraumeni syndrome (TP53), Cowden syndrome (PTEN), and breast and ovarian cancer syndrome (BRCA1, BRCA2) Recognise retroviral infections and DNA transfections as classical models of identifying common tumour oncogenes, c-MYC, RAS, ALK, and the NTRK family, which are becoming actionable targets in treatment Identify the potential for chromosomal translocation and gene fusions that result in malignancy and the BCR-ABL fusion gene generated from translocation of chromosome 9 and 22 as a model for cancerogenesis Explain that there are multiple translocations that result in oncogene activation which are critical to tumour development, can be used for tumour identification, and are increasingly the targets of therapy Demonstrate an understanding of the well described pathway of colorectal cancer development where multiple sequential mutations and epigenetic modifications result in mutations in APC, resulting in polyp formation followed by oncogenic activation in KRAS leading to proliferation and finally loss of TP53 function Determine there are additional alterations in resistance to apoptosis genes, genes involved in cell cycle, DNA damage and repair mechanisms, and mitogenic signal transduction pathways that play a role in cancerogenesis and that a major focus of tumour identification and treatment relies on identification and targeting of these changes Identify the common environmental stresses and exposures that result in mutations leading to malignancy, including cigarette smoke, UV radiation, gamma radiation, heavy metals, radon, asbestos, and benzene among others Distinguish that common viruses can also lead to cancer development when paired with additional cellular alterations, most importantly is the relationship between human papillomavirus and cervical and squamous cell head and neck cancers Identify escape of the immune system as an important aspect of tumour survival Determine that genomic alterations are random and sequential

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	and that lead to intratumour heterogeneity that can evolve under environmental pressure such as therapies
Skills	Demonstrate the ability to: Discuss familial cancer syndromes and risks of subsequent malignancies based on genetic mutations Discuss and interpret environmental risk factors for malignancy development including common carcinogens and their respective cancers Counsel patients with this knowledge as a mechanism for appropriate risk reduction and appropriate population screening Understand the complexity of cancer and its evolving heterogeneity Understand the interaction of the immune system with cancer

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4.1.3. Tumour Immunology

Bently Doonan
Julia Lee Close
Andrew Furness

Objectives	To describe: The basic components of the immune system and the interrelationships between the host immune system and the tumour The immune surveillance postulate of anti-tumour immunity and mechanisms of immune evasion and commonly utilised immunotherapy strategies
Key Concepts	Identify the components of the cellular and humoral immune system and their differences Identify the difference between innate and adaptive immunity and the different components of each system and their interplay Distinguish the different classes of immunoglobulin molecules, their primary roles and location within the immune system, and the mechanism of class switching Express the components of immunoglobulins (Fab/Fc fragment, heavy/light chains, variable/constant domains, hypervariable region) Recognise the primary immunoglobulin manipulated for anti-cancer therapy is IgG and the mechanisms by which this molecule has effect (receptor blocking, opsonisation, ADCC) Explain the role of co-inhibitory and co-stimulatory immune checkpoint molecules, their function in prevention of host autoimmunity, how this is manipulated by tumours for immune evasion and how these are targeted Identify the components of the T-cell receptor complex, the homology with this structure and immunoglobulins, and the role of co-stimulatory molecules in T-cell activation Recognise the main differences between the human leucocyte antigen complex classes (HLA A, B, C v HLA DM, DO, DP, DQ, DR)

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	and their animal counterparts MHC Class I/Class II Identify the role and function of cytokines and chemokines and specifically those related to tumour growth, immune evasion, and those with anti-cancer properties Give examples of the major classes of immunotherapeutics for cancer: monoclonal antibodies targeting growth factor receptors, checkpoint inhibitors, cytokine therapy, tumour-infiltrating lymphocyte therapy, T-cell receptor therapy, CAR-T cell therapy, bi-specific antibodies and cancer vaccines Describe the innate immune system and its components and how tumours evade immune detection and the burgeoning role for targeting/manipulating these cells in anti-cancer therapy Identify the general use and efficacy of immune checkpoint inhibitor therapy across disease types and the difference between immune responsive (hot) tumour types and nonresponsive (cold) tumours Recognise the potential and promise of immunotherapy but the issues with broad application and general total population response rates of roughly 20%
Skills	Demonstrate the ability to: Apply the proper use of immunotherapy in management of disease and where these therapies fall in the stage of cancer treatment Predict common immune-mediated side effects to checkpoint inhibition therapy and the common side effects associated with cell-based strategies including CAR-T cell therapy and be able to differentiate the type of management needed based on symptom severity Discuss the complicated interactions of the immune system and tumour to patients and how immunotherapy works for their given cancer Differentiate between tumour progression, pseudo progression, and hyper progression to immunotherapy agents

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4.1.4. Molecular Oncology

Bently Doonan
Joaquin Mateo

Objectives	To describe: The central role of molecular alterations in cancer biology and evolution that play a role at all stages of tumorigenesis and are one of the largest areas of interest in pharmacologic targeting in cancer The increasing role for targeting tumour characteristics and molecular alterations that are shared among different cancer types and understand how these pathways relate to the mechanisms of action of certain anti-cancer drugs
Key Concepts	Distinguish commonly mutated tumour suppressor and oncogenes involved in tumour development and progression Explain the basis for therapeutic targeting of molecular mutations in tumours and the various mechanisms of pharmacologic intervention Define the importance of molecular oncology in the diagnosis, prognosis, and selection of therapeutic options in solid and

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	haematologic malignancies Describe the concept of tumour molecular heterogeneity and how tumour evolution results in molecular differences in different areas within the same tumour lesion or between different tumour lesions of a same patient Demonstrate an understanding that some molecular alterations will be present from the onset of the tumour cell, whereas others will emerge over time as a result of selective pressure Recognise there are shared molecular alterations across tumour types of different origin and that these mutations may result in common therapeutic targets across classes Demonstrate an understanding of the downstream signalling cascade of intracellular kinase transcription factors as this relates to therapeutic targets, treatment failure, and development of resistance Determine the concepts of pathway up/down regulation and molecular pathways cross-talk or co-regulation Recognise that beyond gene mutations, the activity of a relevant pathway may be modified by transcriptional or epigenetic regulation Interpret the secondary mutational mechanisms and epigenetic modifications tumours make in response to therapy that lead to treatment resistance Give examples of certain pathognomonic chromosomal translocations that define various lymphoid malignancies and how this can be used for diagnosis Determine the importance of tumour suppressor gene functional deficiency in terms of DNA repair mechanisms as a marker for sensitivity to poly (ADP-ribose) polymerase inhibition and DNA damaging agents Interpret advanced molecular testing through FISH, cytogenetic, and next generation sequencing as it relates to appropriate diagnosis and treatment planning Determine that mutation in <i>TP53</i> is the most common molecular alteration in cancer and conveys a worst prognosis than tumours with normal expression Recognise that though increasing in importance and frequency, the number of patients with targetable mutational changes with available therapeutic agents is very limited and most mutations are not currently targetable Identify that globally, infectious diseases are a major contribution to molecular alterations that lead to cancer with EBV, Hepatitis B and C, and HIV as major contributors to malignancy globally
Skills	Demonstrate the ability to: Apply the knowledge of biologic pathways to understand the drivers of cancer progression upon the presence of different molecular alterations Apply selection of advanced molecular testing of tumours for precise diagnosis and identification of therapeutic options Select molecular alterations associated with common familial cancer syndromes as a means for risk reduction in patients and their relatives

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4.2. Cancer Epidemiology

4.2.1. Global Cancer Statistics

Patti Gravitt

Michel P. Coleman

Objectives	To be able to identify major resources for assessing the global cancer burden To describe and differentiate cancer incidence, mortality, and survival
Key Concepts	Define a cancer incidence rate as the number of persons diagnosed with a registrable malignancy in a given country or region (state, province, etc) in a given calendar year, typically expressed per 100,000 population per year (see also Cancer Registries) Define a cancer mortality rate as the number of persons certified as having died with cancer as the underlying cause of death (a specific cancer, or all cancers combined) in a given country/region, again per 100,000 population per year (see also Cancer Registries) Distinguish between crude and age-adjusted incidence and mortality rates and understand when each metric should be used Demonstrate an understanding of the role of high-quality national or state-wide population-based cancer registries for producing reliable national and global statistics on cancer incidence, survival and mortality Demonstrate an understanding that cancer survival is a probability (not a rate) in the range 0-1, usually expressed as a percentage in the range 0%-100% for convenience (see also Cancer Registries) Recognise that survival estimates are only meaningful if the period when the patients were diagnosed and the duration of survival is stated (eg, the estimated 5-year survival of patients diagnosed during 2015-2019 was 75%; see also Cancer Registries) Demonstrate an understanding of why the mortality-to-incidence ratio (M/I ratio) is not a case-fatality ratio, and why its complement (1-M/I) is not a valid proxy for survival Demonstrate an understanding of the importance of age-standardisation for comparing incidence, mortality, and survival estimates over time, or between countries or population sub-groups Define and understand the interpretation of cumulative risk estimates Define the annual percentage change in incidence and mortality rates, and understand its interpretation for cancer trends Define age effects as variations in biologic and social changes in individuals over time, including physiologic changes, external exposure and social experiences accumulated over the lifespan Define period effects as the result of exposures that affect all age groups equally at a particular point in calendar time. These could include local, regional or global changes in environment, economics or social behaviours that are age-independent, as well as changes in how cancer data are coded, defined and collected that change at a fixed point or period in time Define cohort effects as the result of a unique exposure or experience to a group of subjects (eg, a birth cohort) as they move through time (eg, early life exposure to radiation effects of the atomic bomb in Japan)
Skills	Demonstrate the ability to: Use GLOBOCAN publications for estimates of cancer incidence and mortality worldwide Use CONCORD publications for estimates of cancer survival worldwide Perform calculation of age-adjusted incidence and mortality rates Use crude incidence and mortality rates as estimates of disease burden for resource allocation and planning Use age-adjusted incidence and mortality rates to compare cancer burden between populations Use trends and inequalities in population-based survival estimates to evaluate the overall effectiveness of health systems Use the average annual percentage change to evaluate impact of population or policy changes on the cancer burden over time

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Evaluate age-specific cancer rates and trends with an understanding of age-period-cohort effects to identify the root causes of change in cancer burden over time

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4.2.2. Cancer Registries

Michel P. Coleman

Patti Gravitt

Objectives

To describe:

A population-based cancer registry and its key functions
The relevance of cancer registry data in cancer control

Key Concepts

Recognise that population-based cancer registries capture a standardised minimum data set about the person, the malignancy, the treatment and the outcome
Demonstrate an understanding that population-based registries with high completeness and good data quality provide an unbiased picture of cancer epidemiology in their territory
Demonstrate an understanding that population-based registries combine data about each patient from many health care facilities to create a unique database of all residents in their territory who are diagnosed with a registrable malignancy
Demonstrate an understanding that most registries follow up with all registered patients to establish their vital status (alive, dead, lost to follow-up, emigrated) on a regular basis, and that these data are used to estimate population-based cancer survival
Demonstrate an understanding that cancer registration is a statutory requirement in many countries, and be aware of the position in your own country
Explain why hospital-based registries provide valuable information about the patients managed in that hospital (eg, caseload, investigations, follow-up, case-fatality ratios), but cannot usually provide a representative profile of cancer in the country or region where they are located
Define a cancer incidence rate as the number of persons

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diagnosed with a registrable malignancy in a given country or region (state, province, etc) in a given calendar year, typically expressed per 100,000 population per year
Define a cancer mortality rate as the number of persons certified as having died with cancer as the underlying cause of death (a specific cancer or all cancers combined) in a given country or region, again per 100,000 population per year
Demonstrate an understanding that cancer survival is estimated as a probability (in the range 0-1) from population-based data.
Understand that survival estimates are usually expressed as percentage in the range 0%-100%, for convenience
Recognise that survival estimates are only meaningful if the period when the patients were diagnosed and the duration of survival is stated (eg, the estimated 5-year survival of patients diagnosed during 2015-2019 was 75%)
Demonstrate an understanding that net survival is a population-based metric that reflects the survival of all patients in a country or territory, after correction for the risk of death from other causes, given that this competing risk of death is higher in elderly persons
Demonstrate an understanding that registries routinely publish cancer incidence and survival statistics for their territory by age, sex and calendar year, often by other variables such as stage at diagnosis, race/ethnicity, and socio-economic status
Define a case-fatality ratio as the proportion of persons diagnosed with a cancer who die within a specified period of time, usually a few weeks or months
Demonstrate an understanding why the mortality-to-incidence ratio (M/I ratio) is not a case-fatality ratio, and why the complement of the M/I ratio (1-M/I) is not a valid proxy for survival
Recognise that registries maintain the confidentiality and security of their data with electronic, physical, and managerial arrangements designed to reduce the risk of inadvertent disclosure to the absolute minimum
Demonstrate an understanding that population-based registries are a unique resource for research into the causes, incidence, management, and survival of patients with cancer, and into the quality of life of survivors (survivorship research)
Recognise why ethical or statutory approval is usually required for observational research using registry data without patient consent
Demonstrate an understanding why cancer registry data are an essential component of rational cancer control policy
Give examples of how cancer registry data have been deployed to formulate cancer control policies (eg, early diagnosis, screening, access to health care), and subsequently to evaluate the impact of those policies

Skills

Demonstrate the ability to:
Use cancer registry data to describe current patterns and past trends of incidence and survival in your country or region, or in a sub-group of the population
Interpret graphs and tables from registry data appropriately, to gain insight into the adequacy of cancer control plans and intervention programmes
Report information derived from cancer registry data accurately and in appropriate language to policy-makers, to advocate for relevant policy initiatives

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4.3. Cancer Prevention

4.3.1. Population Risk Factor

Larissa A. Korde

Nadir Arber

Objectives	To describe modifiable and non-modifiable risk factors for cancer and understand the underlying behavioural, biologic, and genetic mechanisms associated with risk To be able to discuss clinical and non-clinical strategies through which cancer risks can be modified
Key Concepts	Recognise family history patterns indicative of hereditary cancer syndromes Define modifiable cancer risk factors (eg, obesity, alcohol use, tobacco use, sun exposure, viral infections, air pollution) and discuss prevalence and trends worldwide Explain burden of cancer attributable to genetic risk and recognise appropriate screening and prevention measures for individuals identified with genetic predisposition to cancer Explain the burden of cancer attributable to modifiable risk factors overall and at specific anatomical sites (eg, breast, oesophagus, pancreas, kidney, intestine, uterus, ovary, gallbladder, stomach, brain, liver, blood, and thyroid), including prevalence and strength of association for each site Explain behavioural, biologic, environmental and genetic factors associated with weight gain, excess fat accumulation and obesity, and their societal, communal and individual consequences Recognise disparities in cancer risk between and within individuals with obesity Explain pathways, mechanisms, and alterations through which obesity, alcohol, and tobacco use support tumour growth Explain lifestyle modifications and preventive interventions (eg, medications, surgeries, diet, physical activity) and their impact on cancer incidence Define metabolically healthy obese phenotype and its risk for developing cancer Describe new areas of research and emerging hypotheses exploring lifestyle and environmental factors associated with cancer risk
Skills	Demonstrate the ability to: Communicate cancer population-wide and regional statistics appropriate to individual patients Evaluate a family history and refer for cancer genetic testing as appropriate Distinguish modifiable and non-modifiable risk factors associated with cancer, and explain burden of disease attributable to modifiable risk factors Apply and integrate scientific knowledge regarding modifiable cancer risk factors into clinical practice and patient counselling Explain and advise behaviour modification and other cancer prevention measures, including chemoprevention and risk-reducing surgery, where appropriate Counsel patients at genetic risk regarding appropriate screening and prevention measures

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4.3.2. Primary Prevention

Abenaa Brewster

Nadir Arber

Objectives	To be able to: Define programme for cancer prevention in average and high-risk populations for cancers that are preventable Define and describe types of preventive therapies, behavioural interventions, and surgical strategies, and list specific populations they are used in
Key Concepts	Identify existing behavioural interventions and local resources to address modifiable cancer risk factors Determine existing preventive therapies, eg, aspirin and endocrine agents, and human papillomavirus (HPV) vaccines and their indications for use Summarise existing tobacco cessation strategies Demonstrate an understanding of the management of high-risk dysplastic and proliferative lesions to interrupt the initiation or progression to invasive cancers Describe local and national public health efforts to promote community awareness of cancer prevention Recognise the impact of social determinants of health on disparities in cancer incidence Interpret direct to consumer genetic testing
Skills	Demonstrate the ability to: Define primary prevention and to explain relative risk, absolute risks and benefit/risk balance Participate in multidisciplinary care discussions in order to identify healthy individuals who should undergo risk assessment, genetic counselling and gene mutation testing and prevention counselling Discuss evidence-based cancer prevention guidelines, such as smoking cessation, improvement of dietary habits, maintenance of a healthy body mass index, that may alter an individual's risk for developing cancer Discuss and educate about preventive agents (when, how, whom to prescribe, and, most importantly, when to stop it), eg, aspirin use, endocrine therapies, and HPV vaccines that may alter an individual's risk for developing cancer Discuss and educate the public, decision makers and health care providers about evidence-based prevention approaches

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4.3.3. Secondary Prevention/Screening

Stephen Edge

Nadir Arber

Objectives	To describe: The role of secondary prevention in cancer control and prevention and the scientific basis for screening and case finding Regional, resource, and cultural factors that may affect cancer screening and prevention practises and the model of an Integrated Cancer Prevention Centre
Key Concepts	Demonstrate an understanding that screening is the testing and evaluation of a population of asymptomatic persons to distinguish between those who may have a disease and those who likely do not Demonstrate an understanding of the key characteristics of effective screening tests and strategies: Screening must be a serious condition for which detection in asymptomatic individuals may reduce the morbidity of the disease and its treatment and reduce long-term mortality from the condition The condition must be common enough to warrant screening the general population or of a defined at-risk group The screening test must have acceptable sensitivity and specificity The screening programme and test must be reasonable in terms of cost, be acceptable to people and safe Demonstrate an understanding of the concepts of risk-based screening and active case finding (ACF) and how the benefits and risk of ACF must be carefully balanced in developing and implementing ACF policies Give examples of state-of-the-art cancer screening tests and recognise that screening guidelines vary between organisations with varied perspectives and data interpretation Demonstrate an understanding of the most common cancer types in local/regional area that affect the population and the effective screening strategies for those cancer types Evaluate the direct and indirect costs of screening and the potential cost savings of an integrated prevention and early detection model Identify the resources and levels of access to cancer prevention and screening services in the region and community you serve Determine the key factors in implementation of one-stop prevention and early detection models, including scientific issues, personal, familial, and societal risk factors, and cultural issues to tailor appropriate diagnostic testing Demonstrate an understanding of the role of inherited susceptibility in cancer risk and the impact of inherited risk on cancer screening recommendations for affected persons Recognise the potential for precision medicine in future cancer screening and prevention
Skills	Demonstrate the ability to: Understand principles and criteria for implementation of screening tests (simple, safe, reliable, affordable, sensitivity, and specificity) Identify the value of screening and the relevant guidelines and the symptoms, specific markers, and epidemiologic factors

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important to consider in defining screening and diagnostic recommendations for specific cancer types based on the prevalence in the population, evidence of value, and resource availability

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4.4. Cancer Diagnostics

4.4.1. Laboratory Diagnostics

Alexa J. Siddon

Christopher A. Tormey

David R. Peaper

Objectives	To describe the general methodologies of laboratory testing in order to judiciously order appropriate tests To be able to appropriately use laboratory diagnostic testing for the diagnosis and follow-up of patients with cancer, as well as understand the limitations of testing
Key Concepts	Interpret laboratory testing in patients with cancer and those being evaluated for cancer Demonstrate an understanding of the role of laboratory testing for the diagnosis and management of patients including establishing disease prognosis and response to therapy Recognise the availability of relevant laboratory diagnostic tests and the application of those tests for specific clinical scenarios Describe the components and relevance of common laboratory tests, such as the complete blood count, comprehensive metabolic panel, and microbiology cultures Recognise the balance between utility and costs of diagnostic and prognostic laboratory testing, including biomarkers Recognise the balance among testing sensitivity, specificity, positive predictive value, and negative predictive value for different testing populations for diagnostic testing Recognise the importance of laboratory quality practises, including controls (positive, negative), assessment of data quality, and limitations of techniques Describe pertinent uses of relevant biomarkers in an appropriate clinical context Demonstrate an understanding of the appropriate sample type for various laboratory tests Recognise the importance of sample handling and processing Define adequate frequencies of repeat laboratory diagnostic analyses in different clinical settings Demonstrate an understanding of general microbial identification techniques and other infectious disease-related

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	testing modalities Distinguish current technologies, including molecular methodologies with emerging diagnostic applicability, such as polymerase chain reaction (PCR) and quantitative reverse transcription-PCR, interference with gene expression (small interfering ribonucleic acids, short hairpin ribonucleic acids, overexpression), the Clustered Regularly Interspaced Short Palindromic Repeats system, fluorescence-activated cell sorting, mass spectrometry, high-performance liquid chromatography, basic cytogenetic techniques (fluorescence in situ hybridisation and karyotype), immunohistochemistry, immunofluorescence, Sanger sequencing and next-generation sequencing, single-cell technologies, liquid biopsies: circulating tumour cells, circulating cell-free DNA
Skills	Demonstrate the ability to: Assess critically, interpret, and discuss specific laboratory parameters Evaluate costs of laboratory tests in relation to their clinical relevance Use laboratory findings and other diagnostic procedures in clinical decision making Discuss complex laboratory results with laboratory physician colleagues Discuss and interpret laboratory findings with regard to clinical consequences Explain the results of laboratory tests to patients and colleagues Understand the limitations of laboratory testing

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4.4.2. Pathology

Aldo Scarpa

Julie Steele

Objectives	To describe the pathologic diagnosis and report, and be able to explain the information and its associated management implications to the patient To describe the reasons behind, the basis and the implications of immunohistochemical and molecular analysis
Key Concepts	Demonstrate an understanding of the different tasks in pathology, including gross sampling, frozen section, histology, immunohistochemistry and molecular analyses Recognise the indications for and limitations of frozen section diagnostics and of the importance to wait for the definitive

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	diagnosis before starting a clinical action Evaluate pertinent history (including familial history of cancers), clinical findings and radiographic findings needed to make adequate pathologic diagnoses Demonstrate an understanding of the nomenclature of neoplasia (eg, adenoma v carcinoma, benign v malignant, low-grade v high-grade, dysplasia, in situ v invasive disease, carcinoma v sarcoma, etc) and knowledge of the local growth or metastatic potential of these different types of neoplasms Distinguish grading schemes in different types of tumours Interpret the current WHO classification of tumours and the importance of keeping up to date Interpret the current TNM staging system, and other staging systems used in particular tumours (eg, Ann Arbor for lymphoid malignancies) Describe metastasis and the different mechanisms of spread (eg, haematogenous, lymphatic, perineural, perivascular, and peritoneal) Determine particular microscopic features that have clinical relevance (eg, tumour budding in different cancer types, extranodal extension of nodal metastasis in different cancer types, etc) Define the indications for requesting a biopsy of a new lesion, and selection of the best site to perform the biopsy Determine the different procedures and the types of specimens that are obtained Determine the role of genetic and epigenetic alterations in malignant tumour formation and dissemination Determine the role of infectious agents in the development of some cancers and their potential influence of staging (eg, human papillomavirus in head and neck carcinoma) Determine predictive and prognostic factors—such as oestrogen receptor, progesterone receptor and human epidermal growth factor receptor-2—and how to interpret and use the results in forming a treatment plan Explain the use of immunohistochemistry (IHC) and next-generation sequencing (NGS) and particular markers in establishing diagnoses Describe the applications of IHC or NGS on whole sections of tumours, on microdissected areas or on tissue microarrays Identify the limitations of interpretation of IHC and NGS including the importance of internal and external controls and the importance of preanalytical variables such as fixation Classify molecular alterations in different classes of pathogenicity according to current guidelines of the American College of Medical Genetics and Genomics and the Association of Molecular Pathology Describe ethical, consenting, and storage procedures involved in biobanking, and the various techniques offered in association with them Recognise that many pathology departments have associated biobanks, which enable the collection of surplus diagnostic tissue/fluids from consenting patients
Skills	Demonstrate the ability to: Interpret the pathology report (including histopathology, IHC and molecular reports) and explain it to the patient Discuss the pathology report (including histopathology, IHC, and molecular reports) with the pathologist and the other members of the multidisciplinary team Incorporate the information contained in the Cancer Checklist (Synoptic Summary) into the current pathologic stage (eg, American Joint Committee on Cancer TNM) staging system Use the additional prognostic and predictive information contained in the Cancer Checklist to help formulate the best treatment plan for the patient Recognise a discrepancy or discordance in the pathologic diagnosis with the clinical findings and to discuss with the pathologist Use the information in the pathology report to develop the best treatment plan for the patient Use the information within the pathology report to formulate research projects to help answer gaps in our understanding of cancer and to propose improved therapeutic options

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4.4.3. Molecular Biology/Pathology

Amir Behdad

Caterina Marchiò

Objectives	To describe the role of genomic alterations in the pathogenesis of various neoplasms and to differentiate various types of genomic alterations and their impact in carcinogenesis and management of the disease To be able to acquire a basic technical knowledge of various genomic tests, used in patients with cancer and their specimen requirements
Key Concepts	Demonstrate an understanding of molecular biology (eg, properties of nucleic acid, structure of chromosome, DNA repair process, epigenetic changes, and omics) and basic pathways and signalling networks Recognise genomic findings that impact classification, prognostication and the treatment of various neoplasms Recognise that the role of genomic findings in classification of most neoplasms is in combination with morphologic and immunophenotypic findings Classify tiers of genomic variants, based on the available clinical evidence Give examples of various publicly available databases for annotation of variants Distinguish various types of pathogenic variants, including point mutations, rearrangements, and copy number alterations Demonstrate an understanding of the difference between an oncogene and a tumour suppressor and types of variants, considered pathogenic in each group (activating mutations versus truncating mutations) Explain how specimens are managed and how pre-analytical variables (eg, fixation, decalcification, contamination) may affect the performance of a molecular assay Define adequacy of tumour tissue sample for downstream molecular assays Evaluate critically new genomic technologies considering the downstream costs secondary to genomic analysis for the laboratory and the patient, including the costs associated with new technologies Evaluate basic tests characteristics, such as analytical sensitivity

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	and specificity, and distinguish them from clinical sensitivity and specificity Determine the advantage and limitation of the clinical diagnostic test modalities, including cytogenetics, flow cytometry, immunohistochemistry (IHC), fluorescence in situ hybridisation (FISH), reverse transcriptase polymerase chain reaction (RT-PCR), Sanger sequencing, next-generation sequencing (NGS), and gene expression panels Recognise internal and external quality control parameters of a molecular assay Recognise that within NGS there is a conceptual distinction between panel sequencing, exome sequencing and genome-wide sequencing Recognise that there are different types of assays that can be used in a laboratory, namely regulatory-approved assays, laboratory-developed assays with internal evidence for analytical validity and purely research assays Interpret guidelines/recommendation to refer to for biomarker evaluation
Skills	Demonstrate the ability to: Define genome, exome, metabolome and proteome Select the appropriate molecular test based on patients' needs Distinguish various genomic alterations (eg, point mutations, rearrangements, copy number alterations) and their pathogenicity as it relates to specific type of gene and neoplasm Select appropriate molecular tests based on tumour histology Recognise the circumstances when germline testing and genetic counselling is required and the appropriate tests Identify whether an assay requires DNA, RNA, or protein and how that impacts tissue requirements Predict the analytical sensitivity of an assay and suitability for minimal residual disease testing Recognise the scope and limitation of an assay (eg, single analyte, versus targeted multiple analyte panel, versus genome-wide assay) Interpret molecular pathology reports in conjunction with active discussion with pathologists and clinical geneticists whenever needed Report and contextualise a clinical case within a molecular tumour board

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4.4.4. Genetic and Genomic Testing

Albrecht Stenzinger

Yaolin Zhou

Objectives	To describe and communicate basic test performance, including knowledge of the underlying technology and methodology and appropriate fields of application To be able to accurately assess the clinical validity and clinical utility of genetic test results, appropriately discuss results with patients, and effectively communicate as part of a multidisciplinary team (eg, pathologists, clinical geneticists, and other stakeholders in a molecular tumour board)
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Key Concepts	Recognise that there are legal, ethical, and social implications of genetic testing Demonstrate an understanding for the patient's perspective (including preferences for testing, costs of the assay for the patient, and the potential need for additional follow-up testing or counselling) Distinguish among the different types of genomic assays that can be used in a laboratory: regulatory-approved assays, laboratory-developed assays, and research use only tests Distinguish among the diagnostic, prognostic, and/or predictive information that genomic tests may contain Determine the best approach for obtaining genetic data (eg, tissue and body fluids including blood such as liquid biopsy) Distinguish each test method and genomic test including test parameters (eg, sensitivity, specificity, accuracy, precision, and positive and negative predictive value) Classify genomic tests into next-generation sequencing (NGS) v non-NGS assays (non-NGS include in situ assays and single gene testing, such as different types of polymerase chain reaction [PCR]-based assays and Sanger sequencing) Recognise that NGS-based test can be differentiated according to their genomic coverage, ranging from small gene panels (usually covering hotspot regions of 20-50 major cancer genes) to large gene panels (around ≥ 1 Megabase genomic footprint) and whole exome (WES) as well as whole genome sequencing (WGS) Describe the approaches to NGS testing. With the exception of whole genome sequencing, target enrichment methods are used. Main methods are: hybrid capture, AmpliSeq, anchored multiplex PCR, and single primer extension Classify tissue-based genomic tests as tumour-only sequencing v parallel sequencing of the tumour and germline DNA (usually obtained from lymphocytic DNA in a blood draw) Recognise that tumour-only sequencing harbours genetic information from both somatic and germline DNA. Further work-up may be required if there are possible germline variants detected (eg, confirmatory germline testing and genetic counselling). For whole exome and whole genome sequencing (WES/WGS), parallel germline sequencing is critical Recognise that using NGS, gene fusions can be interrogated at both the DNA (break points) and RNA (transcripts) level. Parallel analysis is ideal. For formalin-fixed and paraffin embedded (FFPE), RNA sequencing is preferred over DNA sequencing Recognise that in contrast to fresh tissue, FFPE material harbours deamination artifacts (C>T transitions) that need to be accounted for in the analysis and influence sensitivity of test results Recognise that liquid biopsies are based on the analysis of the tumour DNA containing fraction of cell-free DNA. Sensitivity is particularly influenced by the number of nucleic acid molecules per locus and the sequencing depth/sensitivity per locus Explain the common pre-analytic variables that may influence test results and include age of archival material, tumour cellularity, quality and quantity of nucleic acids, as well as conditions for collection, preparation, transport, and storage of sample and analyte types Recognise that post-analytic variables in NGS-based testing primarily include bioinformatic tools and filters used for data processing including variant calling, annotation, functional, and clinical variant interpretation
Skills	Demonstrate the ability to: Present core definitions and terms of genomic testing Present core knowledge of genetic testing technology and methodology Identify whether an assay is directed to DNA, RNA, or protein (eg, methylation analysis, whole exome sequencing, transcriptome sequencing, proteome analysis including IHC) Identify the concept the assay is based on, namely either testing for a specific analyte, a panel test, ie, used for multiple analytes or an open, so-called, unbiased, genome-wide assay Recognise different genomic aberrations and methods of detection: missense, nonsense, frameshift mutations, indels, copy number aberrations, translocations/gene fusions, gene expression/transcript levels, and protein levels Classify and interpret genomic variants according to established
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classification systems and interpret variants in their proper clinical contexts Discuss the clinical indications for molecular testing in oncology, including applications in screening, diagnosis, prognosis, response prediction, disease and treatment monitoring, identification of resistance mechanisms, and evaluation for inherited conditions Apply genetic counselling principles, including communicating to family members in need of further testing, and preparing patients for the potential for incidental and secondary germline information before conducting somatic mutation profiling

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4.5. Imaging in Oncology

4.5.1. Radiologic Imaging

Wolfgang G. Kunz

Jens Ricke

Objectives	To describe the state-of-the-art diagnostic imaging strategies for different tumour types To be able to communicate imaging findings with patients and to discuss imaging differentials with imaging experts
Key Concepts	Distinguish existing imaging modalities, in particular, cross-sectional techniques (computed tomography [CT], magnetic resonance imaging [MRI] and hybrid imaging combined with positron emission tomography [PET]), their principles and technical or diagnostic limitations Demonstrate an understanding of image-guided diagnostic and therapeutic interventions, their principles, technical or diagnostic limitations, and complications Recognise the contraindications and safety issues related to CT, including radiation exposure related to patient age, cancer during pregnancy, and contrast media-related risks and side effects Recognise the contraindications and safety issues related to MRI, including implanted medical devices, pregnancy, claustrophobia, gadolinium-based contrast media-related risks, and side effects Identify the influence of pre-test probabilities of disease, to estimate the potential impact of imaging exams on patient management, and to be aware of the costs and cost-effectiveness of different imaging exams Recognise the impact of novel imaging modalities on stage migration, in particular hybrid imaging with tumour-specific tracers compared with conventional imaging Distinguish imaging-based staging systems and the role of different imaging tests, eg, for TNM, Ann Arbor, Barcelona Clinic Liver Cancer, International Federation of Gynecology and Obstetrics (see chapter 4.5.3) Interpret the breast imaging reporting and data system and prostate imaging reporting and data system Demonstrate an understanding of the RECIST (see chapter 4.5.4) Express familiarity with cancer-specific methods of response assessment, eg, the Lugano Classification of the International Conference on Malignant Lymphoma, the modified RECIST criteria for hepatocellular carcinoma, the Choi Response Criteria for gastrointestinal stromal tumours Recognise treatment-specific response patterns on imaging, in particular for immunotherapy, including specific criteria for response assessment, eg, the immune-adapted RECIST criteria Evaluate the imaging appearance of local or systemic treatment-specific toxicities
Skills	Demonstrate the ability to: Report a comprehensive imaging referral form, including current and former treatment history and timeline, and all clinical data relevant to the examination Discuss the basics and the process of any ordered imaging exam or image-guided intervention with patients, including providing information on preparation where appropriate Discuss with patients about complications, side effects, contraindications, as well as radiation exposure related to imaging exams and image-guided interventions Select the appropriate imaging modality based on tumour type, treatment, specific question, and safety profile for individual patients Select the appropriate mode of biopsy, eg, surgical v image-guided, based on patient factors, anatomic location, size of the lesion Discuss the results of imaging exams with patients and put the findings into the context of the individual patient's disease course Apply staging systems based on information provided in imaging reports or in multidisciplinary tumour boards Discuss the results of imaging exams or diagnostic strategies for

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validation with radiologists and nuclear medicine physicians in multidisciplinary tumour boards
Evaluate an image-guided local response in multidisciplinary tumour boards in the context of the patient's overall response to systemic treatment
Discuss the use of image-guided interventions in combination with or as an alternative to surgical, radiation, or systemic treatment in multidisciplinary tumour boards

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4.5.2. Nuclear Medicine and Clinical Molecular Imaging

Stefano Fanti

David A. Mankoff

Objectives	To be able to use nuclear medicine and molecular imaging correctly in daily practice To describe the emerging role of therapeutic radiopharmaceuticals (theranostics) in oncologic practice
Key Concepts	Describe different molecular imaging techniques, and in particular nuclear medicine procedures and different diagnostic radiopharmaceuticals for both positron emission tomography (PET) and single-photon imaging, including single-photon computed tomography (SPECT) Describe the basic principles of nuclear medicine including planar scintigraphy, SPECT and PET imaging, pharmacokinetic evaluation of radiotracers, and radionuclide dosimetry Describe the relevant imaging instrumentation, including hybrid imaging systems that use computed tomography (CT, PET/CT, SPECT/CT) or magnetic resonance imaging (MRI, PET/MRI) and evolving whole-body PET systems Demonstrate an understanding of the geographical variation in the availability of specialised nuclear medicine instrumentation and supply of different molecular imaging techniques and tracers, especially short-lived PET tracers Describe the therapeutic application of radiopharmaceuticals to cancer, the principles of the theranostic approach, and of different radionuclide therapies including emerging agents

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	Identify relevant newer radiopharmaceuticals, including approved agents for imaging new targets, such as prostate-specific membrane antigen (PSMA) for prostate cancer, somatostatin receptors for neuroendocrine tumours, oestrogen receptors for breast cancer, and amino acid transport and metabolism for imaging brain and other cancer, and investigational targets including fibroblast activating protein, human epidermal growth factor receptor 2 (HER2), immunotherapy targets, poly (ADP-ribose) polymerase, and others that can be used for either diagnosis or therapy Describe the normal biodistribution and abnormal patterns associated with cancer used to interpret images for commonly used oncologic nuclear imaging tracers, such as (¹⁸F-fluorodeoxyglucose ¹⁸F-FDG), ^{99m}Tc-diphosphonates Describe the diagnostic indications for scintigraphy, SPECT and PET scans for the different tumour types, with particular reference to clinical guidelines, including the role of ¹⁸F-FDG-PET in lymphoma and other haematologic malignancies (myeloma), in non-small-cell lung cancer, breast and ovarian cancers, in melanoma, in GI tumours and in other malignancies Describe the use of radiopharmaceuticals to guide tissue sampling, including use in sentinel lymph node biopsy Describe the roles of other more specific tracers, such as somatostatin receptor tracers for neuroendocrine tumours and PSMA for prostate cancer Describe the role of molecular imaging (and in particular ¹⁸F-FDG-PET) in evaluating response to therapy and criteria for response assessment (RECIST, EORTC, PERCIST, Deauville/Lugano [lymphoma], and others) Identify existing/approved radionuclide therapies, including Na¹³¹I for thyroid cancer, ¹⁷⁷Lu-DOTATATE and ¹³¹I-mIBG for neuroendocrine tumours, ¹⁷⁷Lu-PSMA, and ²²³RaCl₂ for bone metastases, and other emerging agents and applications, including novel isotopes such as alpha-emitters Describe the radiation doses and toxicities associated with radionuclide therapy agents Describe patient preparation requirements for diagnostic scans and radionuclide therapy and radiation safety precautions, particularly for radionuclide therapy Describe the complementary role of molecular imaging versus anatomic imaging and non-imaging molecular diagnostics in diagnosis, staging, response assessment, and image guidance Describe the use of diagnostic nuclear medicine/molecular imaging to guide therapeutic decisions and the impact of molecular imaging over patient management and treatment decision making Distinguish the role of radionuclide therapy vis-à-vis external beam radiotherapy and standard systemic oncologic agents
Skills	Demonstrate the ability to: Select the right indications for nuclear medicine/molecular imaging, considering anatomic imaging and other diagnostics, in line with clinical guidelines Use nuclear medicine/molecular imaging to guide patient treatment and assess treatment efficacy Identify patients who may benefit from radiopharmaceutical therapy and discuss benefits and risk versus other therapeutic choices Identify, at a basic level, the physiologic biodistribution, pathologic uptake and pitfalls of molecular imaging techniques, and recognise obvious artifacts of molecular imaging techniques Identify major radiopharmaceutical therapy toxicities and possible interactions with other oncologic treatments

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4.5.3. Staging Procedures

James Brierley
Yuichiro Ohe

Objectives	To describe the principles and general rules of staging systems, mainly the TNM staging system To be able to do appropriate and accurate staging
Key Concepts	Describe the principles and general rules of the TNM system Recognise: - The TNM classification - The relationship between the TNM system and contemporary practice in order to assign each stage - The difference between clinical and pathologic staging - Post-therapy or post-neoadjuvant therapy staging and restaging - Stage migration by use of more sensitive methods - Stage shift after introduction of screening - Different systems of staging in each tumour type: the Union for International Cancer Control and American Joint Committee on Cancer classification for the majority of tumours, also the Lugano Classification for lymphoma, and International Federation of Gynecology and Obstetrics stages for gynaecologic tumours - The relationship between stage, prognosis, and additional prognostic factors - The differences in treatment choice based on staging
Skills	Demonstrate the ability to: Perform the appropriate procedures such as physical examinations, imaging studies, laboratory tests, and pathologic or cytologic examinations for individual carcinomas

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4.5.4. Response Evaluation (RECIST Criteria)

Saskia Litière

Objectives	To be able to use RECIST for assessment of tumour response as (part of) an end point in the context of clinical trials
Key Concepts	Demonstrate an understanding that RECIST is the result of an initiative to harmonise the definition of tumour response to establish a credible end point that can be used uniformly across centres in a multicentre trial, but also to compare results across clinical trials on different tumour types and treatment modalities Recognise that RECIST applies to solid tumours only, in the locally advanced or metastatic setting. Other response criteria have been developed for haematologic malignancies Describe the difference between the original RECIST criteria and the RECIST v1.1 Demonstrate an understanding that measurement error is an issue for response assessment, so the choice of imaging modality at baseline and during follow-up is important. Be able to give examples of imaging types which are recommended according to RECIST and which are not, including the reason why not Distinguish between measurable and non-measurable disease and how they are taken into account in the assessment of overall response Define the different categories of response: complete response, partial response, stable disease, progressive disease (PD), early death and non-evaluable Describe how to select target lesions (maximum 5 lesions, max 2 per organ) and how the evolution of the sum of their longest diameter contributes to the response assessment Demonstrate an understanding of how to evaluate non-target disease, eg, the non-measurable lesions or measurable non-target lesions, for integration in the overall response assessment Describe the role of new lesions in the response assessment Recognise that lymph nodes deserve special attention as nodes <10 mm are considered benign; specific rules apply to lymph nodes that disappear and then re-appear Recognise that response (complete and/or partial) needs to be confirmed in single arm trials where it serves as a primary end point; this is to ensure that a response is not merely the result of measurement error only Recognise that once a PD is observed as per RECIST, the outcome of the patients stays PD for RECIST, regardless of what happens afterwards Demonstrate an understanding that specific guidelines, named iRECIST, have been published to collect data in the context of trials testing immunotherapeutics Describe the difference between a confirmed and an unconfirmed progression; more specifically a number of rules are to be applied to confirm a progression at the next assessment Recognise a pseudo-progression and demonstrate an understanding on how to reset such a progression Recognise that RECIST was developed for clinical trials; for the individual patient, treatment benefit should be based on medical judgement that results from a synthesis of clinical, imaging, and laboratory data
Skills	Demonstrate the ability to: Perform an assessment of response to treatment according to the rules specified in RECIST or iRECIST Discuss at tumour board reviews with imaging specialists Present the limitations of the RECIST assessment in the context of the treatment for an individual patient outside of a clinical trial

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4.6. Therapy

4.6.1. Surgical Oncology

Chandrajit P. Raut

Piotr Rutkowski

Objectives	To describe: The indications and contraindications of oncologic surgery by interacting and collaborating with surgeons The role of oncologic surgery in the staging, cure, and palliation of patients with malignant diseases
Key Concepts	Recognise the availability of different diagnostic procedures in various cancer types including indications and different types of diagnostic biopsy Recognise the importance of the multidisciplinary approach for treatment of patients with solid tumours to achieve a better outcome Recognise the existence of different prognostic factors (including patient, tumour, and treatment characteristics) in oncologic entities Determine how to assess a patient for suitability for surgery, including appropriate tests and their interpretation Recognise the importance of value-based health care delivery regarding new surgical techniques and technical devices Recognise the indications for organ preservation, reconstructive surgery, extent of definitive surgery, principles of radical surgical dissection (including regional lymph nodes) and sequencing of surgery with other treatment modalities Recognise the risks and benefits of surgery as a definitive treatment and as an adjunct to radiotherapy and/or systemic therapy, and how the risks and benefits differ based on whether neoadjuvant or adjuvant therapy is used Explain postoperative complications and the expected length of recovery, and its impact on planned postoperative therapy Demonstrate an understanding of the role of surgery in the metastatic and palliative setting Demonstrate an understanding of the importance of prospective trials and differences in planning of surgical trials from planning of medical oncology and radiotherapy trials Demonstrate an understanding of the importance of prospective data and tissue collection for translational research
Skills	Demonstrate the ability to: Present the patient cases during multidisciplinary team meetings and to promote this systematic multidisciplinary strategy Critically discuss the treatment options/recommendations Discuss with colleagues and patients on general management strategies in the neoadjuvant and the adjuvant setting, as well as at advanced stage

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4.6.2. Radiation Oncology

Jacek Jassem

Zhongxing Liao

Objectives	To describe the impact of radiation in oncology To be able to expand access to radiotherapy for improvement of outcomes in patients with cancer
Key Concepts	Demonstrate an understanding of the basic biology of radiation induced cell killing and normal tissue injury Demonstrate an understanding of the role of radiotherapy in multidisciplinary management of patients with cancer Recognise that indications of radiotherapy are based on cancer staging and goal of care Recognise that timing of radiotherapy should be integrated with the whole course of cancer treatment and can be neoadjuvant, concurrent, definitive, adjuvant, palliative, and consolidative Recognise that the stereotactic body radiation therapy (SBRT) is considered as one of the standards of care for early-stage non—small-cell lung cancer Determine the role of local consolidation radiotherapy combined with systemic therapy (cytotoxic chemotherapy, immunotherapy, targeted therapy, etc) in advanced cancers Recognise the important role of radiation in immune modulation and cell therapy Recognise the role of palliative radiotherapy Recognise that there are different types of radiotherapy, including external beam radiation, intracavitary radiation, plaque, and interstitial radiation Recognise that there are multiple effective radiation technologies include 3-dimensional conformal radiation, intensity modulated, image-guided radiation, techniques considering respiratory motion Recognise the different radiation beams including photons, protons, heavy ions, electrons Recognise acute side effect and long-term complication of radiation therapy
Skills	Demonstrate the ability to: Participate in multidisciplinary tumour board discussions and appreciate the considerations that go into deciding the most appropriate combination, timing of treatments (systemic therapy, surgery, radiation) Present the evidence supporting indications for radiotherapy and the risks and benefits of different radiation treatment options Select those patients who are suitable for SBRT as a curative treatment Select those patients who are suitable for concurrent chemoradiation as a curative treatment Report that in selected malignancies adjuvant immunotherapy is standard of care after concurrent chemoradiation Discuss the role of radiation in patients with stage IV cancer Discuss diagnosis and effective management of radiotherapy-related acute and long-term toxicities Identify conditions that palliative radiation may improve patient quality of life in terms of pain control and symptomatic relief Advocate for safety and improvement in process Practise patient centric cancer care by discussing use of radiotherapy via transparent and timely communication with the team involved in the episode of care, caregiver, and patient

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4.6.3. Image-Guided Therapy

Ken Herrmann

Clare Tempny

Objectives	To describe: The fundamentals of image-guided therapy (IGT) and guide therapy selection and educate oncologists in fundamentals of image-guided interventions The role of imaging in IGT, specifically the key contributions to tumour characterisation
Key Concepts	Recognise that cancer imaging methods provide tumour phenotype, size/volume, locations, staging, whole body tumour burden, marker for treatment response and prognostication Demonstrate an understanding that cancer radiologists performing diagnostic image interpretations now commonly use standardised approaches such as the American College of Radiology RADS, eg, breast cancer imaging BI-RADS or prostate cancer magnetic resonance imaging (MRI) PI-RADS Identify that cancer diagnostic biopsies of suspicious lesion/target are almost exclusively defined and guided by imaging Define tumour margins and access/trajectory planning with imaging for interventional radiologists, surgeons, and radiation oncologists using IGT Recognise imaging as predictive marker and patient selector for theranostics (eg, peptide receptor radionuclide therapy in neuroendocrine tumours) Recognise that as ultrasound, computed tomography scan, angiography, MRI or positron emission tomography (PET) scans, can all be integrated into modern operating/procedure rooms Demonstrate an understanding that image-guided therapies use minimally invasive or non-invasive techniques, such as percutaneous thermal (hot/cold) ablation or magnetic resonance (MR) guided focused ultrasound (FUS) or high intensity FUS (HiFU) Determine IGT as an intervention which can lower morbidity and its usefulness in patients with surgical comorbidities Demonstrate an understanding that the goal of IGT thermal ablations is to achieve cell kill temperatures of the image-based 3D volume with an ablative margin of normal tissue. Hence, ablation volumes are generally greater than image-based volumes Recognise that IGT can also serve as selection method for targeted therapies (eg, Fluoroeestradiol-PET in patients with breast cancer and prostate-specific membrane antigen [PSMA] PET before PSMA radioligand therapy in prostate cancer) Explain that MR guided FUS uniquely provides near real-time thermometry allowing for intra-procedural thermal dosimetry to ensure full thermal coagulative necrosis of the target and spare proximal structures Identify that focal image guided rather than whole gland therapies are gaining credibility for prostate cancers which can be safe and effective
Skills	Demonstrate the ability to: Discuss the newest developments in IGT

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	Select patients who may benefit from IGT Discuss different tumour thermal ablation methods (eg, microwave, cryotherapy, FUS, or chemo-embolisation) and theranostics Participate in multidisciplinary team discussions integrating imaging findings and identify patients suitable for theranostics Predict conditions (such as performance status, response to therapy and side effects, comorbidities, prior therapy) that are important to consider when deciding whether to advise surgery or less invasive IGT methods

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4.6.4. Cytotoxic Therapy

Amanda Cass

Cristiana Sessa

Objectives	To describe: The indications, mechanisms of action, the relevant mechanisms of resistance, the pharmacogenomics, and the pharmacology of cytotoxic agents The common toxicities, and their frequency of occurrence, the safety parameters to be monitored, and the ways of administration of cytotoxic therapy
Key Concepts	Describe cytotoxic agents and their respective drug classes Classify cytotoxic agents based on their effect on the cell cycle—cell cycle—specific or non-specific Describe mechanisms of action and relevant mechanisms of resistance for specific cytotoxic agents, the pharmacokinetic, pharmacodynamic, and the pharmacogenetic features relevant for each cytotoxic agent Summarise differences between cytotoxic therapy and other types of therapy, such as targeted therapy and immunotherapy Define indications of specific cytotoxic agents Summarise important pharmacologic factors (metabolism, clearance) of specific cytotoxic agents and how they translate into patient treatment Recognise the work-up necessary before initiation of cytotoxic therapy Recognise the role in therapy for cytotoxic therapy as part of multimodality therapy Define the dosing, schedule, and dose adjustments of cytotoxic therapy for specific indications as a single agent and in combination Demonstrate an understanding of side effect profiles of cytotoxic therapy and their management strategies, like modification of the dose, when needed, in case of renal or

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	hepatic dysfunction Summarise the expected treatment outcome of cytotoxic therapy in patients with malignancies Describe drug-drug, drug-herb, and drug-food interactions for specific cytotoxic agents and their management in clinical practice Describe aim, safety profile, and indications for combining of cytotoxics with radiation therapy Describe aim, safety profile, and indications for combining cytotoxics with immunotherapy
Skills	Demonstrate the ability to: Discuss the expected response of cytotoxic therapy alone or in combination with other agents for specific indications Discuss the role of cytotoxic therapy as part of multimodality therapy Use patient-specific factors when prescribing the appropriate cytotoxic therapy for individuals Manage adverse effects from cytotoxic therapy and adjust treatment accordingly Discuss with patients pros and cons of cytotoxic therapy treatment in comparison with other therapeutic options

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4.6.5. Endocrine Therapy

Evandro de Azambuja

Michaela Higgins

Objectives	To describe the rationale for and mechanism of action of endocrine therapy in the management of some cancer types, including breast, prostate, and ovarian cancers To be able to effectively manage endocrine treatment-related adverse events To describe mechanisms of resistance to endocrine therapies and to use them in combination with other treatments where appropriate
Key Concepts	Demonstrate an understanding: Of tumour biology and the interplay between cancer and hormone receptors Of the mechanisms of action of different endocrine therapies When to use endocrine therapy Of the magnitude of clinical benefit from endocrine therapy Of the multidisciplinary approach to management of patients with endocrine-sensitive tumours Of the prevention and management of acute and chronic treatment-related toxicities of endocrine therapies Of mechanisms of resistance to endocrine therapies in patients with solid tumours including somatic mutations Of the rationale for use of combination endocrine treatments and/or use of endocrine treatments in combination with other agents (eg, luteinizing hormone-releasing hormone agonists,

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	CDK 4/6 inhibitors, PI3KCA inhibitors, etc) in the management of solid malignancies Of the clinical benefit and toxicity profile of commonly used endocrine and targeted agent combinations How to monitor response to endocrine treatments in patients with early stage and advanced cancer Of the rationale for sequencing endocrine therapies approaches in some type of cancers
Skills	Demonstrate the ability to: Participate actively in presenting patient cases during the multidisciplinary team meetings and promote a systematic multidisciplinary approach Select appropriately, present to patients, and prescribe appropriate endocrine therapies Manage acute and chronic side effects of endocrine therapies and/or endocrine treatment combinations across different tumour types

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4.6.6. Targeted Therapy

Charu Aggarwal

Udai Banerji

Objectives	To be able to perform assessment, including ordering and interpreting predictive biomarkers of response and treatment and counselling of patients with cancer who will be receiving targeted therapy (small molecule signal transduction or kinase inhibitors, hormonal agents, antibodies or antibody drug conjugates) To describe the common toxicities seen with these agents when used as a single agent or in combination with other targeted agents or chemotherapy
Key Concepts	Recognise that the basic principles of oncogenesis provide the biologic rationale for the classification of different types of targeted therapy in cancer, eg, small molecules, antibodies, anti-hormonal agents, or antibody drug conjugates Define a targeted agent in the context of DNA damaging agent or a drug harnessing the immune system for its activation Explain the differences between molecularly agents and non-targeted agents, such as DNA damaging or tubulin binding agents Describe the basic principle of the use of a predictive biomarker which could be gene mutation, eg, <i>BRAF</i> , gene rearrangement eg, <i>TRK</i> , gene amplification such as human epidermal growth factor receptor 2 (<i>HER2</i>) or protein expression, such as oestrogen receptor Demonstrate an understanding of basic principles of pharmacokinetics such as role of loading dose for drugs with a long half-life, eg, bevacizumab Recognise the importance of pharmacodynamics in determining the dose and schedule of targeted agents eg, difference from determining only maximally tolerated dose in chemotherapeutic agents Evaluate the use of targeted agents alone or in combination with other classes of drugs eg, other targeted agents (eg, <i>BRAF</i> inhibitor + MEK inhibitor) or in combination with chemotherapy (eg, cetuximab + folinic acid, fluorouracil and

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	irinotecan chemotherapy) Summarise different classes of common toxicities associated with targeted agents, like skin rash or diarrhoea, and specific targeted therapy-based toxicities such as cardiotoxicity with <i>HER2</i> targeting agents Recognise the importance of clonal evolution and emergence of resistance mutations eg, detection of epidermal growth factor receptor (<i>EGFR</i>) T790M mutation in patients with <i>EGFR</i> mutated non-small-cell lung cancer treated with first generation <i>EGFR</i> inhibitors such as gefitinib or erlotinib
Skills	Demonstrate the ability to: Contribute actively to a variety of targeted therapy clinical scenarios Discuss targeted therapy treatment options Select the correct patient for targeted therapy, based on histology, staging, mutations, and performance status Interpret biomarker data eg, protein expression on immunohistochemistry, like oestrogen receptor positivity, <i>HER2</i> , or interpretation of mutations in tumour eg, <i>EGFR</i> mutations or germline mutations such as <i>BRCA1</i> Optimally sequence targeted therapies based on an understanding of resistance mechanisms and biomarker-based response assessment Prescribe targeted agents as flat dose for small molecules, such as osimertinib or as mg/m ² as with cetuximab and mg/kg for bevacizumab Recognise and manage targeted therapy adverse events Perform a risk-benefit assessment for patients considering adjuvant targeted therapy

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4.6.7. Immunotherapy

Kevin Harrington

Siwen Hu-Lieskovan

Objectives	To be able to perform specialist counselling and treatment of patients with cancer who will be receiving immunotherapy, and to monitor and manage emerging immune-related toxicities of such therapies. This summary relates to immune checkpoint-targeted therapies and does not cover cell-based therapies and cytokines/haematopoietic growth factors
Key Concepts	Demonstrate an understanding that the basic principles of tumour immunology provide the biologic basis for the use of different types of immunotherapies for cancer Recognise the different types of immune response that can be utilised for immunotherapy, especially the differences between innate and adaptive immune responses Distinguish the differences between immunotherapy and targeted therapy or chemotherapy Demonstrate an understanding that antibody-based immune

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	checkpoint inhibitors interact with endogenous immune cells, different from cellular therapy Recognise unconventional patterns of response with immunotherapies, including late responses or regression after progression, and the need to verify progression in selected patients who may have pseudo-progression or a mixed response Recognise the phenomenon of hyperprogression, its identification, and appropriate management Demonstrate an understanding that immunotherapy has the potential to induce durable responses in some patients, and improves overall survival Recognise mechanisms of immune-mediated cytotoxicity and the concept of immunogenic cell death Recognise that immunotherapies have a unique spectrum of toxicities different from chemotherapy or targeted therapy Determine the signs and symptoms of immune-related adverse events and their management, including the management of long-term steroid therapy and the use of steroid-sparing immune-suppressive therapies Evaluate approaches seeking to introduce immunotherapy into curative treatment settings, including their use in neoadjuvant, concomitant (with radiation) and adjuvant treatment protocols Recognise potential benefits and unique side effects of combining immunotherapy with conventional therapeutics, such as radiation therapy, targeted therapy, and chemotherapy Recognise specific mechanisms of primary and acquired resistance to immunotherapies, the principles of combination strategies to overcome resistance, and their unique toxicity profiles
Skills	Demonstrate the ability to: Perform a history and physical examination in patients receiving immunotherapy, and recognise patient presentations unique to immunotherapy Contribute to clinical scenarios and discuss the reasoning behind selection of immunotherapy options/recommendations, based on histology, staging, tumour burden, performance status, comorbidities, and tolerance of toxicity Select, communicate, and prescribe the optimal immunotherapy regimen for an individual patient Discuss the choice of the optimal sequence of immunotherapy versus other standard-of-care anti-cancer therapies Recognise the unique response patterns to immunotherapy, including pseudoprogression, late response, and hyperprogression Recognise and manage immune-related adverse events seen with immune checkpoint inhibition, most commonly involving skin, endocrine, gastrointestinal, pulmonary, and hepatic systems Assemble a multidisciplinary group of consultants to facilitate the care of patients suffering from immune-related adverse events Distinguish immune-related toxicity from non-immune-related toxicity and progression of disease Perform a risk-benefit assessment for patients considering immunotherapy, especially in patients with earlier stage disease. Select the optimal duration of immunotherapy, including checkpoint inhibitors based on their toxicity profile and the likelihood of having an unconventional response

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4.6.8. Cell-Based Therapy

Monalisa Ghosh

Kevin Harrington

Objectives	To describe the application of cell-based therapies in the treatment of various malignancies and to manage the most common toxicities associated with cell-based therapies, including cytokine release syndrome (CRS), immune effector cell-associated neurologic syndrome (ICANS), infections, disorders of coagulation, and other immune complications
Key Concepts	Demonstrate an understanding of the different types of cell-based therapies used to treat malignancy Describe the structure and function of approved cell-based therapies including dendritic cells and chimeric antigen receptor (CAR) T cells Distinguish the different types of cell-based therapy used to treat malignancies including, but not limited to, CAR T-cell therapy Demonstrate an understanding of the different generations of CAR T cells and the rationale and mechanistic underpinnings for the modifications made to the structure of the chimeric antigen receptors they bear Evaluate candidates for cell-based therapies based on type of malignancy as well as number of previous lines of therapy Identify disease characteristics or risk factors that would make a candidate ineligible for treatment with cell-based therapies Describe the process of manufacture of various cell-based therapies including the process of cell mobilisation and aphaeresis Demonstrate an understanding of the process of genetic modification used to produce cell-based therapies Demonstrate an understanding of the different approaches that can be used to effect genetic modifications in cell-based therapies and be aware of their relative merits and weaknesses Explain the purpose and risks of using lymphodepleting chemotherapy before cell therapy infusion Summarise the efficacy and toxicity profiles of available cell-based therapies in various malignancies by explaining the response rates, overall survival, and rate of common toxicities observed in pivotal clinical trials for each cell-based therapy Demonstrate an understanding of currently available methodologies for studying the persistence of cell-based therapies after administration to patients Demonstrate an understanding of the grading and management of common toxicities of cell-based therapies, such as CRS and ICANS, and the requirements for use of anti-cytokine therapies, such as anti-IL-6 therapies and corticosteroids
Skills	Demonstrate the ability to: Identify patients who are eligible for cell-based therapies based on type of malignancy, prior lines of therapy, disease burden, performance status, comorbidities, and organ function Discuss with patients the risks and benefits of the process of aphaeresis or any other process used to harvest cells Select the appropriate cell-based therapy based on the patient's malignancy, presence or absence of the cell-based therapy target, and the predicted toxicity and efficacy profiles of the cell-based therapy Select and administer lymphodepleting chemotherapy as needed before cell-based therapy infusion and manage any subsequent side effects Monitor clinical efficacy of cell-based therapy, including an understanding of the kinetics of persistence/disappearance of any administered cell product

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Identify, monitor, grade, and manage common toxicities of cell-based therapies including CRS and ICANS with the assistance of a multidisciplinary team Report other potential toxicities associated with various cell-based therapies including other possible immune side effects as well as common infections

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4.7. Supportive and Palliative Care

4.7.1. Supportive Care and Symptom Management

Christina H. Ruhlmann

Objectives	To be able to: Assess, diagnose, and guide treatment of symptoms to the disease from time of diagnosis and throughout the cancer trajectory Assess patients' and caregivers' supportive care needs and perform counselling from the time of diagnosis and throughout the cancer trajectory
Key Concepts	Recognise that supportive care needs are present from the time of diagnosis and throughout the cancer trajectory, including pre-habilitation, during treatment, survivorship and rehabilitation, or end of life Classify the following as symptoms/signs/complications of the disease or supportive care needs (listed in alphabetical order): anxiety, anaemia, bleeding, breathlessness, cachexia, cancer associated thrombosis, comorbidities, constipation, depression, diarrhoea, hormonal effects, infections, fertility preservation, fatigue, fistula, lymphoedema, malignant effusions, nausea, nutritional support, oral complications, pain, paraneoplastic syndromes, psycho-social effects, sexual effects, tumour-related fever Demonstrate an understanding that the supportive care needs varies throughout the cancer trajectory Recognise that clinical and individual assessment for correct management of symptoms is essential to the overall outcome Determine the common disorders induced by the cancer disease, ie, physical and psycho-social disorders Recognise the overlap between symptoms of the cancer disease and treatment toxicities Demonstrate an understanding of the pathophysiology of the symptoms of the cancer disease and how to tailor supportive strategies accordingly

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	Demonstrate an understanding of the importance of educating patients and caregivers regarding the symptoms of the cancer disease Recognise that supportive care measures and symptom management is often multidisciplinary, including physicians, nurses, pharmacists, and allied health professionals Recognise that active patient and caregiver involvement, including education and use of patient-reported outcomes, is critical for the success of management of the symptoms, including strengths and limitations Interpret available evidence-based supportive care guidelines, and recognise that their routine implementation can reduce the severity of cancer-related symptoms Recognise that optimal supportive care can impact the relative dose intensity of subsequent anti-cancer treatment
Skills	Demonstrate the ability to: Recognise presentations of symptoms of the disease and care needs for patients and caregivers during the various phases of the cancer trajectory Perform a thorough history and relevant clinical examination to determine the likely aetiology of the symptoms as origin of the disease Perform a thorough family and psychosocial history to reveal potential care needs to address Apply evidence-based supportive management strategies for the most common disease-related symptoms and complications including pharmacologic and non-pharmacologic approaches Discuss the principles and benefits of pre-habilitation and rehabilitation Discuss the principles and benefits of advance care planning Discuss the principles and benefits of early integration of palliative care Discuss potential diagnostic tools/surveys and tests, including the merits and limitations of the these Discuss and interpret patient-reported outcomes in clinical practice for supportive care issues Discuss the role and integration of multidisciplinary clinicians for the diagnosis and management of supportive care issues Discuss the importance of supportive care measures in relation to optimal overall cancer care and treatment outcome

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4.7.2. Management of Systemic Therapy Toxicities

Eric J. Roeland

Christina H. Ruhlmann

Objectives	To be able to: Assess, diagnose, and treat patients experiencing toxicities induced by systemic anti-cancer therapies Counsel patients on preventive measures
Key Concepts	Recognise the unique and overlapping toxicities of different classes of cancer treatments (eg, cytotoxic, hormonal, targeted, and immunotherapy) Evaluate the pathogenesis (if known) of therapy-related toxicities and how to tailor supportive strategies accordingly Demonstrate an understanding of the importance of educating patients and caregivers regarding the signs and symptoms of treatment-related toxicity Recognise that treatment-related toxicities can be acute or chronic Recognise that a toxicity's severity and chronicity impact its clinical management Demonstrate an understanding that patients experience toxicities with variable individual risk (risk factors eg, performance status, comorbidities, age, concurrent irradiation), frequency, and severity Determine the relationship between pharmacology and toxicity, including drug-drug and food-drug interactions, and its implications on clinical presentation of treatment-related toxicities Recognise that clinical assessment is critical in the evaluation of treatment-related adverse events Translate available diagnostic tests in assessing toxicity, including strengths and limitations Recognise the differences between patient-reported versus clinician-reported toxicity and quality of life Recognise that active patient involvement, eg, patient education and regular patient-reported outcomes, can improve symptom management Summarise toxicity grading systems (eg, Common Terminology Criteria for Adverse Events), interpret and apply the toxicity grading on cancer treatment Recognise that toxicity management is often multidisciplinary, including physicians, nurses, pharmacists, and allied health professionals Recognise that evidence-based prophylactic strategies exist and their routine implementation can reduce the frequency and severity of treatment-related toxicities Recognise that toxicities can impact the relative-dose intensity of subsequent anti-cancer treatment Recognise that treatment-related toxicities have physical and psychologic impacts on a patient's well-being
Skills	Demonstrate the ability to: Recognise characteristic presentations of systemic treatment toxicities of different classes of anti-cancer therapies Perform a thorough history and relevant clinical examination to determine the likely aetiology of the treatment-related toxicity Use toxicity grading to discuss further relevant investigations and treatment modifications Discuss potential diagnostic studies, including the merits and limitations of the tests Apply optimal supportive management strategies for the most common treatment toxicities, including pharmacologic and non-pharmacologic approaches Discuss the role and integration of other multidisciplinary clinicians for the diagnosis and management of treatment-related toxicities Apply evidence-based prophylactic strategies to prevent systemic treatment toxicities Discuss the relevance of dose delay, dose modification or treatment cessation in case of unacceptable treatment toxicity

nts/guidelines/supportive-care-and-treatment-related-issues

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4. MASCC Guidelines. <https://www.mascc.org/mascc-guidelines>
5. Oncology Nursing Society Symptom Interventions and Guidelines. <https://www.ons.org/ons-guidelines>

4.7.3. Nutritional Support

Jann Arends

Eric J. Roeland

Objectives	To be able to support and maintain normal body composition and function To describe the limitations of artificial nutrition and hydration at the end of life
Key Concepts	Demonstrate an understanding of the differences and similarities between nutrition-associated terms, including malnutrition, starvation, weight loss, frailty, sarcopenia, and cachexia Explain to patients and caregivers the differences between cancer cachexia and starvation Interpret existing evidence-based nutritional guidelines for patients with cancer Identify effectively and treat any reversible causes or symptoms impacting a patient's nutrition Identify and collaborate with key local multidisciplinary experts to optimise nutrition in patients with cancer Distinguish different causes for weight loss, including psychosocial, local tumour-associated, and metabolic factors, especially systemic inflammation Describe the pathophysiology of cancer cachexia and the interaction of resulting derangements on the patient's clinical status Describe the relevance of maintaining body weight and especially skeletal muscle mass Recognise the importance of routine screening for nutritional risk and give examples of different evidence-based screening tools Describe global concepts of defining malnutrition and cachexia, especially as recommended by the Global Leadership Initiative for Malnutrition Describe the importance of an individually targeted and multiprofessional treatment approach in patients with cancer at risk of or diagnosed with malnutrition Describe the escalation of nutritional care, including dietary counselling and indications for offering oral nutritional supplements and different forms of artificial nutrition Recognise the decreasing effectivity, while risks and burdens are maintained, of nutritional interventions at the end of life Describe the relevance of combining nutritional interventions with muscle training Identify settings for supporting body resources before aggressive anti-cancer treatments (pre-habilitation) Summarise the components of a healthy lifestyle to be recommended for cancer survivors
Skills	Demonstrate the ability to: Select and discuss the routine use of a malnutrition screening tool for clinical practice Discuss the interpretation of nutritional assessment Predict energy and nutrient requirements for individual patients Select members of a multidisciplinary group to cooperate in providing best nutritional and metabolic support Present details of a patient report on nutritional and metabolic status and required multimodal interventions

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4.7.4. End-of-Life Care

Nathan Cherny

Frank D. Ferris

Objectives	To describe the fundamentals of end-of-life care and recognize when a patient is actually dying To be able to provide sensitive and effective care to patients dying of advanced cancer and support their family members throughout the dying process and into their acute bereavement period
Key Concepts	Demonstrate an understanding: That there is no one best way to die and that the care of dying patients must be individualised to incorporate specific cultural, religious, or other considerations relevant to each patient and their family Of the major ethical issues surrounding end-of-life care, including documentation of advance care planning, requests for euthanasia, assisted suicide, and withholding/withdrawal of treatments Of the need for interdisciplinary care at the end of life, including early referral and close cooperation with palliative care services Of the need for effective continuity of compassionate care for both the patient and their family throughout the cancer experience, including end-of-life care and family bereavement (without abandonment when treatment to control the cancer is no longer effective) When patients are approaching the end of their lives and palliative interventions focused on completing important life goals and comfort will be the most effective approaches to caring for the patient Of the signs of the dying process when patients are entering the last hours of their lives and provide a safe and comfortable dying process for the patient and the family How to manage effectively the dying process for the patient and family

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Provide bereaved family members with referrals to counselling services that will help them address their grieving and rebuild their lives

Skills

Demonstrate the ability to:

- Effectively use the available tools to guide prognostication as patients are approaching the end of their lives and sensitively discuss prognosis with the patient and family
- Describe the signs of the dying process and identify when a patient is in the last hours of life
- Identify when death has occurred and communicate this effectively to family members
- Discuss and effectively evaluate the needs of the patient and family at each stage of end-of-life care
- Discuss shared goals of life and goals of care with each patient, their family members and health care professionals that includes the physical and emotional, social, cultural, and spiritual dimensions of care and establishes the optimal place for end-of-life care acceptable to everyone
- Design plan of care, incorporate family members into that plan, and ensure they have the skills they need to care for the patient
- Design an effective plan of care with the patient, family, and members of the health care team that focuses on the patient's capacity to complete important life goals, ensures comfort, and provides effective support for family members when patients have a limited life expectancy
- Design an effective plan of care to ensure safe and comfortable dying for the patient and manage the distress of the family when patients are actively dying (with signs of the dying process)
- Assess effectively, prevent, and manage the common symptoms experienced during the dying process, including dyspnoea, dysphagia, excessive secretions, pain, both hyperactive and hypoactive terminal delirium, dry mouth nares and eyes, and skin breakdown
- Schedule early referral to palliative care and counselling services that can assist with the management of the dying process, and support the family throughout the last hours of the patient's life and into bereavement
- Apply the concept of refractory symptoms and the judicious use of palliative sedation to manage them at the end of life
- Perform end-of-life care in a variety of settings including the patient's home

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4.8. Management and Treatment of Specific Malignancies

4.8.1. Thoracic Malignancies

4.8.1.a. Small-Cell Lung Cancer

Maria Q. Baggstrom

Anne-Marie C. Dingemans

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with small-cell lung cancer along the cancer continuum
Key Concepts	Describe the different molecular subtypes of small-cell lung cancer (SCLC) Recognise that tobacco use is the single most important cause of SCLC and tobacco cessation reduces lung cancer risk Explain why lung cancer screening is of limited value in detecting early-stage SCLC Recognise the aggressive nature of SCLC requiring no delays in diagnostic procedures, rapid initiation of treatment, and close monitoring during follow-up Describe the role of [¹⁸F]Fluorodeoxyglucose-positron emission tomography scan and magnetic resonance imaging brain at diagnosis and during follow-up Recognise, evaluate, and give examples of common neurologic and endocrine paraneoplastic syndromes that are associated with SCLC Explain that optimal treatment of SCLC cancer involves a multidisciplinary team, including pulmonologist, thoracic surgeons, medical oncologist, radiation oncologist, neurologist, and palliative care specialist Describe the limitations and potential role of surgical resection in (very) limited SCLC Summarise the role of systemic therapy, including immunotherapy, in adjuvant, curative, and palliative settings Distinguish patients who will benefit from radiation therapy in the definitive, consolidative, and prophylactic settings Distinguish patients with platinum-refractory and platinum-sensitive recurrence Recognise that early palliative intervention has been shown to improve survival and quality of life
Skills	Demonstrate the ability to: Discuss the relevance of Veterans Administration and TNM staging systems for SCLC Practise to select and interpret staging modalities Practise to contribute to discussions on general management strategies, including limited and extensive stage in order to understand the rationale for selecting and sequencing treatments in a multidisciplinary setting Select systemic treatments, including cytotoxic chemotherapy and immunotherapy to optimise patient treatment for response and tolerance Discuss situations where initiating systemic treatment is urgently required Discuss with patients the risk-benefit ration of several treatment strategies as concurrent chemoradiotherapy and prophylactic cranial irradiation (PCI) Apply personalised treatment and follow-up taking into account patient-related characteristics Predict and treat short- and long-term side effects of PCI

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4.8.1.b. Non-Small-Cell Lung Cancer

Jyoti D. Patel

Sanjay Popat

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with non-small-cell lung cancer along the cancer continuum
Key Concepts	Recognise and quantify relationship between environmental exposures and carcinogenesis (tobacco/asbestos/radon) Describe role of governmental policy on tobacco behaviours and lung cancer epidemiology Summarise criteria and evidence for population low dose computed tomography (CT) screening Classify non-small-cell lung cancer (NSCLC) on basis of WHO pathologic classification of sub-types Recognise role of pathogenic somatic gene variants in NSCLC carcinogenesis and therapy alongside technologies used to identify them, their limitations, and role of other pathologic predictive biomarkers eg, PD-L1 status Determine role of multidisciplinary team working in decision making for lung cancer management Classify NSCLC staging using the Union for International Cancer Control TNM clinical and pathologic criteria Determine optimal staging and diagnostic interventions in newly presenting NSCLC, alongside test limitations Explain role of adjuvant/neoadjuvant treatments in resected/resectable NSCLC Define role of stereotactic and non-stereotactic radiotherapy in early- and late-stage NSCLC

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	Evaluate role and quality standards for surgery Compile evidence-based multimodality management treatment strategies in radically treatable stage III NSCLC, alongside guideline recommendations Explain and understand role of palliative care Determine patient selection for optimal systemic therapy according to national and international guidelines in current and subsequent lines Evaluate strategies for prevention and management of toxicities of systemic therapy Determine relationships between clinical evidence, regulatory approvals, and reimbursed treatments Recognise role of extended multidisciplinary team members, including support workers and case coordinators such as specialist nurses Compile plans for lung cancer survivorship and surveillance
Skills	Demonstrate the ability to: Select high-risk patients suitable for CT screening Perform history taking, and physical examination in emergency and ambulatory suspected patients with lung cancer, jointly with interpretation of physiologic, and imaging parameters, to formulate a diagnostic and management plan Discuss patient-level data, including at multidisciplinary tumour board meetings to contribute to patient management discussions, placing case data into context of national and international guidelines Select, communicate, and prescribe the optimal systemic therapy to be used contingent on staging, imaging, pathologic, and physiologic data, taking into account patient and family priorities, drug interactions, comorbid conditions, and additional treatment modalities, eg, radiotherapy Select and enact optimal supportive care or safety strategies to prevent toxicities, communicating risks and immediate actions to patients Predict, evaluate, and classify toxicities of systemic therapy and modify drug scheduling or supportive care to optimise patient care being compliant of local/national pharmacovigilance governance policies Discuss with patients and caregivers to understand shared goals of treatment, defining potential toxicities and treatment benefit; being able to guide patient discussions about treatment decisions in the face of progressive disease Discuss with patients and caregivers about end-of-life decision making in the face of clinical deterioration

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4.8.1.c. Mesothelioma

BC John Cho

Thomas John

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with mesothelioma along the disease continuum
Key Concepts	Recognise the main aetiology for mesothelioma is asbestos with a long latency period, often decades, between exposure and disease Recognise the rarity of mesotheliomas and importance of being assessed at a tertiary centre with mesothelioma experience Recognise that smoking and asbestos exposure synergistically increases mesothelioma risk Recognise there are different pathologic subtypes of mesothelioma which have implications for the selection of the appropriate treatment strategy Recognise mesothelioma is largely incurable with poor outcomes Recognise most mesotheliomas are associated with specific recurrent genetic aberrations (such as <i>BAP1</i>, <i>NF2</i>, and <i>CDKN2A</i>) which can be associated with histologic subtype Determine prognostic factors in mesothelioma including performance status, weight loss, chest pain, stage, histologic subtype, and laboratory abnormalities (such as neutrophil to lymphocyte ratio) Define the appropriate clinical staging of mesothelioma which involves computed tomography and/or PET, pleural biopsy, as well as EBUS if surgery is contemplated Determine treatment is guided by tumour stage, histology, patient functional status and, in selected patients, may be multimodal Recognise the optimal treatment of mesothelioma involves multidisciplinary team, including pulmonologists, thoracic surgeons, medical and radiation oncologists, palliative care specialists, and ancillary services (such as social work) Recognise most mesotheliomas at presentation are unresectable and often treated palliatively with systemic (including immunotherapy agents) and/or radiation therapy Demonstrate knowledge of selecting, communicating, and prescribing systemic therapy Recognise, given the lack of curative treatments and its rarity, patients with mesothelioma are encouraged to participate in clinical trials
Skills	Demonstrate the ability to: Perform a history (including occupational exposure to asbestos) and physical examination Participate in multidisciplinary treatment planning discussions to appreciate all the considerations which go into deciding the appropriate treatment Discuss considerations in prescribing various treatments (such as surgical procedure, systemic agents, and radiation) and their interactions Identify conditions (such as performance status, response to therapy, toxicities, comorbidities, prior therapy) important to consider when determining how to manage mesothelioma Discuss with patients about treatment options, including palliation and best supportive care

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4.8.1.d. Thymoma and Thymic Cancer

Nicolas Girard

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with thymoma and thymic cancer along the disease continuum
Key Concepts	Recognise that thymic malignancies are rare epithelial tumours arising in the anterior mediastinum. Differential diagnoses include thymic hyperplasia, lymphomas, and germ-cell tumours Recognise that the current histopathologic classification distinguishes thymomas from thymic carcinomas. Thymomas are further subdivided into different types (so-called A, AB, B1, B2, and B3). Thymic carcinomas are similar to their extrathymic counterpart, the most frequent subtype being squamous cell carcinoma Define staging based on the 8th TNM classification and/or the Masaoka-Koga system. Staging is based on pathologic assessment after surgical resection of the tumour Determine that myasthenia gravis is found in 30% of patients with thymoma, and other autoimmune disorders may be observed. Systematic immunologic check-up is recommended Explain that treatment strategy is primarily based on whether the tumour may be resected upfront or not. If complete resection is deemed to be achievable, upfront surgery represents the first step in the treatment, possibly followed by postoperative radiotherapy; if not, primary chemotherapy is administered, part of a curative-intent sequential strategy integrating subsequent surgery and/or radiotherapy Determine systemic therapies administered as the sole treatment modality for metastatic, unresectable, recurrent disease not eligible for focal therapies. Regimens are similar to those for primary chemotherapy, and include platin-based regimens. Antiangiogenic agents and immune checkpoint inhibitors may be used Identify major prognostic factors that include tumour stage, completeness of surgical resection and histology
Skills	Demonstrate the ability to: Participate actively to a variety of thymoma and thymic cancer clinical scenarios and patient presentations through multidisciplinary discussions on general management strategies in order to understand all the considerations on which treatment to use and which sequence to select Perform a history and physical examination in patients with thymoma and thymic cancer and determine appropriate biologic and imaging tests (including computed tomography, positron emission tomography, magnetic resonance imaging) and with differential diagnoses Use the various systemic agents considering their potential interactions with radiation therapy, and recognise the side effects Discuss key considerations in multimodal treatment sequences, including surgery, chemotherapy (primary, exclusive) and radiotherapy (postoperative, definitive), at the time of initial management and when recurrences occur Design the follow-up strategies with patients, including the long-term implications regarding autoimmune disorders Critically discuss the treatment options/recommendations

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4.8.2. Gastrointestinal Cancers

4.8.2.a. Oesophageal Cancer

Nina Beri

Stefano Cascinu

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with oesophageal cancer along the cancer continuum
Key Concepts	Describe epidemiology and aetiology of oesophageal cancer Distinguish different biologic and pathologic subtypes of oesophageal cancer (eg, squamous v adenocarcinoma) in order to select the appropriate treatment strategy Recognise the role of Barrett's oesophagus as a major risk factor for oesophageal adenocarcinoma and understand who should be screened for it, know the appropriate surveillance and the therapeutic options for its management Recognise the role of smoking and alcohol consumption in the development of squamous cell oesophageal cancer Identify when to consider patients for germline genetic testing and implications for counselling of family members Define the TNM staging system in oesophageal cancer Describe staging procedures, including diagnostic and radiologic procedures for staging Explain the different roles of treatment and implications for a locally advanced or metastatic disease Recognise the importance of the multimodality approach in treatment of early disease including the role of surgery and radiation oncology Determine the role of preoperative treatment in the management of early disease Evaluate the role of immunotherapy in early and advanced disease and the possible immunotherapy adverse events that may result from this treatment Describe the role of nutritional support in early and advanced disease Interpret the complications associated with disease progression or treatment-associated to be familiar with supportive and palliative care strategies

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Skills	Demonstrate the ability to: Participate in the multidisciplinary management decisions for patients with newly diagnosed oesophageal cancer Discuss with patients the optimal treatment strategies (preoperative chemotherapy or radiochemotherapy, chemotherapy for advanced disease, immunotherapy in early and advanced disease) Evaluate patients for therapy (performance status, nutritional status, comorbidities, etc) by history, physical examination, blood tests Assess and manage disease-related events (tracheo-oesophageal fistula, infections, pain, etc) and complications of systemic therapies (chemotherapy, immunotherapy) Manage patients at all stages of disease, from localised to metastatic and initiation of palliative and supportive care Discuss the appropriate follow-up with patients not only for an earlier identification of relapse but, mainly, to prevent and manage late side effects such as malnutrition

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4.8.2.b. G-E Junction Cancer

Nina Beri

Elizabeth C. Smyth

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with gastro-oesophageal (GE) junction cancer along the cancer continuum
Key Concepts	Distinguish which tumours are considered oesophageal v GE junction v gastric and the potential differences in treatment Describe the histologic and molecular subtypes of GE junction cancer Distinguish hereditary syndromes and understand of how to counsel these patients and their families and when to refer for genetic assessment Evaluate diagnostic and staging methodologies including endoscopy, computed tomography (CT), endoscopic ultrasound, positron emission tomography CT, laparoscopy and the TNM

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	staging system to determine operative candidates Recognise the importance of the contribution of the multidisciplinary team in management of GE junction cancer including medical oncology, radiation oncology, surgery, pathology, radiology, nutrition, and palliative care Recognise that for curative treatment, patients with operable GE junction cancer require surgery, but that the addition of chemotherapy, chemoradiotherapy and immunotherapy may be needed for most patients Recognise the impact of surgery for GE junction cancer on patient nutrition and well-being, and the need for appropriate follow-up after surgery Explain the implications of biomarker testing in GE junction tumours including microsatellite instability or mismatch repair deficiency, human epidermal growth factor receptor 2 (HER2), and PD-L1 on the choice of systemic therapy Define the available lines of systemic therapy including chemotherapy, targeted therapy and immunotherapy, and how to sequence these Determine the potential complications resulting from disease progression or treatment including dysphagia, nutritional challenges and the benefits of early nutritional intervention Recognise that early palliative care support for symptom burden alongside oncology treatment is recommended
Skills	Demonstrate the ability to: Perform a history and physical examination and assess performance status for treatment in patients diagnosed with GE junction cancer Use the commonly available molecular tests (mismatch repair deficiency/microsatellite instability, HER2, PD-L1) to prescribe appropriate targeted or immunotherapy for patients Participate in multidisciplinary team meetings where the multidisciplinary treatment of GE junction cancer is discussed to understand why specific treatments are indicated for each patient Prescribe and discuss systemic therapy and understand their potential interactions with other therapeutic modalities including radiation Predict and manage side effects from cytotoxic chemotherapy, monoclonal antibodies or other targeted therapies, and immunotherapy Manage patients from their initial diagnosis to end-of-life and supportive care including referring for or initiating nutritional and palliative interventions

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4.8.2.c. Gastric Cancer

Nina Beri

Aziz Zaanan

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with gastric cancer along the cancer continuum
Key Concepts	Explain worldwide regional differences in the incidence of gastric cancer and be aware of specific lifestyle risk factors and premalignant conditions for gastric cancer Recognise that there are different biologic and pathologic subtypes of gastric cancer which have implications for the selection of the appropriate treatment strategy Distinguish the appropriate diagnostic and staging investigations in gastric cancers, such as upper endoscopy with biopsy, endoscopic ultrasound, computed tomography and PET imaging, and laparoscopy Recognise that the optimal treatment of gastric cancer involves a multidisciplinary team, including gastroenterologists, digestive surgeons, medical and radiation oncologists, and palliative care specialists Determine the most appropriate therapeutic strategy which is mainly guided by tumour stage, patients' functional status and biomarkers, such as human epidermal growth factor receptor 2, PD-L1, mismatch repair deficiency/microsatellite instability, and other currently under assessment Recognise the indications of endoscopic resection, surgery, perioperative, and adjuvant treatments in early/localised gastric cancer stage Describe the pattern of metastases of gastric cancer Recognise the role of chemotherapy and monoclonal antibodies in the management of patients with advanced gastric cancer Define the value of lines of treatment in case of disease progression Identify hereditary forms of gastric cancer, and determine the management of these families and the implications for individual patients Recognise the symptoms and complications that derive from disease progression and those that are treatment-associated in the context of being familiar with supportive and palliative care settings
Skills	Demonstrate the ability to: Perform a history and a physical examination in patients diagnosed with gastric cancer at different stages of disease Counsel patients on prevention strategies, their families, and provide an understanding of when germline genetic testing would be indicated Participate in multidisciplinary discussions on treatment sequencing Discuss and determine with the patient a treatment plan at all stages of disease, from early localised disease to metastatic disease Manage side effects from treatment with cytotoxic chemotherapy, radiation therapy, monoclonal antibodies, and immunotherapy Manage disease-related symptoms Prescribe systemic therapies including chemotherapy, monoclonal antibodies and immunotherapy Perform care for patients at all stages of disease until the initiation of hospice care

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2. ASCO Clinical Practice Guidelines: Gastroesophageal Cancer. <https://www.asco.org/practice-patients/guidelines/gastrointestinal-cancer>

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4.8.2.d. Colon and Rectal Cancer

Nilofer Azad

Julien Taieb

Anuradha Krishnamurthy

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with colon and rectal cancer along the cancer continuum
Key Concepts	Describe the epidemiology of colorectal cancer Determine the indications and diagnostic tools available for colon and rectal cancer (such as colonoscopy, endosonography, and magnetic resonance imaging) and their implications for therapies Describe concept of screening colorectal cancer (using rectosigmoidoscopy, complete colonoscopy, faecal occult blood tests, and others) and its impact on cancer prevention and early diagnosis Determine the implications of the different biologic and pathologic subtypes of colon and rectal cancer in order to select the appropriate treatment strategies Recognise that colon and rectal cancer in early stages are treated differently Summarise the risk assessment of prognostic factors, especially the TNM staging system for colon and rectal cancer Recognise the importance of the multimodality approach to treat patients with colon and rectal cancer Distinguish the indications and value of surgery, radiotherapy and chemotherapy in the adjuvant and neoadjuvant setting of colon and rectal cancer Determine the options for therapy of locally advanced rectal cancer (eg, standard long course chemoradiation v short course v total neoadjuvant therapy) Determine a non-surgical/organ preservation surveillance approach for rectal cancer with a complete response after chemoradiotherapy (watch and wait) Describe the principles of the multimodality approach in patients with limited or oligometastatic disease Recognise the role of surgery in resectable liver and lung metastases and the role of chemotherapy in borderline or unresectable situations in order to achieve resectability Recognise the role of liver directed therapies in the setting of oligometastatic disease Recognise the role of cytoreductive surgery ± hyperthermic intraperitoneal chemotherapy in patients with limited peritoneal metastases Recognise the role of chemotherapy and targeted therapies in the management of patients with advanced disease Recognise the strengths of personalised medicine and the importance of offering individualised targeted therapies based on molecular findings, such as mismatch repair deficiency, <i>KRAS</i>, <i>NRAS</i> or <i>BRAF</i> mutations Recognise the importance of tumour location in selecting therapy in the metastatic setting Distinguish hereditary syndromes, the management of families with these and implications for individual patients Recognise the value of lines of treatment in case of disease progression and in the continuum of care Distinguish the symptoms and complications that derive from disease progression and those that are treatment-associated in the context of being familiar with supportive and palliative care settings

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	Determine the impact of colorectal cancer treatment on fertility Describe surveillance strategies in stage I-III colorectal cancer Interpret clinical trials and understand their place in the spectrum of treatment options for metastatic disease Recognise chronic complications of various treatment modalities (surgery, radiation, and chemotherapy) that will need to be addressed during surveillance
Skills	Demonstrate the ability to: Participate actively in a variety of colon and rectal cancer scenarios and patient presentations Identify the main molecular subtypes upfront to determine the optimal treatment type and strategy Critically discuss the treatment options and recommendations for early and metastatic disease Perform a history and physical examination in patients with colorectal cancer, including different subtypes and different stages of disease Discuss general management strategies which include an understanding of the value of a multidisciplinary approach and a good understanding of treatment choice and sequence Prescribe various chemotherapeutic agents and targeted therapies taking into consideration their potential interactions (including with radiation therapy where applicable) Manage neoadjuvant and adjuvant treatment of colorectal cancer, especially in the setting of rectal cancer and oligometastatic disease Evaluate conditions or clinical prognostic factors such as performance status, tumour load, molecular profile, number of metastases, prior adjuvant chemotherapy, concomitant diseases and other previous therapies that will impact treatment decision Compare the available liver-directed therapies Manage side effects of various therapeutic agents and modalities Perform surveillance of treated early-stage colon and rectal cancer Discuss prevention strategies with patients and, if applicable, potential implications for family members Identify all genetic syndromes linked to colorectal cancers for genetic counselling Manage acute and chronic side effects of colorectal cancer treatments Discuss the psychosocial and medical complexities of early-onset colorectal cancer (eg, concurrent childcare/elder care responsibilities, financial impact, fertility, etc)

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3. ESMO Clinical Practice Guidelines: Rectal Cancer. <https://www.esmo.org/guidelines/gastrointestinal-cancers/rectal-cancer>
4. ASCO Clinical Practice Guidelines: Colon and Rectal Cancer. <https://www.asco.org/practice-patients/guidelines/gastrointestinal-cancer>

4.8.2.e. Anal Cancer

Simon Pernot

Nilofer Azad

Anuradha Krishnamurthy

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with anal cancer along the cancer continuum
Key Concepts	Recognise specific lifestyle and epidemiologic risk factors (sexual behaviours, immunosuppression) Recognise the role of human papillomavirus (HPV) infection (aetiologic factor) Understand the protective value of HPV vaccinations in the development of anal cancers Recognise the role of HIV factor (risk factor) Distinguish the majority of anal cancer are squamous cell carcinoma, other rare histopathologic entities exist (eg, adenocarcinoma, neuroendocrine tumours, etc) Recognise the importance of cancer precursor lesions and premalignant conditions for the development of anal cancer (anal intraepithelial neoplasia) Determine the modality of screening in high-risk patients, and the lack of international consensus Classify the different stages of anal cancer in order to select the appropriate treatment strategies Summarise the pattern of metastases of anal cancer Distinguish the diagnostic tools available for anal cancer (such as endoscopy with or without endoscopic ultrasound, computed tomography [CT], magnetic resonance imaging, and positron emission tomography/CT imaging), indications for their use and their role in choosing an appropriate therapeutic strategy Distinguish the rare indications for and limits of exclusive local excision Determine the indications and value of the multimodality approach of radiation therapy and chemotherapy in non-metastatic anal cancer, and the absence of indication for adjuvant systemic therapy Explain the treatment approach to the patient and prescribe the appropriate therapy Recognise the complexity of radiation therapy in anal cancer and that ideally it would require intensity-modulated radiation therapy because of the varying size and shape of the target volume and the proximity to dose-sensitive critical structures such as the small bowel, rectum, bladder, femoral heads, perineum, and external genitalia Explain the role of surveillance protocols and the appropriate interval from the completion of radio-chemotherapy as definitive treatment to first restaging evaluation Determine the value of salvage surgery after primary definitive radio-chemotherapy in localised anal cancer Recognise symptoms of disease progression Recognise treatment-associated complications and the role of supportive management in providing improved function and quality of life Determine the role of chemotherapy in the management of patients with recurrent and metastatic cancer
Skills	Demonstrate the ability to: Select high-risk patients who might benefit from anal cancer screening Critically discuss the role of chemoradiotherapy, exclusive radiotherapy or salvage surgery for early stage Discuss chemotherapy for the metastatic disease Perform a history and physical examination patients with anal cancer including digital rectal exam (and vaginal examination in women) and palpation of the inguinal nodes Manage acute and delayed toxicities of chemotherapy and chemoradiation Predict potential interaction with HIV treatment in HIV-positive patients Discuss prognostic factors such as performance status, tumour load, number of metastases, prior radio-chemotherapy, concomitant diseases Educate patients in the importance of lifestyle factors, viral infections, and the preventative value of HPV vaccinations of anal cancer

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4.8.2.f. Hepatobiliary Cancers

Nina Beri

Thomas Decaens

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with hepatobiliary cancers along the cancer continuum
Key Concepts	Recognise risk factors that may lead to development of hepatocellular carcinoma (HCC) including hepatitis B/C, nonalcoholic steatohepatitis, cirrhosis, alcohol-related liver disease Recognise immune mechanisms involved in chronic liver diseases and in liver cancer leading to immune exhaustion Explain the staging system for HCC and biliary cancers, including the TNM staging system and the Barcelona Clinic Liver Cancer staging system (for patients with HCC) Evaluate patients' Child Pugh and MELD status and how that may influence treatment options for patients with HCC, including the options for locoregional therapy and systemic therapy Determine when to refer patients with HCC for liver transplant evaluation Recognise the importance of next generation sequencing in biliary cancers as these cancers are enriched for targetable mutations Interpret the molecular differences seen in the different classifications of biliary cancers Recognise potential biliary obstruction and potential complications from this including cholangitis and when to refer for endoscopic intervention Determine the optimal sequence of systemic therapy for patients with hepatobiliary cancer Recognise the potential side effects of treatment with cytotoxic chemotherapy, immunotherapy, and targeted therapy Distinguish how to select and prescribe systemic therapy and discuss systemic therapy options including potential side effects with patients
Skills	Demonstrate the ability to: Participate in management of patients with HCC in a multidisciplinary fashion with the involvement of the transplant team, surgery, interventional radiology, medical oncology, and hepatology Participate in multidisciplinary management of patients with biliary cancers Discuss therapy options with patients with all stages of

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hepatobiliary cancers

Assess performance status, Child Pugh and MELD status when determining a patient's ability to tolerate systemic therapy for HCC and ability to recognise when initiation of hospice would be appropriate

Design optimal sequence treatment for multidisciplinary therapy in patients with HCC

Design sequence of systemic therapies including targeted therapies if applicable for patients with hepatobiliary cancer

Execute management of patients from their initial diagnosis to advanced disease and initiation of hospice

Differentiate between symptoms related to underlying cirrhosis versus the HCC and management strategies

Predict and manage side effects from systemic therapies, including cytotoxic chemotherapy, immunotherapy and targeted therapy

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4.8.2.g. Pancreatic Adenocarcinoma

Nina Beri

Teresa Macarulla

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with pancreatic adenocarcinoma along the cancer continuum
Key Concepts	Describe the biology of pancreatic cancer, and be aware of the poor prognosis of the disease Explain the etiologies of pancreatic cancer, and be aware that 10%-12% of these patients may present with a cancer predisposition syndrome Distinguish that adenocarcinomas are treated differently than neuroendocrine tumours and often have very different prognosis Recognise the importance of the multidisciplinary team in treating resectable pancreatic cancer Distinguish the various diagnostic tools used including endoscopic ultrasound, computed tomography (CT) scans, positron emission tomography/CT, diagnostic laparoscopy and the implications for the therapeutic strategy Distinguish imaging studies including pancreatic CT scans to correctly identify whether or not the disease is resectable Interpret germline genetic testing guidelines and hereditary syndromes and how the results may influence counselling of patients and family members Recognise the role of endoscopic techniques in the management of biliary obstruction Define the various classifications of pancreatic cancer including

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	resectable, borderline resectable, locally advanced and how this influences the therapeutic strategy Determine the role of neoadjuvant chemotherapy in the treatment of borderline resectable and locally advanced disease Evaluate the presence of a biomarker for platinum-based chemotherapy: DNA damage response and repair alterations Determine how Eastern Cooperative Oncology Group (ECOG) performance status may impact the choice of chemotherapy regimen Define the most appropriate systemic therapy for metastatic disease Recognise the importance of clinical trials in this disease Distinguish complications that may result from the disease versus side effects resulting from therapy Recognise the importance of quality of life in this disease Recognise the importance of next generation sequencing in this disease, and appreciate that younger patients may be more likely to have tumours harbouring druggable alterations
Skills	Demonstrate the ability to: Participate in multidisciplinary discussions with pathology, radiology, surgery, gastroenterology, medical oncology, and radiation oncology Perform a history and physical examination on patients with pancreatic cancer, and ability to identify the patients ECOG score and use this to help determine an appropriate treatment approach Discuss effectively with patients, particularly as this is a tumour with a dismal prognosis Discuss treatment options and sequencing for patients at various stages of the disease Perform follow-up in patients from initial diagnosis until the initiation of hospice Prescribe targeted therapies and chemotherapy Predict and manage side effects resulting from systemic therapies Predict and manage symptoms related to the tumour

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4.8.3. Breast Cancer

Giuseppe Curigliano

Erica Michelle Stringer-Reasor

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with breast cancer along the cancer continuum
Key Concepts	Determine that breast cancer includes several molecular subtypes defined by genomic testing and immunohistochemistry (IHC) surrogates Recognise that IHC surrogates and molecular subtypes have implications for prognosis and for the selection of appropriate treatments Describe the classification of different pathologic subtypes of breast cancer, including rare histologic subtypes and implications for prognosis and treatment Recognise that breast cancer screening includes mammogram and in some cases ultrasound and magnetic resonance imaging to improve sensitivity Recognise that breast cancer screening should be personalised for individuals and patients harbouring <i>BRCA</i> germinal mutations and other hereditary breast and ovarian cancer germline mutations, and understand the risk of related breast cancer and implications for surveillance of carriers, diagnosis and treatment Recognise that some individuals and patients should be tested, when indicated, for the presence of germline hereditary cancer-related syndromes (such as <i>BRCA</i> mutations), and understand the implications for surveillance of asymptomatic carriers and treatment of mutation-related cancer cases Determine breast cancer in male patients Recognise the availability of different diagnostic and staging procedures, including imaging and pathology Interpret different prognostic and predictive factors, including genomic assays, to stratify the risk and tailor treatment in the adjuvant setting Recognise the importance of the multidisciplinary approach to manage patients with breast cancer, in the early and the metastatic settings Recognise the existence of different therapeutic modalities namely surgery, radiotherapy, systemic therapies (chemotherapy, endocrine therapy, immunotherapy, and targeted therapy), as well as specialities such as physical therapy to manage lymphoedema Determine that in specific subtypes neoadjuvant therapy should be preferred Determine that systemic treatment in the metastatic setting should follow an evidence-based and subtype-tailored approach, and sequence of therapy may impact outcome Express competences on routine follow-up of patients, including tackling issues of survivorship Identify patients with metastatic breast cancer that can have long-survival with biomarker-directed systemic treatment Recognise and consult international guidelines for the management of patients with breast cancer, since they are based on level of evidence and grade of recommendation Recognise the existence of social determinants of health and its association with healthcare disparities in breast cancer
Skills	Demonstrate the ability to: Select those patients who have an indication for neoadjuvant treatment and those who would be best treated by primary surgery Participate actively in a variety of breast cancer clinical scenarios and patient presentations and to multidisciplinary tumour board discussion on general management strategies and understand all the clinical and biologic features that will drive the decision making on which treatment to use and which sequence to select for the multidisciplinary strategy Perform an history (family history, comorbidities) and physical examination Discuss the appropriate type of molecular testing, genomic signature or IHC marker to be used to personalise treatment in

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	the early and in the metastatic setting Prescribe and manage various chemotherapeutics, immunotherapies, targeted agents, and monoclonal antibodies Manage side effects of chemotherapy, immunotherapy, targeted therapy, and monoclonal antibodies Identify conditions (such as performance status and patients' clinical condition, concomitant disease(s), previous treatments, etc) that are important for considering treatment options Discuss chemoprevention strategies with patients Apply survivorship care plans which include appropriate clinic visits, routine diagnostic test, and guidance to improving health such as nutrition and exercise Discuss genetic counselling/testing with patients and their relatives Discuss and encourage treatment compliance (particularly regarding adjuvant endocrine therapy) with patients Discuss and offer fertility preservation to young patients

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4.8.4. Genitourinary Cancers

4.8.4.a. Renal Cell Cancer

Munveer Bhangoor

Lisa Pickering

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with renal cell cancer along the cancer continuum
Key Concepts	Classify the sub-types of renal cancer and their relative incidence: clear cell (75%-80% of cases); papillary types I and II (together 10%-15%); chromophobe (5%) and more rare subtypes of medullary; translocation; collecting duct carcinomas Recognise that >95% of renal cell cancer is sporadic with <5% being inherited due to mutations in autosomal dominant genes including <i>VHL</i>, <i>FH</i>, and <i>MET</i>

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	Describe that inactivating <i>VHL</i> mutations in clear cell renal cancer drive constitutive activation of HIF2 alpha and in turn HIF-dependent genes including <i>VEGF</i> which explains the highly angiogenic nature of renal cancer Explain the systems for categorising the individualised risk of localised and metastatic renal cancer Describe the different types of local therapy that may be used in small primary renal cancers including cryotherapy and hyperthermia/radiofrequency ablation as well as partial nephrectomy Recognise that radical nephrectomy is required for larger and central tumours and that renal cancer surgery is increasingly performed with laparoscopic or robotic techniques Describe that the main classes of systemic therapy used in the treatment of renal cancer are checkpoint inhibitor immunotherapy (IO) and small molecule tyrosine kinase inhibitors (TKI) targeting the vascular endothelial growth factor (VEGF) receptor (VEGFR) and mTOR Evaluate the results of adjuvant studies of VEGF-targeted therapy and summarise that these have not demonstrated an established role for this approach Recognise that adjuvant pembrolizumab immunotherapy confers an improvement in disease-free survival for patients with intermediate- and high-risk resected clear cell renal cancer Identify the studies in first and later lines of therapy for patients with metastatic clear cell renal cell cancer that have led to improved progression-free and overall survival Explain that optimal treatment for first-line renal cell cancer increasingly involves the use of immunotherapy-based combination treatment either as an "IO + IO" or "IO + TKI" strategy Describe that at present there are no validated predictive markers to choose between approved systemic options in the treatment of renal cell cancer Recognise that selection between these options may be guided by clinicopathological factors such as risk category, performance status, comorbidities and disease distribution. For example, approval for "IO + IO" with nivolumab + ipilimumab is limited to use in intermediate- and poor-risk disease Summarise the studies that have been conducted in patients with non-clear cell renal cell cancer including those showing the role of the vascular endothelial growth factor receptor TKIs sunitinib and cabozantinib Describe the role of cytoreductive nephrectomy in management of favourable and intermediate-risk metastatic renal cancer in the light of published studies Appreciate that emerging data show it has less of a role than in the past in this era of more effective systemic therapies Recognise that local therapy, either metastasectomy, stereotactic radiotherapy or radiofrequency ablation, has an important role in the management of oligometastatic disease and should be discussed at multidisciplinary team meetings Explain ongoing studies with combination therapies, vaccines, HIF2 alpha-targeting therapy
Skills	Demonstrate the ability to: Report the indications for nephrectomy, partial nephrectomy, ablative therapies and metastasectomy in patients with localised disease and metastatic disease Select appropriate systemic anti-cancer therapies in the adjuvant and metastatic settings in accordance with recognised guidelines for localised and metastatic renal cell cancer Identify conditions that are important to consider when deciding whether to initiate or change treatment, such as performance status, comorbidities, response to, and side effects from prior therapy Apply knowledge and algorithms in the management of the toxicities associated with targeted therapies and checkpoint inhibitor immunotherapy Participate in multidisciplinary treatment planning discussions (for at least 20 patients with renal cancer) in order to appreciate all the considerations which, go into deciding the most appropriate treatment for a patient

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4.8.4.b. Urothelial Cancer

Munveer Bhangoo

Maria De Santis

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with urothelial cancer along the cancer continuum
Key Concepts	Identify the risk factors associated with urothelial cancers and provide the recommendations about cessation of smoking at any stage of disease Distinguish between non—muscle invasive (NMIBC) and muscle invasive bladder cancer (MIBC) Determine the role of urine cytology, and to know how to use transurethral resection of bladder, diagnostic imaging and cystoscopy in the staging and follow-up of patients with NMIBC Determine the role of intravesical therapy in the management of NMIBC, as well as the role of salvage instillation and surgery in recurrent and/or progressive non—muscle invasive and early-stage invasive cancers Distinguish the advantages and disadvantages and indications for radical cystectomy and lymph node dissection and definitive chemo-radiotherapy or trimodality treatment for MIBC Recognise the survival benefit for neoadjuvant cisplatin-based chemotherapy for patients with MIBC undergoing radical cystectomy Identify emerging indications for adjuvant immunotherapy for patients with residual disease after cystectomy Identify the clinical criteria that determine platinum-eligibility in order to guide selection of first-line systemic therapy Determine about alternative treatment options for platinum ineligible patients Determine the indications of immunotherapy for the treatment of metastatic urothelial cancer (mUC) Determine the concept of switch maintenance immunotherapy for mUC responsive to platinum chemotherapy Explain mechanism of actions of antibody drug conjugates (ADCs) and fibroblast growth factor receptor inhibitors and role in mUC
Skills	Demonstrate the ability to: Counsel patients concerning risk factors for bladder cancer progression and recurrence Perform the work-up and diagnostic procedures in case of haematuria

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Discuss interdisciplinary the treatment options for NMIBC, instillation therapy and early cystectomy

Design adequately staging of patients with MIBC

Discuss definitive treatment options for MIBC, cystectomy, urinary diversions, and trimodality treatment with bladder preservation

Discuss with the patients the optimal treatment strategies according to the criteria for cisplatin eligibility, platinum eligibility, and clinical prognostic factors

Discuss perioperative chemotherapy and immunotherapy

Select and prescribe ChT, immunotherapy, targeted therapies, and ADCs for advanced and metastatic disease, and the side effects of these treatments and counsel patients and their families

Select and prescribe treatment of ChT and immunotherapy-relapsed disease

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4.8.4.c. Penile Cancer

Lisa Pickering

Philippe E. Spiess

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with penile cancer along the cancer continuum
Key Concepts	Summarise that penile cancer is uncommon, accounting for <1% of all cancers and <0.1% of cancer deaths in the US and Europe but a higher proportion in other countries such as South America, Asia and Africa Describe the role of human papillomavirus (HPV), non-HPV biologic pathways, ethnic background and hygienic standards in the aetiology of penile cancers and that circumcision is protective Recognise that any penile lesions that are suspicious of a possible malignancy or non-responsive to prior therapy should be biopsied to rule out the diagnosis of penile cancer

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	Explain that squamous cell carcinoma accounts for more than 95% of cases of penile cancer with less common subtypes including verrucous, basal cell, and adenocarcinoma Recognise that currently no molecular biomarkers have been shown to be useful in clinical practice Explain the different approaches for staging and the particular importance of lymph node staging including early detection of lymph node metastases by dynamic sentinel node biopsy (DSNB) Explain that while 5-year survival for those with early-stage disease (0-II) exceeds 80% this drops to <20% for those with stage IV disease Summarise the range of potential treatments for localised disease according to stage at presentation; including topical therapy for low-disease stages, the increasing role of penile-preserving techniques, wide local excision plus reconstructive surgery, laser therapy approaches, radiotherapy delivered as external beam radiation therapy or brachytherapy with interstitial implants, as well as radical penectomy for high tumour stages Recognise that patients diagnosed and treated for penile cancer have an ensuing significant impact on their quality of life hence should be screened for depression as well as offered appropriate counselling and support Recognise that optimal management of regional lymph nodes is of fundamental importance in penile cancer treatment and that multimodality treatment has a role Explain the importance of surgically assessing the inguinal lymph nodes either by inguinal lymph node dissection (ILND) or DSNB in patients with a high-risk primary tumour (pT2 or greater) even in the absence of palpable inguinal adenopathy Summarise that patients with bulky inguinal lymph node (cN2/3) metastasis in the absence of distant metastatic disease, should be seen by a multidisciplinary team with consideration of upfront neoadjuvant systemic platinum-based chemotherapy followed by ILND versus upfront ILND without chemotherapy Explain that ipsilateral pelvic lymphadenectomy is considered when more than two lymph nodes are involved (N2) or there are extracapsular lymph node metastases (N3) Recognise that in the setting of N2 or N3 disease, adjuvant chemotherapy should be considered for patients who did not receive neoadjuvant chemotherapy Explain that when pelvic (as opposed to inguinal) lymph nodes are enlarged and/or suspicious, an FNA should be obtained. If confirmed to represent metastatic disease, multidisciplinary evaluation is required to consider systemic chemotherapy or radiotherapy with concurrent chemotherapy as reasonable treatment options. In select patients with a favourable response to such treatment modalities, there may be a role for surgical resection Explain that patients with N3 lymph nodes may be considered for chemoradiation to the affected inguinal lymph node basin Recognise that following definitive management of penile cancer in a given patient, diligent surveillance will be required, with judicious use of chest and pelvis imaging at regular intervals based predominantly on the nodal burden in a given patient which predicts the likelihood of recurrence Describe that treatment options for metastatic penile cancer are palliative in nature and include systemic chemotherapy; epidermal growth factor receptor-directed therapy and may include radiotherapy for symptom control Recognise that historically there have been few clinical trials for penile cancer and that level 1 evidence for systemic therapy is lacking Summarise that in recent years prospective trials addressing efficacy of systemic therapies have been reported and that trials investigating new systemic therapy approaches and optimal treatment of high risk, node positive localised disease are ongoing
Skills	Demonstrate the ability to: Discuss the appropriate diagnostic tests in the evaluation of a suspected penile mass or in the setting of the established diagnosis of penile cancer
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	Discuss the various treatment options for the management of a primary penile tumour Identify the possible multimodality treatment approaches for lymph node disease Educate patients with metastatic penile cancer about suitable treatment options including suitable systemic therapy regimens, radiotherapy, clinical trials, and/or hospice care/palliation Select appropriate systemic therapy when indicated, be able to prescribe this treatment correctly and communicate the recommendation to the patient using appropriate language Participate in multidisciplinary tumour boards planning the management of patients with localised and metastatic penile cancer Perform screening in patients with penile cancer consistently for possible depression/suicidal ideas and provide key educational resources including patient support groups or psychologic assessment as needed

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4.8.4.d. Prostate Cancer

Mark T. Fleming

Carmel Pezaro

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with prostate cancer along the cancer continuum
Key Concepts	Summarise the controversies surrounding the use of prostate-specific antigen (PSA) in screening for prostate cancer, including utility and interpretation of serum PSA in different clinical settings Classify localised prostate cancer into risk groupings, using the latest Gleason grading system and with reference to emerging data regarding genetic risk factors
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	Interpret the presence of adenocarcinoma, neuroendocrine differentiation and small cell carcinoma on biopsy and the treatment implications of non-adenocarcinoma histologic patterns and tumour heterogeneity Summarise the surgical and non-surgical treatments for primary prostate cancer, including the potential role of active surveillance for lower risk disease and combination approaches in men with locally advanced disease Explain the concept of watchful waiting and how this differs from a curative-intent treatment approach Distinguish between traditional and emerging imaging modalities in prostate cancer, recognising that these may be useful at different points along the disease spectrum Explain the role of salvage therapies in the treatment of men with localised prostate cancer. Discuss the current data regarding local treatments for men with oligometastatic disease Demonstrate an understanding of the short- and long-term morbidity and toxicities associated with androgen deprivation therapy (ADT), including strategies for mitigating these effects Give examples of patients who may be suitable for intermittent rather than continuous ADT, supported by trial evidence Describe the systemic and targeted upfront and/or escalated treatment options for men with hormone-sensitive metastatic prostate cancer Define castration-resistant prostate cancer (CRPC) and describe the survival-prolonging hormonal, chemotherapeutic, bone-targeting, radionuclide and immunotherapeutic therapies available for men with metastatic CRPC, including the likely benefit and potential toxicities for each option Summarise the evidence for sequential therapy in men with metastatic CRPC, including the deficits in current data Evaluate the role of bone-targeted agents in men with advanced prostate cancer, both for bone health and in the prevention of skeletal-related events Define non-metastatic CRPC and describe the evidence to support oral hormonal treatment options in these men Recognise the emerging data on genomic abnormalities in men with prostate cancer and explain the current evidence for treating men with proven DNA repair defects Determine patient-focused and supportive strategies in the management of men with metastatic prostate cancer, including the monitoring for and treatment of complications from advancing cancer
Skills	Demonstrate the ability to: Predict the benefit and potential harms from PSA testing in men without symptoms of prostate cancer Participate in the multidisciplinary discussion of a patient with localised prostate cancer, predicting the likely cancer outcomes and potential toxicity issues with curative-intent treatments Schedule appropriate follow-up procedures to identify or monitor prostate cancer progression, individualised to encompass disease- and patient-specific factors Discuss the initiation of ADT and strategies to minimise the morbidity of treatment Apply existing late-phase trial data in the use of systemic treatment options in men with CRPC Select the appropriate investigation and management strategy for a patient presenting with symptoms of malignant spinal cord compression

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4.8.4.e. Malignant Germ-Cell Tumours of the Adult Male

Jourik A. Gietema

Christian Kollmannsberger

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with malignant germ-cell tumours (GCT) of the adult male along the cancer continuum
Key Concepts	Recognise the rising incidence of malignant GCTs, their pre-natal origins and associated familial and clinical risk factors Recognise that there are different pathologic, anatomical, and biologic subtypes of GCT with different biologic behaviours, each associated with clinical implications for treatment planning and management Summarise the appropriate standard staging modalities of GCTs involving determination of classic serum tumour markers, three dimensional imaging (computed tomography scan of chest and abdomen), and testicular ultrasound Define the importance and limitations of tumour markers for staging, treatment evaluation and prognosis Describe prognostic criteria and the staging classifications for GCT and the important limitations thereof (TNM and the 1997 International Germ Cell Cancer Cooperative Group [IGCCCG] classification) Determine that the optimal treatment of GCTs is based on tumour stage/the IGCCCG classification and involves a multidisciplinary team, including medical oncologists, oncologic surgeons, urologic surgeons, radiation oncologists, pathologists, and radiologists. Indirect or direct consultation with high volume centres of excellence is highly encouraged. Referral of poor risk as well as relapsed patients to a high volume reference centre is strongly recommended Summarise the correct treatment modalities for the different stages of local, regional and metastatic GCT (stages I, II, III) Recognise that GCTs are uniquely chemotherapy (cisplatin)-sensitive with an excellent prognosis across all stages and that quality of survival is a major driver of management decisions Recognise that clinical stage I disease is, by far, the most common presentation and understand the advantages and disadvantages of active surveillance, primary retroperitoneal lymph node dissection and adjuvant chemotherapy for clinical stage I (CSI) non-seminoma and active surveillance, adjuvant chemotherapy or adjuvant radiation for CSI seminoma Describe and distinguish the different cisplatin-based combination chemotherapy regimens used in the treatment of GCTs (bleomycin, etoposide, and cisplatin; cisplatin, etoposide, and ifosfamide; paclitaxel, ifosfamide, and cisplatin; high dose chemotherapy; etc) and the strict number of cycles based on the IGCCCG risk profile Determine the negative impact of dose reductions and dose delays on treatment outcomes and the importance of maintaining dose intensity Explain the increased risk and risk factors for thromboembolic events in patients with metastatic GCT Recognise the essential importance of high volume centres for referral of complex cases (such as poor risk, relapsed disease or extragonadal GCT), for assistance in care and guidance and urgent expert consultation Recognise high-risk and unusual presentations in patients with GCT including metastatic choriocarcinoma and extragonadal GCTs and the need for urgent expert consultation and referral to a high-volume reference centre for these rare presentations Determine the predictable pattern of metastases in GCT and its impact on surveillance and follow-up strategies

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	Explain management strategies for relapse after CSI disease and after first-line chemotherapy treatment of metastatic disease including high dose chemotherapy with autologous stem-cell support. Consider inclusion into clinical trials whenever possible Distinguish the different management strategies for post-chemotherapy residual lesions in non-seminoma and seminoma after first-line chemotherapy Identify the critical importance of guideline and expert guided treatment for optimal outcomes in GCT Evaluate carefully the rapidly emerging themes since 2017 with immediate practice changing implications for cancer care delivery improvement (liquid biomarkers miR371, centralisation or regional guidance in decision making, care in low-resource environments, quality of care delivery, and high quality survivorship) Identify the importance of survivorship care after successful treatment with platinum-based chemotherapy with continued attention for late effects such as fatigue, paraesthesia, Raynaud's phenomenon, metabolic syndrome, and increased risk for second cancers and cardiovascular disease. Importance of cardiovascular risk management
Skills	Demonstrate the ability to: Perform an adequate and timely diagnostic plan for patients with suspected GCT Apply current staging classifications to individual patients with localised and metastatic disease based on the results of their staging procedures Discuss management options in CSI non-seminoma and seminoma including pros and cons of the different management strategies particularly with respect to overtreatment Design an overall management plan for patients including the various steps from diagnosis, diagnostic staging procedures to chemotherapy and post-chemotherapy surgery Select the correct chemotherapy regimen and cycle number according to the IGCCCG classification for patients with metastatic disease Present patients and their findings in the context of a multidisciplinary tumour board for optimal decision making or through high volume centres Use the information of cumulative dose of chemotherapy agents received or radiation delivered, develop a sufficient surveillance and follow-up schedule to avoid unnecessary follow-up investigations along with long-term survivorship plans

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4.8.5. Gynaecologic Malignancies

4.8.5.a. Ovarian Cancer and Other Ovarian Malignancies

Sara Dudley

Jonathan A. Ledermann

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment, and counselling of patients with ovarian cancer (including Fallopian tube and primary peritoneal cancer) and other ovarian malignancies along the cancer continuum
Key Concepts	Describe the epidemiology, aetiology, risk factors, and clinical presentation of ovarian cancer Evaluate the evidence for and against screening Recognise the genetic syndromes associated with ovarian cancer and implications for genetic testing and risk-reducing bilateral salpingo-oophorectomy Distinguish primary imaging modalities (pelvic ultrasound, contrast-enhanced magnetic resonance imaging and computed tomography [CT], positron emission tomography-CT) utilised in work-up and diagnosis Describe the International Federation of Gynecology and Obstetrics and American Joint Committee on Cancer eighth staging systems Express familiarity with the different histologic and molecular classifications of ovarian and associated clinical behaviour Recognise the clinical behaviour of rare ovarian tumours that include low-grade carcinoma, clear cell and mucinous subtypes, and non-epithelial stromal cell tumours Determine the presentation and management of ovarian germ-cell tumours Identify unique issues in younger patients, such as fertility preservation and management during pregnancy Determine the surgical management of newly diagnosed ovarian cancer, including upfront debulking surgery versus neoadjuvant chemotherapy and interval debulking surgery Determine different systemic cytotoxic therapies and their indications (including anti-angiogenic drugs, poly [ADP-ribose] polymerase [PARP] inhibitors, and intraperitoneal therapy) for newly diagnosed ovarian cancer Recognise the role of molecular and genetic testing in ovarian cancer (including <i>BRCA</i> genes, MSI/MMR, <i>NTRK</i>, and HRD) Define the principles of follow-up to detect and manage recurrent disease Determine systemic therapy options for relapsed/refractory disease (anti-angiogenic treatment, PARP inhibitors, hormonal therapy) Recognise the role of surgery for relapsed disease, including secondary cytoreduction and palliative procedures for organ obstruction Determine palliative management of symptoms such as bowel obstruction, pleural effusions, and ascites
Skills	Demonstrate the ability to: Perform initial evaluation and history and physical examination (including pelvic examination), discuss prognosis and order further work-up studies as indicated for patients with newly diagnosed ovarian cancer Discuss role of genetic testing Participate in multidisciplinary discussion regarding plan of care for newly diagnosed and recurrent/refractory ovarian cancer Select and prescribe systemic therapies for patients with both newly diagnosed and recurrent/refractory ovarian cancer (taking into account prior treatments, comorbidities, and current performance status) and in addition rare ovarian
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tumours, including malignant germ cell tumours Manage PARP inhibitor therapies and their toxicities Assess and manage both treatment-related toxicities and disease-related complications Design follow-up and surveillance plans with patients

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4.8.5.b. Endometrial Cancer

Sara Dudley
Domenica Lorusso
Camilla Nero

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with endometrial cancer along the cancer continuum
Key Concepts	Describe epidemiology, risk factors, genetic predisposition, molecular features, and signs and symptoms of endometrial cancer Determine upfront diagnostic work-up Explain fertility preservation options Define the molecular integrated risk assessment used in endometrial cancer (low-, intermediate-, high-intermediate, and high) Express familiarity with molecular features in terms of technical assays and prognostic impact (DNA polymerase epsilon, mismatch repair deficiency [MMR-d], MSI, TP53, p53, PD-L1) Interpret multiple classifier patients Distinguish therapeutic opportunities of patients with MMR-d Recognise the benefit of patient enrolment in molecular-driven clinical trials Determine the management of newly diagnosed endometrial cancer in relation to molecular integrated risk groups:
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	Indications for surgery (including fertility sparing surgery, minimally invasive techniques, role of lymphadenectomy, and sentinel lymph node) and radiotherapy Indications for adjuvant treatment (systemic therapy, radiotherapy) Determine the management of recurrent endometrial cancer: Systemic treatment options (role of chemotherapy and hormonal therapy, immunotherapy, and immune/TKI combinations) Role of surgery in relapsed disease, including palliative procedures Role of palliative radiotherapy
Skills	Demonstrate the ability to: Participate in the multidisciplinary management decisions of patients with newly diagnosed and recurrent endometrial cancer Select patients for therapy (history and physical examination, including complete pelvic exam) and discuss prognosis and treatment options Design management plans for patients with newly diagnosed endometrial cancer according to stage and molecular integrated risk stratification, taking into consideration comorbidities and performance status Design and prescribe systemic therapy plans for patients with recurrent endometrial cancer, taking into consideration performance status, comorbidities, molecular profile, and prior toxicities Assess and manage disease-related events (eg, vaginal bleeding), complications of radiotherapy and systemic therapy Discuss and perform follow-up with patients

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4.8.5.c. Cervical Cancer

Linus Chuang

Ana Oaknin

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with cervical cancer along the cancer continuum
Key Concepts	Recognise that: Cervical cancer ranks fourth for incidence and mortality in cancers affecting women globally. About 85% of the new cases and deaths occur in low- and middle-income countries (LMIC) Human papillomavirus (HPV) causes nearly all cervical cancers and intraepithelial precursor lesions of the cervix Cervical cancer vaccination prevents 90% of cervical cancer High-quality screening program can lower the incidence by up to 80% The World Health Organization screening guidelines, including cytology, visual inspection (in LMIC), and HPV DNA testing The appropriate staging of cervical cancer involves clinical examination, incorporation of imaging (computed tomography, magnetic resonance imaging and/or positron emission tomography) and pathologic findings, including the lymph node disease status Treatment is guided by tumour stage, patient functional status and is often multimodal The optimal management of cervical cancer involves a multidisciplinary team, including gynaecologic oncologists, medical and radiation oncologists and palliative care specialists Surgery procedures: minimally invasive surgery v open radical hysterectomy Early-stage cervical cancer may be treated with surgery or radiation therapy (RT), while patients with locally advanced cervical cancer are treated with concurrent chemoradiation therapy (CCRT) The indications for patients who may benefit from adjuvant RT or CCRT after surgery Chemotherapy plus bevacizumab is first-line treatment for women with recurrent, metastatic and persistent cervical cancer Determine: The use of incorporating checkpoint inhibitors in either first-line treatment for women with recurrent, metastatic and persistent cervical cancer or locally advanced setting along with CCRT The use of single-agent immunotherapy for women who have progressed after first-line therapy The development of novel strategies for women who have progressed after first-line therapy Strategies in the management of acutely symptomatic patients The patterns of metastatic spread which guide follow-up That survival and quality of life are improved with early palliative intervention
Skills	Demonstrate the ability to: Select patients who might benefit from cervical cancer HPV vaccination and screening programmes Perform a history (cervical cancer screening, smoking history, etc) and physical examination (on patients with cervical cancer of different stages and histologic subtypes) Report the different histologic subtypes of cervical cancer Discuss the types of imaging and molecular testing available, when such testing is useful, and how to use the results to determine stage and optimal treatment modality Participate in multidisciplinary treatment planning discussions in order to appreciate all the considerations which go into deciding the most appropriate treatment for patients with cervical cancer Use chemotherapy and predict the interaction with RT Select indications of adjuvant therapy after surgery Select, communicate and prescribe bevacizumab in the management of patients with advanced, metastatic or recurrent

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settings

Select, communicate and prescribe immunotherapy in the different treatment scenarios: locally advanced, first-line for recurrent/metastatic/persistent and after platinum failure

Predict parameters such as performance status, side effects, comorbidities that guide treatment decisions, and the consideration of early palliative intervention

Schedule appropriate follow-up procedures, including the use of imaging studies and survivorship upon completion of treatments

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4.8.5.d. Vulvar and Vaginal Cancers

Sara Dudley

Philipp Harter

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with vulvar and vaginal cancers along the cancer continuum
Key Concepts	Describe the epidemiology, presentation, and risk factors for vulvar and vaginal cancers Express familiarity with methods of prevention of vulvar and vaginal cancers, including the diagnosis and management of pre-invasive disease (vulvar intraepithelial neoplasia, lichen sclerosis) Distinguish the distinct patient characteristics and presentation of human papillomavirus (HPV)-associated and HPV-independent vulvar cancer Interpret staging studies (including magnetic resonance imaging, positron emission tomography-computed tomography, endoscopic ultrasound and sentinel-lymph node biopsy) and implications for treatment planning Recognise the importance of the multimodality approach to treatment, including surgery, systemic treatment and radiation therapy Determine the primary role of surgery in the management of vulvar cancer and early-stage vaginal cancer Evaluate the optimal lymph node management (sentinel-

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	lymphadenectomy, full lymphadenectomy), role of (chemo) radiotherapy in primary disease Determine the indications for primary chemoradiation therapy for advanced/unresectable vulvar cancer and for most vaginal cancers Determine the indications for adjuvant therapies (local and systemic) following radical surgery Determine the role of molecular testing and implications for targeted systemic therapy in advanced/metastatic disease (MMR/MSI, PD-L1, <i>NTRK</i> and tumour mutational burden for vulvar cancer; <i>NRAS</i>, <i>KIT</i> and <i>BRAF</i> for vaginal melanoma) Describe post-treatment complications and define survivorship strategies Recognise presentation of disease progression after primary treatment and express familiarity with supportive/palliative care strategies
Skills	Demonstrate the ability to: Perform a complete patient history and physical examination, including gynaecologic and rectal examination Discuss available treatment options and recommendations with the patient Participate in multidisciplinary discussion of optimal management strategies and treatment sequencing of surgery, chemotherapy and/or radiation therapy Prescribe chemotherapy and manage toxicities of radiochemotherapy Manage post-treatment sequelae of surgery, chemotherapy, and radiation Discuss salvage and supportive options for patients with persistent, recurrent, or metastatic disease following primary treatment

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4.8.5.e. Gestational Trophoblastic Neoplasia

Sara Dudley
Olesya Solheim

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with gestational trophoblastic neoplasia along the disease continuum
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Key Concepts	Describe the staging systems, including International Federation of Gynecology and Obstetrics (FIGO) anatomical staging for gestational trophoblastic neoplasia (GTN) and modified WHO prognostic scoring system Express familiarity with the different histologic types of GTN (including complete and partial molar pregnancy, invasive mole, choriocarcinoma, placental site trophoblastic tumours and epithelioid trophoblastic tumours), including molecular pathogenesis and their prognosis Express familiarity with the diagnostic evaluation of GTN, including the role and limitations of computed tomography, magnetic resonance imaging, and pelvic ultrasound Recognise the role of primary surgery in the disease management Define the management of GTN by FIGO stage and WHO scoring system including the indications for single-agent versus multiple-agent chemotherapy, and the role of chemotherapy and immunotherapy in the treatment of persistent or recurrent disease Explain the surveillance of GTN following treatment, including the importance of (and methods for) preventing subsequent pregnancy
Skills	Demonstrate the ability to: Participate in discussion on general strategies for the management of suspected molar pregnancy Participate in discussion on treatment of GTN (all stages), including management of placental site trophoblastic tumour and epithelioid trophoblastic tumours Prescribe single-agent versus combination chemotherapy and to discuss the benefits and limitations of different chemotherapy options Discuss with patients the surveillance strategy, including the prevention of subsequent pregnancy during the surveillance period and the risk of recurrent disease in a subsequent pregnancy

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4.8.6. Head and Neck Cancers

Cesar A. Perez
Amanda Psyrrri

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with head and neck cancers along the cancer continuum
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Key Concepts	Describe that although there are several etiologies for head and neck squamous cell carcinoma (HNSCC), worldwide, tobacco use, and high-risk human papillomavirus (HPV) infection represent the most common etiologies Distinguish that HPV-associated oropharyngeal cancers represent a distinct entity in terms of biologic and clinical behaviour and describe the molecular events in HPV-induced carcinogenesis Determine that appropriate staging of head and neck cancer involves a complete head and neck examination, mirror and fiberoptic examination and computed tomography (CT) with contrast or MRI with contrast of the primary and neck. Appreciate that endoscopic ultrasound, [¹⁸F]Fluorodeoxy glucose positron emission tomography/CT, chest CT (with or without contrast) should be considered if clinically indication exists Recognise that in all oropharyngeal squamous cell carcinomas HPV status should be assessed using p16 immunohistochemistry ± HPV DNA detection Identify the differences in TNM staging in patients with oropharyngeal primaries according to their HPV status Determine that treatment is guided by tumour stage, HPV status, patient functional status and is often multimodal Distinguish the different anatomical subsites of head and neck cancers and their biologic difference and response to different treatment modalities Recognise that the optimal treatment of HNSCC involves a multidisciplinary team, including otolaryngologists, oral maxillofacial surgeons, medical and radiation oncologists and palliative care specialists Recognise the role of single modality therapies for the treatment of early-stage disease Determine that unresectable or locally advanced cancer may be cured with combined systemic and radiation therapy Recognise that while the mainstay of treatment of operable HNSCC is surgery, many patients benefit from adjuvant radiation or chemoradiation Identify the specific patient-related health and social factors which influence into the selection of individualised treatment modalities Distinguish the different patient and disease-related variables to select, communicate and prescribe systemic therapies for all stages of HNSCC Define the role of PD-L1 immunohistochemistry in the treatment selection for patients with recurrent or metastatic squamous cell carcinoma of head and neck Recognise the role of molecular testing and predictive biomarkers in the treatment of metastatic salivary gland malignancies Describe the aetiology and biology of nasopharyngeal carcinoma Explain the role of chemotherapy and radiotherapy in the management of locally advanced nasopharyngeal cancer Describe the work-up of cervical lymphadenopathy from unknown primary squamous cell carcinoma
Skills	Demonstrate the ability to: Perform a history (smoking history, etc) and physical examination in patients with HNSCC of different stages and anatomical sites Participate in multidisciplinary treatment planning discussions (for at least 20 patients with HNSCC) to appreciate all the considerations which go into deciding the most appropriate treatment Select patients for organ preservation strategies Present considerations in prescribing cisplatin chemotherapy Select patients who may benefit from adding cisplatin to adjuvant radiotherapy Apply appropriate algorithms in the management of side effects of various cytotoxic, targeted, and immunotherapeutic agents Manage the long-term toxicities of multimodality therapy Select the appropriate treatment for patients with recurrent and metastatic disease Discuss surveillance and survivorship follow-up recommendations
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Counsel patients, partners and families on smoking cessation and HPV infection

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1. ESMO Clinical Practice Guidelines: Head and Neck Cancers. <https://www.esmo.org/guidelines/head-and-neck-cancers>
2. ASCO Clinical Practice Guidelines: Head and Neck Cancers. <https://www.asco.org/practice-patients/guidelines/head-and-neck-cancer>
3. NCCN Guideline: Head and Neck Cancer. <https://www.nccn.org/guidelines/guidelines-detail?category=1&id=1437>
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4.8.7. Sarcomas

4.8.7.a. Bone Sarcomas

Anna Maria Frezza
Katherine Thornton

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with bone sarcomas along the disease continuum
Key Concepts	Evaluate and suspect the first diagnosis of a patient with bone sarcoma and proactively refer patients to sarcoma reference centres for specialised multidisciplinary care Collaborate with sarcoma reference centres on the medical management of patients with bone sarcomas, as needed, through proactive networking Recognise that all bone sarcomas are rare cancers, worth being referred, following biopsy, to centres specialised in their care and management Distinguish the main subtypes of bone sarcomas, including, osteosarcoma, Ewing sarcoma, chondrosarcoma, chordoma and other ultra-rare types, each with distinct characteristics in terms of epidemiology, natural history and treatment paradigms Recognise that bone sarcomas can occur anywhere throughout the skeleton depending on the subtype, with oftentimes marked discrepancies in pathologic diagnosis between reference centres and the community Recognise that proper treatment should always be the result of a multidisciplinary discussion Recognise that chemotherapy is especially effective in
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	improving survival in osteosarcoma and Ewing sarcoma utilising intensive multidisciplinary protocols Identify and prescribe the appropriate systemic regimen after discussion with a multidisciplinary care team at a sarcoma reference centre Recognise that molecularly targeted therapies may be appropriate for giant cell tumour of bone and chordoma Recognise the survivorship issues in children, adolescent, and young adult (AYA) patients cured of their bone sarcomas Recognise that select patients, mainly affected by osteosarcoma, may warrant referral to genetic counsellors for identification of genetic syndromes like Li-Fraumeni
Skills	Demonstrate the ability to: Discuss with surgeons facing a clinical or pathologic diagnosis of bone sarcoma, or suspected bone sarcoma Execute referral of patients with bone sarcoma to centres of reference by conveying essential, meaningful clinical information Discuss actively patient cases with reference centres in regard to strategic clinical decisions and medical treatment conduct, if needed Report the unique complexities of long-term management of patients post-treatment for bone sarcomas and the inherent survivorship issues they face

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1. ESMO Clinical Practice Guidelines: Bone Sarcomas. <https://www.esmo.org/guidelines/sarcoma-and-gist/bone-sarcomas>
2. NCCN Guideline: Bone Cancer. <https://www.nccn.org/guidelines/guidelines-detail?category=1&id=1418>

4.8.7.b. Soft Tissue Sarcomas

Silvia Stacchiotti

Katherine Thornton

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with soft tissue sarcomas along the disease continuum
Key Concepts	Recognise that: Soft tissue sarcomas (STS) are rare cancers and represent an exceedingly heterogeneous group of malignancies that can affect any age and any anatomic location STS should be treated in sarcoma reference centres or tertiary paediatric oncology centres as appropriate for age STS pathology should always be confirmed by a sarcoma pathology expert, based on the 2020 WHO classification, as there is remarkable discrepancy rate in pathology diagnoses between reference institutions and the community Appropriate treatment should be based on multidisciplinary discussions beginning at the time of diagnosis Surgery is the mainstay of treatment in patients with adult-type, localised STS and should be carried out by a surgeon specifically trained in the treatment and management of STS Wide excision ± radiation therapy (RT) are the standard treatment in high-grade lesions with RT omitted only after multidisciplinary discussion in a reference centre Adjuvant and neoadjuvant chemotherapy is not standard, but an anthracycline plus ifosfamide-based regimen can be proposed to patients at high risk for STS-related death STS patients following treatment should be followed prospectively based on surveillance guidelines In the advanced disease setting, the indication for systemic therapies and selection of therapeutics is dependent on the STS histologic sub-type First-line treatment is typically anthracycline-based, and can be

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	combined with other agents based on histology and treatment goals Second-line therapy and beyond, can be considered in patients with advanced STS with disease progression based on performance status with strong consideration for clinical trials Disease-specific treatment approaches need to be considered in selected histologies, such as desmoid tumours and giant cell tumours of the tendon sheath. This may include an active surveillance approach
Skills	Demonstrate the ability to: Report that the correct pathologic diagnosis and appropriate first surgery is crucial to patient outcome Discuss with surgeons facing a clinical/pathologic diagnosis of STS or suspected STS Execute referral of patients with STS to high volume sarcoma centres with specialised surgical, radiation oncology, medical oncology and pathology expertise Discuss patient cases with reference centres for strategic clinical decisions and medical management Report that systemic treatment relies on accurate diagnosis and is driven by histologic sub-type Select, communicate and prescribe the most appropriate systemic treatment for each sarcoma type and phase of disease with collaboration from a multidisciplinary sarcoma centre Use the guidelines for long-term surveillance of patients with STS after initial treatment

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4.8.7.c. Gastrointestinal Stromal Tumour

Sebastian Bauer

Katherine Thornton

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with gastrointestinal stromal tumour (GIST) along the disease continuum
Key Concepts	Recognise that: GISTs are rare cancers, worth being referred to centres specialised in their treatment GISTs can first be diagnosed on an emergency, but also an incidental basis GISTs should be considered in the differential diagnosis of abdominal masses and may be diagnosed as incidental endoscopic findings Biopsies are safe and should be considered before any treatment decision Proper management should be carried out on a multidisciplinary basis

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	The diversity of genotype and the highly relevant impact on treatment planning The necessity of expert pathology particularly in patients lacking mutations in <i>KIT</i> and <i>PDGFRA</i> The relevant risk factors and the important risk classifications for decision making in the adjuvant setting The patient population to receive adjuvant imatinib and challenge of duration and appropriate dosing GISTs can be associated with genetic syndromes like Carney-Stratakis and germline <i>NF1</i> mutations Molecularly targeted agents can be particularly effective, but require knowledge of genotype (due to risk of over- and undertreatment) The importance of genotyping for selection of drugs and selection of dose In isolated cases, it may be suitable for GISTs <2 cm to be followed by endoscopic ultrasound The objectives for surgery for localised disease The patterns of non-dimensional and varying subsets of tumour response to molecularly targeted agents (risk of misinterpretation of pseudo-progression) Down-staging of surgery can be achieved in select cases of GIST with targeted therapy The relevance of compliance and adherence for survival The relevance of side effect management
Skills	Demonstrate the ability to: Discuss with surgeons and gastroenterologists facing a clinical/pathologic diagnosis of GIST or suspected GIST Execute referral of patients with GIST to centres of reference by collecting and conveying essential, meaningful clinical information Discuss actively patient cases with reference centres in regards to strategic clinical decision and medical treatment conduct, as needed Discuss critical milestones of decision making that require expert advice (expert pathology, local treatments with high risk of morbidity, surgery of metastatic disease) Select and prescribe appropriate treatment as well as manage side effects in order to be able to care for patients in collaboration with reference centres Present basic concepts of treatment sequences and side effect management in order to be able to care for patients in collaboration with reference centres Discuss the impact of adherence on survival particularly in early treatment lines

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3. NCCN Guideline: Gastrointestinal Stromal Tumors

4.8.8. Skin Cancers

4.8.8.a. Melanoma

Olivier Michielin

Rodabe Navroze Amaria

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and
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	counselling of patients with melanoma along the disease continuum
Key Concepts	Recognise that while UV exposure is the major risk factor for development of cutaneous melanomas, while some cutaneous melanomas and other melanoma subtypes (acral, uveal, mucosal) are not related to UV exposure Recognise that routine skin surveillance by a dermatologist is effective in high-risk populations and can lead to earlier diagnosis of cutaneous melanoma Recognise that there are different subtypes of melanoma which have implications for the management of early- and late-stage disease Recognise that patients with melanoma will benefit from molecular profiling of tumour DNA Recognise that appropriate staging of melanoma involves computed tomography (CT) and/or positron emission tomography (PET) imaging of the body with CT or magnetic resonance imaging (MRI) imaging of the brain Recognise that wide local excision of the primary tumour and sentinel lymph node biopsy is the appropriate surgical management of early-stage disease Recognise that completion lymph node dissection is no longer the standard of care for patients with clinically occult sentinel lymph node positivity Recognise that adjuvant immunotherapy and adjuvant BRAF/MEK inhibition improve recurrence-free survival outcomes for patients with resected stage III melanoma Define appropriate systemic therapy, communicate risk and benefit with patients and prescribe therapy Recognise that neoadjuvant therapy for patients with clinical stage III melanoma is an emerging field and consideration of clinical trial enrolment for these patients is recommended Identify that, for most patients, long-term benefit must be the goal of systemic therapies in stage IV melanoma Recognise that immunotherapy followed by targeted therapy is associated with better long-term outcome than the reverse sequence and that it should be given priority in the treatment plan Integrate inclusion into clinical trials within the patient's therapeutic strategy Participate in multidisciplinary tumour board that includes radiologists, surgeons, and radio-oncologists for the management of stage IV disease
Skills	Demonstrate the ability to: Select patients who would benefit from skin cancer screening Perform a history (UV exposure) and physical examination (with focus on primary tumour site and regional lymph nodes) Select the types of molecular testing available, understand when such testing is useful, and how to use the results to determine whether a targeted therapy would be appropriate Participate in multidisciplinary treatment planning discussions in order to plan best adjuvant therapy options for specific patients Discuss considerations in prescribing adjuvant immunotherapy versus BRAF/MEK targeted therapy including efficacy data and safety profiles Select treatment for patients, communicate the risks and benefits of the treatment, and implement the therapy Perform full baseline imaging work-up with PET or CT scans including brain MRI to guide treatment decision in stage IV Select the clinical biomarkers associated with stage IV outcomes and include these into treatment decisions Manage toxicities of stage IV systemic treatment according to modern algorithms, in particular for immune-related adverse events

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4.8.8.b. Basal Cell and Squamous Cell Cancers of the Skin

Michael K. Wong

Elsemeike Plasmeijer

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with basal cell and squamous cell cancers of the skin along the disease continuum
Key Concepts	Recognise the anatomical structure of skin and the cells of origin for cutaneous squamous cell cancer (cSCC) and basal cell cancer (BCC) Identify the risk factors for the development of cSCC and BCC (UV exposure, immunosuppression, radiotherapy) Distinguish the immunohistochemical characteristics for squamous and basal cells (high molecular weight cytokeratin, nuclear p63, EMA, BCL-2) Recognise the high-risk clinical and pathologic features of cSCC (differentiation status, perineural invasion, involvement of deep structures) Determine the genetic conditions predisposing to cSCC (Xeroderma pigmentosum) and BCC (basal cell nevus syndrome) Distinguish the spectrum of cSCC from actinic keratosis and field cancerisation to Bowen disease to invasive cancer Explain the role of UV exposure and high mutational burden as both a risk factor of cSCC, BCC and also as the source of these tumours responsiveness to immunotherapy Interpret the mechanism of action for Hedgehog inhibitors in BCC Interpret the mechanism of action for anti-PD1 therapy in cSCC and BCC
Skills	Demonstrate the ability to: Present and rationalise patients' presentation, diagnosis, and treatment decision in a multidisciplinary tumour board (at least 10 cases) Select the indications for the use of systemic immunotherapy Predict when the extent of local involvement mandates the use of systemic therapy

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Early recognition of autoimmune toxicities (colitis, pneumonitis, endocrinopathies)

Select the right patient, communicate about use and side effects and prescribe immunotherapy

Predict and manage the multitude of low-grade side effects of Hedgehog inhibitors for BCC and be aware of the teratogenic potential of these drugs

Discuss the risk factors for cSCC and BCC and be able to give individualised information about skin cancer prevention and risk mitigation

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4.8.8.c. Merkel Cell Carcinoma

Jürgen C. Becker

Kathryn Bollin

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with Merkel cell carcinoma along the cancer continuum
Key Concepts	Describe the biologic and clinical characteristics of Merkel cell carcinoma (MCC), and the distinctions between MCC, melanoma, and epithelial skin cancers (squamous cell carcinoma, basal cell carcinoma) in their clinical course and response to therapy Identify that the main risk factors for MCC include immunosuppression, advanced age, and chronic UV exposure Recognise that MCC may be caused either by UV-associated DNA mutation or integration of the Merkel cell polyomavirus (MCPyV) and that cell of origin is still unknown, but that it comprises characteristics of epithelial, neuroendocrine, and even pro/pre B cells Explain that MCC warrants a comprehensive histopathologic assessment, preferably by someone with expertise in dermatopathology Recognise the epidemiology and changing incidence trends of MCC, the potential for rapid clinical course, and propensity to metastasise to skin, lymph nodes, and distant organs

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	Determine that the appropriate initial staging of MCC includes anatomic features such as tumour size, presence of invasion into bone, muscle, fascia, or cartilage, and the presence and number of lymph node and/or distant metastases Determine that appropriate staging includes sentinel lymph node evaluation with imaging dependent upon initial disease stage that could include ultrasound, computed tomography (CT), magnetic resonance imaging, FDG- positron emission tomography (PET), and FDG-PET-CT Recognise that there are no clinically relevant biomarkers for guiding clinical decision making, although when MCPyV T-antigen antibodies are present in serum of patients at time of diagnosis there are data suggesting this may be useful as a prognostic and surveillance marker Define that the optimal treatment of MCC involves a multidisciplinary team, including specialists in dermatology, surgery, medical oncology, and radiation oncology, who provide guidance based on tumour stage and patient characteristics Recognise that while the mainstay of treatment of early-stage MCC is surgery with adjuvant radiation, patients with locally advanced disease may benefit from systemic therapy Explain that patients with metastatic MCC can have prolonged survival with systemic immunotherapy Explain that risk for disease recurrence after local therapy is used to guide surveillance exams and imaging Recognise that patients with advanced MCC refractory to immunotherapy may still benefit from palliative radiation and chemotherapy
Skills	Demonstrate the ability to: Select those patients who might benefit from skin cancer screening in general and that screening for MCC as part of their examination increases the benefit Perform a history (sun exposure history, immune suppression status) and physical examination (skin, lymph nodes, etc) Discuss the types of imaging and molecular testing available, when such testing is useful, and how to use the results to determine disease stage and response status after treatment Discuss the efficacy and toxicity of systemic therapies for the treatment of advanced MCC, particularly immunotherapy, in order to determine the optimal therapeutic indication Participate in multidisciplinary treatment planning discussions in order to appreciate all the considerations which go into deciding the most appropriate treatment for a patient Predict conditions (such as performance status, immune suppression, comorbidities, prior therapy) that are important to consider when deciding on treatment modalities Demonstrate communication skills to explain the benefits and risks of systemic therapy Execute appropriate follow-up, including skin and lymph node exams and, when appropriate, imaging and biomarker surveillance

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4.8.9. Endocrine Tumours

4.8.9.a. Thyroid Cancer

Laura D. Locati

Lori J. Wirth

Objective	To be able to perform specialist assessment and guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with thyroid cancer along the cancer continuum
Key Concepts	Recognise that the increase in worldwide incidence of thyroid cancer is almost exclusively related to small differentiated thyroid cancer (DTC); screening is not recommended; active surveillance should be considered when papillary microcarcinoma is diagnosed Recognise that a germline <i>RET</i> test is mandatory in any new diagnosis of medullary thyroid cancer (MTC) Distinguish treatment recommendations according to the type of tumour (DTC; MTC; anaplastic thyroid cancer [ATC]) and TNM stage, especially in determining the extent of surgery and the role of adjuvant radioactive iodine (RAI). Tumour genotype is playing an increasing role in treatment decisions Distinguish the appropriate risk-based imaging before the initiation of any treatment Define indications for RAI, modalities and radioprotection methods; recognise that external beam radiotherapy should only be considered as adjuvant therapy in selected cases Recognise that risk stratification for recurrent disease is a dynamic process in DTC; it starts at least 6 months after the completion of primary treatment and continues throughout the follow-up period Evaluate thyroid hormone replacement: it should be individualised for TSH suppression in patients with DTC according to the type of primary surgery (total or hemithyroidectomy) and stratification-risk class Evaluate tumour markers throughout follow-up, especially for their doubling time: thyroglobulin (Tg) and anti-Tg antibodies in patients with DTC; calcitonin and CEA in patients with MTC Identify sensitivity to RAI in unresectable locoregionally recurrent and/or metastatic DTC before initiation of any systemic therapy Recognise that: Disease monitoring (eg, watchful waiting) is appropriate for some patients with unresectable locoregionally recurrent and/or metastatic RAI-refractory DTC and MTC RAI-redifferentiation strategies are investigational, but may be appropriate in selected patients (eg, <i>BRAF</i> or <i>RAS</i> mutant DTC, low tumour burden, slow disease progression) RAI refractory-DTC, MTC and ATC are rare tumours; multidisciplinary consultation at referral centres may be helpful in determining optimal approaches to treatment Tumour testing for potentially actionable molecular alterations (eg, <i>RET</i> and <i>RAS</i> mutations in MTC; <i>BRAF</i> and <i>RAS</i> mutations, plus <i>RET</i>, <i>NTRK</i> and <i>ALK</i> fusions for DTC and ATC) should be performed in all patients in need of systemic therapy DNA and RNA next-generation sequencing is the preferred molecular testing method. Recognise that <i>BRAF</i> V600E immunohistochemistry may be helpful as a rapid detection method in ATC Prehabilitation is recommended before the initiation of systemic therapy, especially for patients with advanced disease for whom multikinase therapy is planned
Skills	Demonstrate the ability to: Present the distinct biologic origins, genetic backgrounds, treatment approaches and outcomes of patients with DTCs, MTC and ATC Discuss individualised treatment approaches across the

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spectrum of thyroid cancers (eg, optimal surgical approach, administration of RAI, thyroid hormone replacement therapy, etc) Prioritise the treatment strategies (eg, in ATC patients, first check patent airway and swallowing, test BRAF status, assess surgical status, hypothesize the treatments sequence) Select the optimal systemic therapy according to the histotype and tumour genomic profile Prevent and manage side effects of multikinase therapies Present/discuss clinical case in a multidisciplinary setting Prescribe appropriate follow-up strategies following response

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4.8.9.b. Neuroendocrine Neoplasms

Eva Tiensuu Janson

Sherise Rogers

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with neuroendocrine neoplasms along the disease continuum
Key Concepts	Explain the principals and the clinical use of the 2019 WHO classification of neuroendocrine neoplasms (NENs) Describe the different biologic behaviour of neuroendocrine tumours (NETs) and neuroendocrine carcinomas (NECs) depending on grade and location of the primary tumour and the impact on clinical handling and therapy selection Give examples of inherited syndromes and understand the implication for family members Describe the clinical syndromes induced by hormone secretion and treatments that may be used to ameliorate them

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	Recognise hormone-related emergencies related to treatment of NETs Interpret hormone levels for biochemical testing, diagnosis and treatment monitoring and be aware of causes of false elevation Define the role of different anatomical and functional imaging methods and how the result can be used for treatment decisions Explain the indications for surgery in patients with NET Describe the role of somatostatin analogues for control of hormone secretion and tumour growth as well as other different therapeutic options for patients with NEN including chemotherapy and targeted therapy and when to use a specific treatment Explain how to select and prescribe systemic treatment and to communicate the reason as well as pros and cons with the selected therapy to patients with NENs Explain the concept of peptide receptor radionuclide treatment (PRRT) in relation to other treatment modalities for NEN Describe how the management of poorly differentiated carcinomas (large or small cell) differs from treatment of NETs in urgency and modalities Recognise the importance of a multidisciplinary approach to the treatment of patients with NEN Identify patients who need dietary consultation due to gastrointestinal symptoms Determine when to refer patient to supportive care providers as indicated
Skills	Demonstrate the ability to: Execute a genetic risk assessment and appropriate referral to genetic counselling Perform a history and physical examination in patients with NEN, including different subtypes with a special focus on symptoms of hormone secretion Apply knowledge of histopathology, biomarkers, molecular imaging, and various radiologic imaging for appropriate diagnosis of NETs and NECs Discuss the different indications for surgery, radiation therapy, chemotherapy, immunotherapy, hormonal agents, biologic agents, targeted agents, and PRRT for NETs and NECs Use appropriate treatments to manage side effects of various chemotherapeutic, hormonal agents, biologic agents, and targeted agents as well as PRRT Apply appropriate indications for local-regional treatment of liver metastases with embolisation/radioembolisation Present and discuss the diagnosis and treatment of patients with NEN within a multidisciplinary tumour board

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4.8.9.c. Adrenal Carcinoma

Alfredo Berruti

Eren Berber

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with adrenal carcinoma along the cancer continuum
Key Concepts	Determine that adrenocortical carcinoma (ACC) in adults may occasionally occur as part of multiple hereditary syndromes, such as Li-Fraumeni, Beckwith-Wideman, Lynch, multiple endocrine neoplasia (MEN) 1, and familial adenomatous polyposis Recognise that a significant portion of ACC presents with a functional endocrinopathy: Most commonly non-adrenocorticotrophic hormone dependent hypercortisolism (Cushing syndrome), and/or virilising symptoms, less commonly other hormone hypersecretion syndromes (eg, hyperaldosteronism) Recognise that a complete adrenal hormonal work-up is required for all suspected patients with ACC Recognise that standard staging for patients with suspected ACC includes abdominal cross-sectional imaging: computed tomography (CT) or magnetic resonance imaging, and chest CT, or [18F] FDG-positron emission tomography/CT Identify that imaging characteristics for ACC include large tumour size, heterogeneity, irregular borders, internal haemorrhage, necrosis, and invasion into surrounding structures Recognise that adrenal biopsy is not required in the diagnostic work-up of patients with suspected ACC except in case of metastatic disease Describe that the cornerstone of ACC surgery is maintaining tumour capsule integrity and preventing tumour spillage via en bloc tumour resection, regional lymphadenectomy, and resection of contiguously involved organs Recognise that laparoscopic adrenalectomy can be considered for a select group of stage I and II well circumscribed tumours, with a low threshold to convert to open. Surgical oncologic principles with a “no touch” technique and en bloc resection should be followed for both minimally invasive and open approaches. The size limit for laparoscopy is different for each surgeon, based on experience and technical skills Recognise that surgical resection, performed at high volume centres, is essential for ACC treatment Determine that a panel of immunohistochemical markers: steroidogenesis factor 1, inhibin-alpha, calretinin and melan-A is crucial for ACC diagnosis Distinguish that the most important prognostic factors for overall survival are low stage and an R0 resection. Other favourable factors are: young age, non-functional tumours, and low Ki-67 expression (<10%) Determine that more than half of patients with ACC who have undergone radical surgery are destined to relapse, often with metastases Recognise that mitotane is the reference drug for the management of ACC and understand that it has a long half-life and a narrow therapeutic window Identify patients with ACC at high risk of recurrence (stage III, or R1-RX resection, and/or Ki-67 index >10%) to be considered for adjuvant mitotane therapy Define that mitotane in association with etoposide, doxorubicin, and cisplatin (EDP-M) is the standard therapy for metastatic ACC Determine that the efficacy of mitotane to diminish steroid

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	excess is often delayed by several weeks and steroidogenic enzyme inhibitors, such as metyrapone or osilodrostat, are often needed in the first weeks of therapy
Skills	Demonstrate the ability to: Discuss all ACC patients at a multidisciplinary team conference Design possible neoadjuvant treatment with the EDP-M scheme to induce tumour shrinkage in the case of locally advanced ACC Apply measures to prevent postoperative adrenal insufficiency in patients with excess glucocorticoid secretion, by administering intravenous stress dose hydrocortisone and oral corticosteroids postoperatively Select patients with advanced ACC who have indolent versus aggressive disease, in order to adopt appropriate algorithms of management Select patients with locally recurrent or local metastatic disease amenable to surgical resection or other locoregional treatments Use an escalating dose regimen when starting mitotane therapy, tapering the dose based on tolerability in the first few weeks Execute a mitotane dosage titration to the best tolerable dose while maintaining a plasma level between 14 and 20 mg/L Apply glucocorticoid replacement in all patients treated with mitotane (except those with cortisol excess) using higher doses than that used for management of Addison disease to prevent adrenal insufficiency Discuss that mitotane is a strong inducer of CYP3A4. All concomitant medication should be checked for CYP3A4 interactions Apply guideline recommendations for follow-up after complete resection, including cross-sectional imaging every 3 months for 2 years, then every 3-6 months for at least another 3 years

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4.8.10 Central Nervous System Malignancies

Tracy Batchelor

Michael Weller

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and
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	counselling of patients with central nervous system malignancies along the disease continuum
Key Concepts	Classify primary brain tumours according to the 2021 WHO classification Interpret the significance of major diagnostic and predictive biomarkers: 1p/19q co-deletion, isocitrate dehydrogenase mutations, histone mutation, O⁶-methylguanine-DNA methyltransferase promotor methylation Recognise familial nervous system tumour syndromes and identify need for appropriate medical assessment and genetic counselling Recognise the differential risk and pattern of CNS metastasis from cancers originating outside the CNS Distinguish the diagnostic role of different neuroimaging modalities: magnetic resonance imaging, computed tomography (CT), positron emission tomography Evaluate key prognostic factors for common brain tumour entities Recognise the roles of surgery, various approaches of radiotherapy, and of systemic therapies for the treatment of primary brain tumours Recognise systemic therapy options for primary brain tumours and be familiar with prescribing these therapies Distinguish tumour entities that can be cured by surgery alone, eg, many meningiomas, pituitary tumours, schwannomas, from those requiring further treatment beyond surgery Evaluate the competing options of surgery versus radiosurgery versus fractionated radiotherapy for select primary brain tumours and CNS metastases Recognise different leptomeningeal metastasis subtypes and design appropriate management plans Recognise the significance of symptomatic and supportive care interventions, including the engagement of additional staff as appropriate, including psychologists, social workers, home health nurses, palliative care specialists, and hospice staff Evaluate potential complications of therapeutic modalities used in the treatment of primary and metastatic brain tumours and the management of those complications Recognise neurologic emergencies in patients with cancer, epidural spinal cord compression, hydrocephalus, seizures/status epilepticus Recognise the different sources for clinical trials for brain tumour subtypes and when to consider offering clinical trials for patients with brain tumours
Skills	Demonstrate the ability to: Perform the relevant clinical history and perform a general, mental status, and neurologic examination for patients with primary and metastatic brain tumours Perform an interpretation of the essential findings on CT and magnetic resonance images of the CNS Schedule the appropriate brain or spine imaging radiologic studies at appropriate intervals Discuss pathology reports, including interpretation of targeted and high throughput molecular testing Design a therapeutic plan of multimodality care for patients with primary and secondary brain tumours Apply contemporary guidelines for diagnostic assessments for patients with primary and metastatic brain tumours Practise effectively within a multidisciplinary team, including neurosurgeons, neuro-oncologists, radiation oncologists, neuropsychologists, and psychologists to develop comprehensive care plans

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4.8.11. Carcinoma of Unknown Primary Site

Manel Esteller

John D. Hainsworth

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with carcinoma of unknown primary site along the cancer continuum
Key Concepts	Describe carcinoma of unknown primary site (CUP) as a syndrome that includes a variety of advanced cancers with different clinical, pathologic, and molecular features Recognise CUP as a relatively common syndrome, accounting for approximately 1%-3% of cancer diagnoses Summarise the clinical evaluation required to make the initial diagnosis of CUP Distinguish different subgroups based on the histology of the initial biopsy Define a plan for further evaluation based on the histology and the initial clinical evaluation, with the goals of: (1) identifying a primary site, or (2) identifying the patients (approximately 30%-40%) who fit into a favourable subset and require specific treatment Recognise that pathologic evaluation in addition to light microscopy is required in almost all CUPs Describe the importance as well as the limitations of immunohistochemical (IHC) staining in identifying the tissue of origin in CUP Recognise that the use of a molecular cancer classifier assay (MCCA) can accurately predict the tissue of origin in most patients with CUP Identify that comprehensive molecular profiling reveals the presence of molecular alterations targetable with currently available therapeutic agents in approximately 20%-30% of CUPs Determine after completion of the diagnostic evaluation, whether the patient fits into any of the favourable subsets, and know the specific treatments for each of these subsets Distinguish the treatment options for poor prognosis patients (eg, those who do not fit into any of the favourable subsets) Define optimal systemic therapy, and to explain the details and rationale for treatment to patients with CUP Summarise the controversies regarding the use of site-specific treatment, based on the IHC and/or MCCA predictions, versus empiric chemotherapy in patients with poor prognosis CUP Evaluate data supporting the use of molecular alterations, identified by comprehensive molecular profiling, to guide targeted therapy Recognise that patients with CUP and specific molecular tumour alterations are good candidates for inclusion in clinical basket trials testing new targeted drugs Recognise that further improvements in the treatment of CUP

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	will mirror improvements in treatment of advanced cancers of known primary site
Skills	Demonstrate the ability to: Perform appropriate clinical evaluation in making the initial diagnosis of CUP Use results of the initial clinical tests and the histology from the initial biopsy to direct further clinical and pathologic evaluation Schedule the use of specialised pathologic testing, including IHC and/or MCCA, to predict the tissue of origin Select subsets of patients with favourable prognosis Apply specific treatments for patients in favourable subsets Discuss treatment options for patients who do not fit into any of the favourable subsets Use developing data to select patients for site-specific therapy (based on the results of specialised studies) versus empiric chemotherapy Report data supporting the use of comprehensive molecular tumour profiling to identify potentially treatable molecular targets

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4.8.12. Haematologic Malignancies

4.8.12a. Leukaemias

Cristina Papayannidis

Marin Xavier

Quinne Sember

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with leukaemias along the disease continuum
Key Concepts	Classify subtypes of leukaemia using clinical characteristics, cytogenetics, molecular genetics, and immunophenotyping based on WHO and/or European LeukemiaNet (ELN) classification systems Identify predictive and prognostic markers of the disease that aid in selection of treatment Recognise factors that increase the risk for leukaemia including genetic syndromes (such as Down syndrome) and prior exposure to radiation or chemotherapy Determine the need for leukapheresis based on the presence of leukostasis symptoms Identify the subtypes of leukaemia and risk factors that indicate need for allogeneic or autologous stem-cell transplantation Evaluate the need for assessment of leukaemic involvement of

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	the brain and the need for treatment or prophylactic treatment of the central nervous system Recognise techniques to identify human leucocyte antigen (HLA)—matched stem-cell or bone marrow donors Distinguish between the indications for treatment with stem-cell transplant, chemotherapy, targeted therapy, or chimeric antigen receptor (CAR) T cells Recognise the importance of targeted and emerging novel therapies including FLT 3 and IDH 1 and 2 inhibitors in acute myeloid leukaemia, Bruton tyrosine kinase inhibitors, PI3K inhibitors, and anti-CD20 monoclonal antibodies in chronic lymphocytic leukaemia, and BCL-2 inhibitors in both Evaluate medical comorbidities and performance status in choosing treatment modalities Recognise major side effects of treatment for leukaemia including severe infections and graft versus host disease after bone marrow transplant Determine the status of a patient's disease including remission using response assessments such as minimal residual disease assessments Recognise the psychosocial implications of a diagnosis of leukaemia and utilise supportive and palliative care strategies as appropriate
Skills	Demonstrate the ability to: Perform a detailed anamnestic history to identify previous exposure to pharmacologic or environmental agents, potentially involved in leukaemia pathogenesis, as well as previous haematologic malignancies from which leukaemia may have arisen Perform bone marrow aspirates, biopsies and lumbar punctures for cytology and other diagnostic techniques (flow cytometry, cytogenetics, molecular biology) Apply clinical, laboratory and biologic data into a final and comprehensive diagnosis, based on available leukaemia classification systems (eg, WHO, ELN) Identify haematologic emergencies, such as hyperleukocytosis syndromes, bleeding due to coagulopathy and/or thrombocytopenia notably in acute promyelocytic leukaemia, septicemia in patients with neutropenia, mediastinal syndrome, and set the most appropriate therapeutic approach Design and assess the appropriate therapeutic path for patients based on disease, fitness and molecular aberrations, according to published guidelines and literature suggestions, ranging from palliative approach to intensive treatments Schedule the appropriate time to start treatment, and the conditions which may require a temporary or permanent treatment discontinuation Identify and manage toxicities related to both standard chemotherapy and targeted agents (eg, tyrosine kinase inhibitors, monoclonal antibodies, CAR T cells, BCL2 inhibitors) Apply adequate supportive care, including red blood cells and platelets transfusions, anti-infective prophylaxis, and therapy Present patients' cases within a multidisciplinary team, aiming at discussing critically treatment, indications, and contraindications, as well as adverse events (physicians, nurses, psychologists, etc) in order to share managements and improve knowledges Design and assess an appropriate follow-up plan, based on patients' disease, therapeutic algorithm, and monitoring plan

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4.8.12.b. MDS/MPN/Others

Mrinal M. Patnaik
Uwe Platzbecker

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with myelodysplastic syndromes (MDS)/myeloproliferative neoplasm (MPN)/others along the disease continuum
Key Concepts	Recognise and diagnose MDS, MPNs, and MDS/MPN overlap neoplasms Distinguish and discriminate effectively these entities from reactive blood disorders Interpret bone marrow biopsy results, cytogenetic and molecular genetic data that will aid in diagnosing, risk stratifying and in the treatment of affected patients
Skills	Demonstrate the ability to: Participate actively in the work-up of patients with suspected MDS/MPNs and overlap neoplasms that includes performing bone marrow aspiration and biopsies and ordering the necessary work-up of the material collected and interpretation of data (morphology, flow cytometry, cytogenetics, and molecular genetics) Present actively the case and discuss evidence-based treatment options Perform history and physical examination in patients with MDS/MPN different subtypes Discuss general management strategies including molecular guided therapies and allogeneic stem-cell transplantation Predict disease-specific conditions that are important for considering when to start and to stop treatment, which treatment option to choose and when to switch Discuss patient-specific conditions/comorbidities that are important to choose between treatment options Select therapy according to pathology findings and molecular marker status Report MDS/MPN and overlap neoplasms as chronic disorders with implications for long-term follow-up Manage side effects of treatment

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4.8.12.c. Lymphomas

Jeremy S. Abramson
Maria Gomes da Silva

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with lymphomas along the disease continuum
Key Concepts	Classify non-Hodgkin lymphomas (NHL) and Hodgkin lymphomas (HL) according to the WHO classification Identify biologic and clinical differences between different lymphoma subtypes Explain optimal diagnostic procedures to accurately diagnose a lymphoma subtype Describe relevant genomic rearrangements detected by fluorescence in situ hybridisation (FISH) in NHL subtypes, including <i>MYC</i> , <i>BCL2</i> and <i>BCL6</i> in large B-cell lymphomas; <i>MYC</i> in Burkitt lymphoma (BL); <i>CCND1</i> in mantle cell lymphoma (MCL); <i>BCL2</i> in follicular lymphoma (FL); and <i>ALK</i> in anaplastic large cell lymphoma (ALCL) Explain the risk and frequency of high-grade transformation of low-grade lymphomas and the implications in disease course Interpret the Lugano staging system for lymphoma, and the role of staging procedures including positron emission tomography/computed tomography and bone marrow biopsy in appropriate circumstances Identify appropriate risk stratification tools in NHL including the International Prognostic Index (IPI) in diffuse large B-cell lymphoma (DLBCL), follicular lymphoma international prognostic index (FLIPI) and FLIPI2 in FL, and the mantle cell lymphoma international prognostic index in MCL; recognise the risk of CNS relapse/infiltration in DLBCL and the risk assessment with the CNS IPI score Identify appropriate risk-stratification tools in classic HL (cHL), including the German Hodgkin Lymphoma Study Group and European Organisation for Research and Treatment of Cancer criteria in limited stage HL, and the International Prognostic Score in advanced stage cHL Explain appropriate pre-treatment testing for HIV, hepatitis B and hepatitis C viruses, and HTLV1 in T-cell lymphoma Describe the indications for therapy in indolent B-cell NHLs such as FL, marginal zone lymphoma (MZL), chronic lymphocytic leukaemia (CLL)/small lymphocytic lymphoma (SLL), and lymphoplasmacytic lymphoma (LPL) Determine which lymphomas are treated with curative intent, including DLBCL, high-grade B-cell lymphoma (HGBCL), primary mediastinal B-cell lymphoma (PMBCL), BL, peripheral T-cell lymphoma (PTCL), ALCL and cHL Describe unique biologic and clinical features of nodular lymphocyte predominant Hodgkin lymphoma (NLPHL) and differences from cHL

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	Give examples of upfront chemoimmunotherapy or chemotherapy regimens used in the initial treatment of DLBCL, FL, MCL, PMBCL, PTCL, ALCL, and cHL Identify unique considerations for management in selected subgroups of patients including pregnant patients, elderly or frail patients, patients with severe medical comorbidities, and immunocompromised patients Explain the optimal management of relapsed DLBCL, including the role of high dose chemotherapy with autologous stem-cell transplant Explain the role of anti-CD19 chimeric antigen receptor (CAR) T cells in the management of relapsed DLBCL, HGBCL, PMBCL, MCL, and FL Describe the role of targeted therapies in the management of relapsed/refractory NHL subtypes, including Bruton's tyrosine kinase inhibitors and lenalidomide in MCL, CLL/SLL, MZL, and LPL; PI3K inhibitors, tazemetostat and lenalidomide in FL; and antibody drug conjugates (ADCs, polatuzumab vedotin and loncastuximab), tafasitamab-lenalidomide and selinexor in DLBCL Determine the optimal use of the anti-CD30 ADC brentuximab vedotin in the treatment of newly diagnosed and relapsed cHL, and the role of immune checkpoint inhibitors in relapsed cHL Explain the role of radiation therapy in the management of limited stage FL, MZL, DLBCL, cHL, and NLPHL Describe care for lymphoma patients following completion of primary therapy, including disease monitoring and survivorship
Skills	Demonstrate the ability to: Discuss the epidemiology and the known risk factors of HL and indolent and aggressive NHL including viral and bacterial infections, autoimmune diseases, immunodeficiencies, and family history Perform the history and physical examination of patients with lymphoma with attention to lymph node areas, spleen, liver, and Waldeyer's ring, recognising the diversity of clinical presentations, including extranodal sites Select the investigations required for the diagnosis and staging and the need for specific investigations in particular lymphoma subtypes and patient risk groups (eg, consideration of CNS risk in aggressive B-cell lymphomas, and gastrointestinal tract involvement in MCL) Estimate prognosis using prognostic scoring systems according to lymphoma subtype, recognising their implications for the treatment plan and patient counselling Assess risk of tumour lysis syndrome based on histology, tumour burden and specific treatment, and apply appropriate prophylaxis and treatment Select optimal first-line therapy including chemotherapy, immunochemotherapy, radiotherapy and targeted agents used in specific settings in aggressive NHL, indolent NHL, cHL and NLPHL, and select supportive treatment where appropriate Predict and manage side effects of chemotherapy, immunotherapy (including immune checkpoint inhibitors in cHL and anti-CD19 CAR T cells in NHL) and novel agents used for lymphoma treatment Identify treatment failure and appropriate treatment options for relapsed and refractory lymphomas according to patient and disease characteristics, including cellular therapies (such as transplantation and anti-CD19 CAR T cells) Plan surveillance and survivorship care of patients with lymphoma, recognising the increased risk of late toxicities incurred in certain treatment and disease settings, including second primary malignancies, cardiovascular effects and prolonged immune suppression

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4.8.12.d. Multiple Myeloma

Roman Hájek

Anuj Mahindra

Objective	To be able to perform specialist assessment, guide systemic therapy in the context of multidisciplinary treatment and counselling of patients with multiple myeloma along the disease continuum
Key Concepts	Distinguish that there is a spectrum of plasma cell dyscrasias which includes monoclonal gammopathy of undetermined significance (MGUS), smouldering myeloma, multiple myeloma (MM), POEMS syndrome (polyneuropathy, organomegaly, endocrinopathy, monoclonal protein, skin changes), primary and secondary plasma cell leukaemia, monoclonal gammopathy of renal significance and amyloid light chain or primary amyloidosis Recognise diagnostic studies in a patient with newly diagnosed MM include serum protein electrophoresis with immunofixation, serum free light chains, urine protein electrophoresis, complete blood count, creatinine, calcium, skeletal imaging, bone marrow biopsy and flow cytometry evaluation Determine staging of patients with MM by the Revised International Staging System includes beta 2 microglobulin, albumin, lactate dehydrogenase, fluorescence in situ hybridisation studies on bone marrow biopsy Determine suitability for high dose chemotherapy and autologous stem-cell transplant Recognise treatment includes incorporation of immunomodulatory drugs, proteasome inhibitors, monoclonal antibodies, chemotherapy drugs, targeted agents and consolidation with high dose chemotherapy when indicated Recognise maintenance strategies with the intent of prolonging progression-free survival and overall survival are evolving, however maintenance after autologous stem-cell transplantation is standard of care Recognise management includes prevention and treatment of skeletal-related events Recognise response assessment includes evaluation of monoclonal protein and serum free light chains as well as evaluation of minimal residual disease by flow cytometry and/or next-generation sequencing in patients achieving complete remission. Approximately 2% of patients with MM have non-secretory MM and require bone marrow biopsies for response assessment
Skills	Demonstrate the ability to: Perform diagnosis of the spectrum of plasma cell dyscrasias Assess comorbidities, performance status and their impact on decision making for management Select appropriate laboratory studies at diagnosis, staging and follow-up Report the indications for imaging modalities—skeletal survey, low dose whole body computed tomography (CT) scan, MRI and positron emission tomography (PET) or PET/CT scan

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	Select indications for treatment modalities including chemotherapy, immunotherapy, high dose chemotherapy, and radiation Manage adverse effects of treatment modalities Discuss ongoing experimental and clinical trial options and incorporate clinical trial strategies in the management of patients Present importance of negative minimal residual disease status for prognosis Discuss limitations of current treatment options and when to recommend end-of-life options

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4.9. Management and Treatment of Specific Populations

4.9.1. Cancer in Adolescents and Young Adults

Najat C. Daw

Emmanouil Saloustros

Objectives	To describe the epidemiology, clinical characteristics, and treatment of cancers in adolescents and young adults (AYA)s and the specialised multidisciplinary care of these patients To be able to guide systemic therapy in the context of multidisciplinary care
Key Concepts	Describe the age range and epidemiology of cancer in AYA Recognise the modest improvement in survival gains compared with childhood and adult cancers Demonstrate an understanding of the complex psychologic, social, and financial impact of a cancer diagnosis during a period of rapid physiologic, personal and psychologic growth that affects well-being in significant ways Recognise that haematologic malignancies (predominantly lymphoma and leukaemia) and central nervous system tumours are more common in young AYAs, but as age increases, carcinomas become more common. Other cancers include melanoma, germ cell tumours, thyroid cancer, and sarcomas Explain the inequitable access to services which provide expert cancer care and consider the unique needs of AYA Describe the many histotypes for which tumour genomics,

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	biology and clinical behaviour may differ in AYAs compared with children and older adults Explain the diagnosis often made at an advanced stage due to insufficient awareness that cancer may occur in this age group, the complex evaluation process and pathway to diagnosis Give examples of the multidisciplinary care in an age-appropriate setting, ie, crucial to support a healthy and productive life during and after cancer therapy Demonstrate an understanding why lack of compliance is a considerable issue and long-term follow-up is necessary Determine the need to immunise AYAs with and without cancer for human papillomavirus through age 26 years
Skills	Demonstrate the ability to: Provide age-appropriate information and adapt to communication challenges Select, communicate and provide the most appropriate evidence-based therapy within the relevant cancer-specific multidisciplinary team To participate in the comprehensive multidisciplinary care that AYAs with cancer need or refer to a cancer centre specialised in AYA cancers Discuss the patient needs related to psychosocial status, fertility, genetic predisposition, and survivorship Design the shared decision-making process and enforce compliance and treatment adherence Discuss peer support Discuss fertility risk and preservation options before initiation of treatment Practise the inclusion in age-specific clinical trials Perform transition to cancer survivorship care and management of treatment side effects Discuss prevention strategies and healthy lifestyle behaviours

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4.9.2. Cancer in Older Adults

Hans Wildiers

Enrique Soto-Perez-de-Celis

Objectives	To be able to perform/interpret geriatric screening and/or assessment of older patients with cancer and coordinate the
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	implementation of geriatric interventions To be able to counsel on an optimal treatment strategy for each individual and guide systemic therapy decisions as part of a multidisciplinary team
Key Concepts	Describe the epidemiology of cancer in relation to age Distinguish that tumour biology can be different in older versus younger patients with cancer Recognise that older adults are underrepresented in clinical oncology trials, and explain the importance of expanding inclusion criteria Recognise the importance of the evaluation of the general health status by geriatric assessment in older patients with cancer: detection of unidentified non-cancer health problems, prediction of adverse outcome and better estimation of non—cancer-specific life expectancy in relation to lethality of the malignancy Identify the different domains of geriatric assessment: social status/support, functional status, fatigue, comorbidity, cognition, mental health status, nutrition, and geriatric syndromes such as falls, incontinence, and delirium Define the frailty status of an older adult with cancer through the use of geriatric assessment Identify the need of polypharmacy evaluation, drug-drug interactions, and drug compliance in this population Evaluate social situation, access to care and the needs of the caregiver Explain that, if geriatric assessment reveals problems, it needs to be followed by targeted geriatric interventions Recognise that older patients may die from their cancer, but also from other causes as well as from adverse effects of cancer treatment Distinguish that pharmacology of anti-cancer agents can be different in older adults, and that dosing modifications may be required Recognise that the toxicity of anti-cancer agents can be different in older adults, can be affected by comorbidities and frailty status, and requires a close monitoring and early implementation of supportive care strategies (eg, antiemetics, growth factors) Summarise international guidelines, eg, from the International Society of Geriatric Oncology (SIOG) concerning specific treatment approaches for different tumour types Summarise SIOG and ASCO guidelines on other ageing-related issues such as geriatric evaluation and pharmacology Give examples of key older adult—specific trials that are relevant for the tailoring of treatment decisions Identify the needs of older cancer survivors and the long-term side effects of cancer and its treatments, and the indications for referrals
Skills	Demonstrate the ability to: Perform a geriatric screening using validated tools like G8 or VES-13 Use the results of a geriatric assessment to select the optimal cancer therapy and to plan tailored interventions aimed at mitigating or solving geriatric problems Assess the decision-making capacity and patient preferences of older adults with cancer Discuss the treatment plan with geriatricians and other members of the multidisciplinary team to improve care for each older patient with cancer Predict non—cancer-specific survival using validated geriatric assessment—based tools (such as those listed at www.eprognosis.org) Predict the risk of chemotherapy induced toxicity using validated geriatric assessment—based tools such as CARG (https://www.mycarg.org) or CRASH (https://moffitt.org/eforms/crashscoreform/)

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4.9.3. Cancer and Pregnancy

Fedro Alessandro Peccatori

Adriana Hepner

Objectives	To describe the impact of cancer therapies on fertility and counsel patients with pregnancies occurring after cancer To be able to diagnose, stage, and treat pregnant patients with cancer considering both maternal and foetal issues
Key Concepts	Demonstrate an understanding of the importance of contraception during and after cancer treatment Explain fertility preservation options before treatment and the need of early referral Describe the epidemiology of the most frequent types of cancer occurring during pregnancy Recognise that frequent diagnostic pitfalls of cancer during pregnancy are mostly linked to low suspicion and assumed physiologic pregnancy changes Recognise the importance of coordination of the multidisciplinary treatment care and recognise cases that will require referral to specialised centres Determine the appropriate diagnostic and staging procedures considered safe for the pregnant patient and the foetus, including consideration on the effects of imaging studies and anaesthesia (local or general) Recognise that treatment is guided by tumour type, stage, gestational age (pregnancy trimester), maternal-foetal complication risks and teratogenic risks Demonstrate an understanding of the principles of surgery, radiation therapy, and systemic therapy during pregnancy, including data limitation on modern therapies, such as immune checkpoint inhibitors Express knowledge in pharmacokinetics and develop awareness of frequent dose correction requirements following weight changes during pregnancy Demonstrate an understanding that when indicated and when allowed by local laws, early pregnancy termination could be discussed, and a shared decision-making process with patient and partner should be prioritised Recognise clinical scenarios when early delivery should be considered, such as rapid maternal deterioration due to disease progression Determine that children exposed in utero to treatment of maternal malignancy should have a long-term follow-up Explain the feasibility and safety of pregnancy following

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	oncologic treatment Recognise the potential impact of previous therapies on subsequent pregnancies after cancer treatment, including maternal effects (eg, drug-induced infertility, cardiomyopathy, radiation-induced breast fibrosis) and foetal effects (eg, genotoxicity of recent treatment)
Skills	Demonstrate the ability to: Apply routine pregnancy testing into clinical practice and provide counselling on contraception to women of childbearing potential before oncologic treatment start and as necessary Promote increased awareness of early diagnosis of cancer during pregnancy and exercise judgement to refer patients to centres with experience on multidisciplinary care Perform a detailed medical history and physical examination of the pregnant patient with cancer, considering key aspects as gestational age calculation Participate in the multidisciplinary management of the pregnant patient with cancer throughout pregnancy and puerperium, including tailored treatment planning and frequent re-assessment with appropriate consultation of the surgeon, radiation oncologist, obstetrician, perinatologist, and phycologist when appropriate Discuss treatment options and recommendations according to tumour type and gestational age, including maternal-foetal prognostic considerations Select, communicate, and adequately prescribe systemic therapies in pregnant women diagnosed with cancer Recognise the challenges and limitations of clinical trial conduction in this setting, discuss inclusion of data on maternal-foetal outcomes into international registries after patients' consent Demonstrate an empathic, non-judgemental care and share the decision-making process with the patient and her family Counsel patients on the safety and feasibility of subsequent pregnancies after oncologic treatment, when appropriate

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4.9.4. Cancer Treatment in Patients With Comorbidities

Capucine Baldini

Martine Extermann

Objectives	To be able to recognise comorbidities, their burden, adapt treatment in collaboration with the organ specialists To be able to guide systemic therapy in patients with comorbidities
Key Concepts	Recognise comorbidities and evaluate the impact on cancer treatment (efficacy and toxicity) Demonstrate an understanding of how comorbidities affect the pharmacokinetics and pharmacodynamics of cancer drugs Distinguish key drug interactions in terms of comorbidities, drugs, and cancer treatments Recognise the difference between comorbidities, Eastern Cooperative Oncology Group performance status and functional status Give examples of comorbidities and the impact on life expectancy and instruments to assess that Recognise the role of interdisciplinary management of comorbidities to improve cancer treatment feasibility Demonstrate an understanding of how in older patients interdisciplinary management should be integrated in a comprehensive geriatric assessment and management plan for best outcomes Demonstrate an understanding of how to individualise the management of different types and stages of cancer in patients with comorbidities Define comorbidities and related contraindications to specific cancer treatments Evaluate role of comorbidities in clinical trial design and enrolment and external validity Demonstrate an understanding of how cancer-directed treatment can lead to the exacerbation of comorbidities during or after the completion of therapy
Skills	Demonstrate the ability to: Perform a thorough and accurate assessment of a patient with cancer's comorbid medical conditions Critically discuss and coordinate the management of comorbidities of patients with cancer with other specialists Apply understanding of drug pharmacology to adapt and modify therapeutic plans in patients with cancer with comorbidities, including varying degrees of hepatic and renal dysfunction Evaluate whether comorbidities allow trial eligibility or not and whether they are part of a pattern of frailty and unfitnes or not Incorporate comorbidities in determining the risk/benefit ratio for pursuing cancer-directed therapy and for specific anti-cancer agents and procedures Predict potential acute and chronic treatment-related complications (eg, neuropathy) and initiate pro-active supportive care in patients with cancer and comorbidities Participate actively in the management of patients with cancer and comorbidities at the time of diagnosis, and during the initiation, transition, and cessation of treatment Discuss and leverage local oncogeriatric resources to provide an integrated care plan for older patients with comorbidities

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4.9.5. Cancer in LGBTQ Populations

Alison May Berner

Shail Maingi

Objectives	To describe and understand the disparities experienced by lesbian, gay, bisexual, transgender, and queer (LGBTQ) patients across the cancer continuum To be able to consult with LGBTQ patients with sensitivity and cultural humility and tailor care to meet the specific needs of LGBTQ patients with cancer
Key Concepts	Recognise the impact of stigma and discrimination on the patient-provider relationship and experience Determine the local and national protections in place for LGBTQ populations in your country/region and how this might impact your consultations with patients to ensure safety Describe the impact of behavioural cancer risk factors such as higher rates of smoking, tanning bed use, and obesity on LGBTQ populations Recognise that human papillomavirus transmission contributes to higher rates of anal cancer among men who have sex with men Demonstrate an understanding that LGBTQ patients receive a lower quality of care across the cancer control continuum, have lower overall survival, and may fear disclosure of their sexual and gender minority (SGM) status Explain the importance of sexual orientation and gender identity (SOGI) in cancer data sets, including for patient-reported outcome measures, and the barriers to their collection Describe how gender-affirming hormone therapy and surgery may affect incidence of some cancers Summarise how screening needs differ for transgender patients according to the sex they were assigned at birth and any gender-affirming hormones they may have accessed Recognise the gaps in knowledge across the cancer continuum for transgender people on gender-affirming hormones, including drug interactions and risk from inherited syndromes Demonstrate an understanding of the barriers to lower rates of cancer screening among LGBTQ people Recognise the need for anatomy-based cancer screening, evaluation, and treatment for transgender patients Identify ways to encourage safe disclosure of LGBTQ+ identity in your practice Recognise the importance of intersectionality in identifying the specific cancer needs of LGBTQ patients Demonstrate familiarity with local, culturally competent resources for LGBTQ+ populations in your area including for fertility preservation and end-of-life care Compile and prioritise documentation of patients' choice of surrogate decision makers Recognise a lack of legal protections for terminally ill LGBTQ patients with cancer and their loved ones and encourage them to address inheritance, child custody and burial rights once non-curative cancer is identified
Skills	Demonstrate the ability to: Use a standardised, non-assumptive, welcoming approach to enquiring about identity, preferred pronouns, partner status, support systems and sexual behaviour Select and include appropriate surrogate decision makers, caregivers, and families of choice in the care of the patient

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Perform SOGI data collection in clinical practice, and include in the design of cancer databases, quality metrics and research
Evaluate emerging literature on LGBTQ cancer care
Demonstrate a person-centred approach to care, recognising the variability in the way a person's sexual orientation or gender identity may impact their care
Demonstrate cultural humility when consulting with LGBTQ+ patients
Apply the principles of shared decision making in situations where cancer care may affect gender-affirming treatments
Apply existing best practices across the cancer continuum once SOGI identity is disclosed

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4.9.6. AIDS-Associated Malignancies

Scot C. Remick

Objectives	To describe the natural history and spectrum of AIDS—defining and non—AIDS-defining neoplasms in the setting of underlying HIV infection, viral co-infection(s), and associated risk behaviours To be able to extrapolate treatment approaches with appropriate knowledge of tumour stage and clinical and immune status of the patient
Key Concepts	Demonstrate an understanding of: Conceptual framework comprised of basic epidemiology, pertinent disease pathogenesis, natural history, clinical manifestations and general orientation to therapeutic and/or preventive approach of the different AIDS-defining tumour types—Kaposi's sarcoma (KS); non-Hodgkin's lymphoma, including primary central nervous system lymphoma and Burkitt lymphoma; and cervical cancer Conceptual framework of the different non—AIDS-defining tumour types, especially Hodgkin's lymphoma, anal cancer, ocular surface squamous neoplasia, hepatocellular cancer, and lung cancer in certain settings Disease pathogenesis by virtue of coinfection with other tumorigenic viruses (eg, KS-associated herpes virus, Epstein-Barr virus, human papillomavirus, and hepatitis B/C virus) in the backdrop of HIV infection Differences in clinicopathologic and molecular

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	characterisation, disease patterns and natural history of KS (eg, classical v endemic v epidemic v transplant less important) and NHL (eg, HIV-associated v non-HIV-associated v endemic Burkitt lymphoma) Thoughtful clinical assessment of tumour stage and immune status in selecting and optimising therapeutic approaches to the HIV-infected patient with cancer cART, monitoring of viral replication and immune status Suitable therapeutic approaches using all modalities of cancer therapy for all tumour types including emerging contemporary modalities (eg, radiation, haematopoietic stem-cell transplantation) even in sub-Saharan Africa and/or referral in select instances to international centres Supportive and palliative care interventions and hospice referral Suitable prevention strategies, including modifying risk behaviours Systems-based knowledge and multidisciplinary team approaches in the management of patients with AIDS-associated malignancies cART treatment, drugs, monitoring, and OI prophylaxis strategies Systemic chemotherapy and/or other drug classes of anti-cancer agents The safety profiles of cART and systemic chemotherapy and the management thereof The identification of the access to new strategies of care for HIV infection and cancer through access to clinical trials and other appropriate supportive interventions that may be available and are expanding globally through international partnerships
Skills	Demonstrate the ability to: Select appropriate therapy in the context of tumour stage, clinical and immune status, and/or appropriate palliative care and hospice referral Participate actively in a variety of settings (outpatient clinics, inpatient wards, multidisciplinary tumour boards, women's health clinics and HIV clinics) to gain access to the spectrum of cases of malignant disease encountered in the backdrop of HIV infection Perform a thorough history and physical examination, including nuanced history and sentinel physical examination findings indicative of HIV risk behaviours and/or stigmata of HIV disease and associated neoplasms Present and discuss the cases Practise shared clinical decision making along the continuum of care from prevention and counselling to diagnostic, therapeutic (HIV therapy and anti-cancer therapy across all modalities), and palliative care and end-of-life decision making Apply clinical recommendations across the continuum of care based on understanding of performance status, tumour stage, clinical status and comorbid conditions, and immune status Select, communicate and prescribe systemic therapy in the context of underlying immunosuppression and cancer status Participate in multidisciplinary team approaches to the management of patients with AIDS-associated malignancies including in select instances referral to regional and/or international centres Discuss the collection of biosamples as part of emerging clinical/translational research pursuits Use various databases (eg, tumour and/or matched HIV infection registries; global tumour repositories including genomic profiles)

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4.10. Emergency in Oncology

Thorvardur R. Halfdanarson

Christina H. Ruhlmann

Objectives	To be able to identify, diagnose, and treat common oncologic emergencies
Key Concepts	Demonstrate an understanding that emergency in oncology includes signs and symptoms arising from the cancer disease itself or from the applied anti-neoplastic treatment Demonstrate an understanding the pathophysiology of each of the oncologic emergencies, including which anti-neoplastic treatments are responsible for which emergencies Classify the following diagnoses as oncologic emergencies (listed in alphabetical order): airway obstruction and/or haemorrhage, cancer associated thrombosis, endocrine abnormalities (eg, hyperglycaemia, pituitary dysfunction, adrenal insufficiency), febrile neutropenia, increased intracranial pressure, malignant bowel obstruction, malignant effusions (pleural, pericardial, peritoneal), malignant spinal cord compression, metabolic derangements (eg, hypercalcaemia, hyponatraemia), pathologic fractures, tumour lysis syndrome, superior vena cava syndrome Recognise the importance of early diagnosis and treatment in order to prevent a fulminant course, disability and death Identify patient- and treatment-related risk factors for developing oncologic emergencies Describe the presenting features of each of the oncologic emergencies Recognise that signs and symptoms can be overlapping, non-specific in nature, and challenging in drawing the appropriate conclusions and actions Summarise the diagnostic approach to each of the oncologic emergencies Give examples of the available diagnostic tests and appropriate use of diagnostic methods for specific emergencies Explain the appropriate use of the specific treatments for each of the oncologic emergencies Demonstrate an understanding that some oncologic emergencies can present as the first symptoms of previously unknown cancer disease or be the presenting feature of disease recurrence or progression Describe prophylactic strategies, where relevant, to avoid oncologic emergencies Demonstrate an understanding that in situations where life expectancy is very short and/or no effective anti-neoplastic treatments exist the best course of action is palliation of symptoms without therapy directed at the particular emergency
Skills	Demonstrate the ability to: Report characteristic as well as less common presentations of oncologic emergencies Perform a thorough history and relevant clinical examination to determine the likely aetiology of the oncologic emergency

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	Discuss potential diagnostic investigations including the merits and limitations of the tests Demonstrate skills in prompt recognition of signs and symptoms for each of the oncologic emergencies Use optimal treatment strategies for the most common oncologic emergencies, including pharmacologic, surgical, interventional radiologic, radiation, and other supportive non-pharmacologic methods Discuss the presence of an oncologic emergency in the context of a specific cancer disease, the stage of the disease, and the current anti-neoplastic treatment applied (if any) Apply evidence-based prophylactic strategies that can be instituted to prevent oncologic emergencies Discuss that under certain circumstances, especially at the end of life and when no effective anti-cancer therapies exist, supportive care and palliation of symptoms may be an appropriate intervention

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4.11. Psychosocial Aspects of Cancer

4.11.1. Psycho-Oncology

Lidia Schapira

Luzia Travado

Objectives	To be able to: Recognise and describe the psychosocial domains of patient-centred cancer care, such as eliciting, concerns and patients' preferences for care along the various phases of treatment and survivorship Implement psychosocial assessments and screening for distress and integrate appropriate psychosocial care into routine oncology care
Key Concepts	Demonstrate an understanding of simple instruments to screen for emotional distress (eg, Distress Thermometer, PROMIS, PHQ 9) and implement screening at regular intervals during the continuum of the cancer Recognise when patients may benefit from timely and efficient referrals to psycho-oncologists, psychiatrists, psychologists, social workers and chaplains based on need and availability following established guidelines Recognise, diagnose, triage, and treat common psychiatric conditions including depression, anxiety and assess for suicidality for patients at risk Identify and document factors that increase the risk of psychologic morbidity including social determinants of health,

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	and a prior history of psychiatric disorders Recognise normal coping mechanisms and protective factors (family and social support, spirituality) and identify the role of self-support and group therapy
Skills	Demonstrate: Proficiency in fostering adaptive coping Proficiency in cross-cultural communication and develop strategies to minimise stereotyping and bias The ability to prescribe and monitor use of psychotropic drugs to reduce anxiety, depression, insomnia, pain, delirium, and other common and distressing symptoms

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4.11.2. Communication Skills

Lidia Schapira

Luzia Travado

Objectives	To be able to: Recognise that effective doctor-patient communication skills are crucial throughout all phases of the cancer care continuum Demonstrate the necessary skills to effectively communicate to patients and their caregivers regarding disease, treatment options, prognosis and preferences for care at the end of life
Key Concepts	Demonstrate an understanding of the verbal and non-verbal aspects of communication Recognise cognitive and implicit biases of both clinician and patient (such as thoughts, attitudes and feelings which are influenced by cultural and contextual variables) that play a role in the medical encounter Recognise that effective communication skills foster patients' trust in clinicians, facilitates shared decision making, enhances adherence to treatment and clinical recommendations, and participation in clinical trials Demonstrate an understanding of ASCO's consensus guidelines regarding patient-clinician communication
Skills	Demonstrate the ability to: Apply effective communication skills in the clinical encounter throughout the continuum of cancer care to promote trust and adjustment to the disease Use agenda setting skills to identify patients' concerns and psychosocial needs (eg, distress) Predict and respond effectively to patients' emotions (eg,

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empathy, validation, exploring) Use a stepwise protocol to effectively deliver bad news (eg, Setting up, Perception, Invitation, Knowledge, Emotions with Empathy, and Strategy or Summary) Perform a family meeting to discuss issues related to patients' condition and needs (eg, dependency, advance care planning)

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4.11.3. Patient Education

Meredith Giuliani

Carla Ida Ripamonti

Objectives	To be able to: Use active listening and other communications techniques to elicit needs, engage in two-way conversation, inform and educate patients and caregivers effectively adhering to health literacy principles Perform as an effective teacher
Key Concepts	Define health literacy principles and best practices Define health literacy and know its prevalence and impact on health Describe and practise health literacy universal precautions Describe teach back as applied to patient and caregiver interactions Define numeracy as a component of health literacy and describe examples of common issues with numeracy Practise the principles of adult education and active listening to support your teaching and learning Describe approaches for establishing a mutual learning agenda and establishing rapport Describe the purpose of plain language communication Demonstrate an understanding of the importance of patient-centred communication ie, clear and appropriate for each individual patient, inclusive of health literacy and other determinants of health like race, employment status and culture

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Skills Demonstrate the ability to: Use teach back to ensure understanding from clinical encounters Apply plain language in practise (verbal and written) and in the development of educational materials Use translation services appropriately Use techniques for eliciting patients' concerns at follow-up visits

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4. National Cancer Institute: Resources for Patients, Caregivers, and Health Professionals. <http://www.cancer.gov/>

4.12. Genetic Testing and Counselling

Banu Arun

Judith Balmaña

Objectives	To be able to: Identify patients with a clinical suspicion of a germline cancer susceptibility Communicate cancer risk and offer medical management to individuals with a genetic cancer susceptibility, and encourage communication to family members for cascade genetic testing
Key Concepts	Recognise that germline susceptibility represents about 10% of patients with cancer Demonstrate an understanding of the nature of the hereditary predisposition to cancer, including the polygenic risk factors Demonstrate an understanding of tumour phenotypes associated with risk of hereditary cancer Demonstrate an understanding of the need to provide adequate genetic counseling when ordering a germline genetic test Demonstrate an understanding of genetic testing results, including variant of uncertain significance and its reclassification follow-up Determine the most appropriate strategy for communication of cancer risk and provide resources for cascade testing in relatives Evaluate and interpret results of genetic sequencing to be able to distinguish the origin of a genetic alteration (eg, germline, somatic, mosaicism) Demonstrate an understanding of the duty to warn family members when a germline variant is identified in a patient with cancer Distinguish cancer risk stratification based on genetic and non-genetic risk factors to be able to translate adequate screening or risk-reducing options to individuals Give examples of transmission of cancer susceptibility according to the type of inheritance (dominant or recessive) Explain available options for cancer surveillance and risk-reduction options according to cancer risk stratification Demonstrate an understanding that germline alterations in cancer genes are not conventional biomarkers for therapeutic decision making

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Skills	Demonstrate the ability to: Present adequate communication skills to report a genetic risk of developing cancer Participate in multidisciplinary teams to discuss cancer risk assessment of familial cancer syndromes, interpretation of genetic results, and medical management Recognise individuals with a clinical suspicion of a hereditary cancer predisposition Use public databases to help interpreting the pathogenicity of genetic variants Cope with emotional reactions derived from learning that there is an increased genetic risk to develop cancer Discuss and recommend germline-specific screening and risk-reduction procedures to individuals

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4.13. Survivorship

Anne Blaes

Lorna Zdravcov Zaletel

Objectives	To describe the long-term sequelae of cancer therapies taking into account cancer-specific treatments, age at treatment and associated comorbidities and personal/family history with understanding of unique needs of paediatric and young adult cancer survivors in their requirement for lifelong surveillance and health care prevention To be able to perform outpatient follow-up assessments and screening recommendations based on best practice or guideline recommendations for the detection of cancer recurrence, new primary cancers, and chronic diseases and to educate patients about healthy lifestyle
Key Concepts	Recognise that a cancer survivor, defined by the National Cancer Institute of the US, includes any individual from the time of initial diagnosis, through cancer treatment, and continues until the end of life. Family members, friends and caregivers are also affected by the survivorship experience and are included in this definition Define and describe three major groups of late sequelae: Somatic late sequelae: Endocrine, cardiovascular, renal, gastrointestinal, urologic/

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	gynaecologic, neurologic, skin, mucosal, dental, and other neurologic problems: motor and sensory problems, neuropathy impaired immune capacity (especially after surgical/radiotherapy splenectomy, bone marrow transplantation), chronic fatigue pain accelerated ageing Second primary cancers (treatment-related, genetics-related) Psycho-social problems: Cognitive dysfunction, learning disabilities, emotional disturbances, anxiety, depression, and loss of self-esteem/confidence Unemployment, poorer social status, lower accessibility to insurance and mortgages, caregiver burden Explain the roles of long-term follow-up (according to national/international guidelines): Describe screening for cancer recurrence and second primary cancers, screening for somatic late sequelae and their management Recognise importance of care for psychosocial well-being, referring to psycho-social, occupational rehabilitation if needed and empowerment among patients and patients' advocates Describe screening for cardiovascular disease and for second primary cancers and their management Explain promotion of healthy lifestyle, self-examination (breast, skin), care of immunisation, family risk evaluation
Skills	Demonstrate the ability to: Critically discuss the treatment options/recommendations of screening for cancer recurrences and second cancers, long-term and late effects Perform a thorough history, physical examination, laboratory studies and diagnostic imaging as indicated for new or persistent symptoms in cancer survivors Present awareness of promoting empowerment and wellness among survivors and their families/caregivers by teaching or referring them to programmes/primary care providers that emphasise the importance of obtaining routine preventative health care and the importance of adopting healthier lifestyles as are developing and/or maintaining physically active lifestyles, weight management and avoidance of obesity, reducing alcohol consumption, tobacco cessation, making healthy dietary choices, managing depression/anxiety Discuss secondary prevention strategies with patients, family and related specialists Discuss psychosocial and financial challenges unique to cancer survivors, and to provide resources, facilitate referrals for vocational training (educational, job) and social/financial support Discuss resources for ongoing education, psychosocial and financial needs for supporting other health care providers as well as patients and patient families

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Publications/Handbooks/Rehabilitation-Issues-During-Cancer-Treatment-and-Follow-Up

4.14. Cancer Research

4.14.1. Clinical Research

Giuseppe Curigliano

Joel N. Saltzman

Objectives	To be able to: Formulate an appropriate research question Select the optimal clinical trial design and develop the ability to run the clinical trial based on ethical principles and to interpret accurately the results based on the statistical analysis
Key Concepts	Demonstrate an understanding of general concepts on clinical trials design, selection of the questions, selection of the appropriate end point, the study population, the integrity in research, the randomisation process, the study blinding and the effectiveness of studied treatment Demonstrate an understanding of how to read the results of clinical trials Recognise basics of statistics, statistical tests, sample size calculation Understand how to interpret the results of a clinical trial, the survival analysis, missing data and covariate adjustment, meta-analysis and subgroup analysis, introduction to regression modelling Demonstrate an understanding of the relevance, pros and cons of different possible end points that are often used in clinical research Recognise safety, clinical, and surrogate outcomes (including translational end points), recruitment of study participants and participant adherence, clinical research in the context of personalised medicine, the business of clinical research, effective communication in clinical research Recognise non-inferiority designs, adaptive designs, interim analysis, phase I, II, and III and multicentre trials, observational studies, confounders in observational studies, using the method of propensity score, randomised controlled trial v observational designs Express competences on effectiveness trials and observational real-world trials
Skills	Demonstrate the ability to: Discuss what is the study question and hypothesis Understand how should the treatment effect be assessed and interpreted Design a trial to maximise validity, precision, and generalisability Select the clinical trial end points for approval of cancer drugs and biologics (with special focus in personalised cancer medicine) Perform calculation of sample size, power, and subgroup analyses and acquire essentials in Bayesian design and analysis of clinical trials; estimating treatment effects; Bayesian v frequentist approaches Find useful information on clinical research, to plan hypothesis directed research questions in clinical trials, to understand clinical validity and clinical utility of companion diagnostic tests, to assess response assessment (functional imaging, traditional imaging, biologic markers) and to plan comparative effectiveness research Discuss health care and comparative effectiveness and quality improvement trials and about assessment of new technologies as part of a clinical trial design Disseminate, implement, and de-implement research Discuss cost-effectiveness, cost utility, and cost-benefit analyses in clinical research Understand phases of clinical trials (I, II, III, and IV) Understand the complexity of trial organisation (sponsors of trials, partnership of intergroups, institutional, industry) Learn about the P4 paradigm (predictive, preventative, personalised, participatory) Report the conflict of interest Be mindful of equitable research designs in order to avoid bias

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research populations and to be aware of publication bias (eg, that negative trials become less published)

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4.14.2. Translational Research

Joel N. Saltzman

C. Benedikt Westphalen

Objectives	To be able to: Identify and answer relevant translational research questions Effectively build teams around a research question
Key Concepts	Recognise that translational research projects depend on multistakeholder engagement Identify specific training opportunities in translational research Demonstrate a basic understanding of the molecular foundations of cancer Recognise principles of cancer biology in clinical practice Demonstrate an understanding of cancer immunology Identify translational research opportunities in your area of expertise Compile and analyse existing scientific data to help defining a scientific question Define key chances and challenges when answering your research question Define a research question and lay out a project plan Identify key partners essential for the success of the project Identify and engage key partners and explain the project and their role in the process Define the responsibilities and benefits for all partners involved Identify and define ownership of data and any tissue collected as part of the research project Determine and allocate the necessary resources (time, financial, etc) to your project Evaluate the project progress on a regular basis Summarise your results and communicate them to the team Summarise findings to receive internal and external feedback Determine a publication strategy for your project
Skills	Demonstrate the ability to: Plan and execute scientific projects Demonstrate willingness to be part of a multidisciplinary research team Present the research question, its chances, and challenges in a balanced manner

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Present research in a scientific environment Discuss and grow as a researcher from the critiques of research project by a diverse scientific community

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4.14.3. Bioethical Principles and GCP

Jose Luis Perez-Gracia

Joel N. Saltzman

Objectives	To be able to conduct and collaborate in clinical research projects in accordance with the applicable regulations: Declaration of Helsinki, Good Clinical Practice (GCP) Guidelines and local/regional regulations for clinical research
Key Concepts	Demonstrate an understanding and knowledge of ethical principles of respect for autonomy, beneficence, nonmaleficence, justice and truthfulness Demonstrate an understanding and knowledge of the basic principles of the Declaration of Helsinki, GCP Guidelines and the applicable local/regional regulations for developing clinical research Demonstrate an understanding of the principles guiding collection, storage and study of clinical data and biologic human samples especially those regarding a patient's privacy rights, including the implications of Big Data analysis Demonstrate an understanding of the relevance of disclosing adequately potential conflicts of interest for research projects Recognise the issues of equity in biomedical research and the importance of assuring adequate care for all research subjects Compile informed consent process Demonstrate an understanding of how subjects from special patient populations (eg, phase I research, paediatric patients) need for special procedural safeguards Demonstrate an understanding and be aware that all patients have the right to choose not to participate in clinical research and will still receive excellent standard care
Skills	Demonstrate the ability to: Analyse the ethical aspects of the design of a clinical trial or research project especially those regarding to patients' rights Discuss, guide, and document the process of informed consent, before participating in a clinical trial or research project Discuss ethical dimensions of randomisations, stopping rules, and confidentiality in clinical trials Identify potential situations in which the rights of an individual participating in a trial might be compromised (eg, clinical interference of the protocol with best medical
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practice), and follow the adequate procedures in such cases Perform correctly the pharmacovigilance procedures applicable in clinical trials Practise with surrogate decision makers in a research setting

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4.14.4. Statistics

Saskia Litière

Joel N. Saltzman

Objectives	To be able to: Develop a working knowledge of clinical trial and medical statistics Develop the capacity to critically interpret medical statistics, as presented in any format
Key Concepts	Distinguish types of outcomes (continuous, binary, time-to-event) and identify the commonly associated analysis methods (linear regression, logistic regression, Kaplan-Meier techniques, proportional hazards model, etc) Interpret key clinical trial and epidemiology summary statistics (such as response rate, hazard ratio, odds ratio, etc) Recognise different measures of variability (standard error, confidence intervals) Interpret a <i>P</i> value Describe concepts of sample size calculation (type I error, power, targeted effect) Explain the role of randomisation and describe the different randomisation methods (block, minimisation, stratification) Explain the link between a trial objective, an end point and a statistical test Recognise the difference between types of data (clinical trials, observational studies, real-world data such as registries or electronic medical records, case studies) Describe concepts of clinical trial designs (comparative v non-comparative, blinding, superiority v non-inferiority, intention-to-treat v per-protocol analysis, confirmatory v exploratory, basket designs, platform designs) Identify sources of bias and describe the impact on study outcome
Skills	Demonstrate the ability to: Apply statistical concepts in research questions Perform basic analyses of research data Correctly present the results of clinical research Assess critically the scientific value of data being presented, and to deduce knowledge from such information Perform calculation of sample size of a standard design Discuss and interact with statistical and data science
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professionals Report and understand the difference between relative treatment effect (eg, a hazard ratio) and absolute benefits (eg, a 10% difference in overall survival at 5 years)

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5. CANCER CONTROL POLICIES

5.1. Fundamentals of Cancer Care Organisation

Josep Maria Borrás

Mary Gospodarowicz

Objectives	To describe the benefits of a comprehensive cancer centre/program to improve quality of cancer care of the patients and population-based cancer control and describe centre-wide initiatives that support effective functions of the cancer centre/program; list initiatives specifically aimed at improving clinical outcomes To be able to identify the main characteristics of different approaches of organising comprehensive cancer care both as a program, centre or in a network of hospitals providing cancer care in a territory
Key Concepts	Describe the functions of a comprehensive cancer centre that contribute to continuous improvement of cancer-related outcomes Leadership and governance Strategy Quality Performance management Identify important methods/elements of strategic planning for cancer services Give examples of the responsibilities of medical leaders in cancer centre Explain the elements of financing framework in a comprehensive cancer centre. Provide examples of the ways to improve the value of services provided Describe the impact of data, utilisation and outcomes collection on strategy, planning and fostering a learning cancer centre Describe the elements of risk management in comprehensive cancer centre Describe the Donabedian framework for health care quality measures and give examples of quality measures for each category Classify the six domains of health care quality (defined by Institute of Medicine as safe, effective, patient centred, timely, efficient, and equitable) and give examples of their application in cancer care Give three examples of cancer center wide initiatives to secure effective communication with internal (management, health professional staff, support staff, patients) and external audiences (referring institutions and professionals, patients, public, donors, policy makers) Describe conditions the main characteristics of multidisciplinary team and effective functioning of the health care team, and/or tumour board/committee
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	Describe the elements of project management for implementing a cancer care program in a hospital or in a territory Demonstrate an understanding of the elements of the governance structure of health care organisation Describe the opportunities and challenges of cancer center engagement in cancer prevention, both primary and screening Recognise the importance of coordination of cancer-specific services with primary care, particularly for timely access to diagnosis in case of high suspicion of cancer, for follow up of patients after treatment and for palliative care, if required Demonstrate an understanding of the need for coordination of cancer care through clinical pathways both within the cancer center/program or within a network of hospitals providing care for patients with cancer Describe the importance and elements of integration of various clinical services to secure seamless care delivery Demonstrate an understanding of the challenges posed to cancer care by pandemics, such as COVID-19 or some other service disruptions and crises
Skills	Design the agenda for a department/team leadership meeting aimed to organise a clinical pathway or the multidisciplinary team Design a workplan for a quality improvement project Discuss the challenges and opportunities for engaging with partner organisations in a network in a territory or for specific tumour site Design a process for creating a strategic plan including creating vision, mission, short- and long-term goals for the center, department, or service Select metrics to measure quality of processes/outcomes in your team and your center/program and describe how they will be used to improve the process of care

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5.2. Digital Health and Cancer

Natalie Dickson

Mark Lawler

Objectives	To describe: How digital health technologies and telehealth provide alternative avenues for delivery of modern cancer care How big data can be deployed to enhance cancer outcomes and improve patients' health (eg, enhance quality of life)
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Key Concepts	Demonstrate an understanding of the opportunities that the responsible and effective use of big data brings and the challenges that it poses Recognise the potential for big data to support and enhance cancer care Demonstrate an understanding of the preparation required to be proficient in preparing for and leading successful virtual consultations/encounters with patients Recognise that telemedicine provides patients, especially those located in rural areas, with timely access to medical care and advice via real-time audio/video communication Recognise that remote monitoring may enhance the care of high-risk patients and improve outcomes Explain how the clinical information obtained during these virtual encounters provides valuable intelligence to underpin better health care delivery and enhance population health Recognise that patients and caregivers are co-creators in the development of eHealth/telemedicine processes and that there are standard processes for providers to deliver and patients to access telemedicine services Recognise the importance of patients' understanding of the risks and benefits of eHealth services and the associated costs Determine that eHealth services are safe and confidential, and mimic as closely as possible the quality of care provided by an in-person visit Demonstrate an understanding of how technical difficulties are handled and how relevant patient information is communicated in a timely manner Recognise how multimodal data and its analysis may contribute to enhancing patient diagnosis and prognosis Define the principles of consent and how to apply them in the use of patient data for research Explain to patients how the collection of their data and its use can affect improvement in service and research Demonstrate an understanding of the advantages and challenges of collecting Patient-Reported Outcome Measures Recognise and adapt relevant telemedicine/eHealth processes that have been developed during the COVID pandemic
Skills	Demonstrate the ability to: Apply local/regional laws and institutional policies governing eHealth Use local health information systems to capture data and run data queries Select appropriate patients who would benefit from remote monitoring and/or telemedicine visits; discuss the eHealth service with the patient or legal guardian to ensure their understanding of the risks and benefits and document their consent Apply an approach to collect data that ensures patient privacy and is compliant with ethical and legal guidelines Discuss with the patients how their data may be deployed to underpin service improvement or research Design a personal action plan for troubleshooting technical challenges during telemedicine encounters Design a personal medical decision-making process in the virtual setting Use appropriate lighting, background, and body language to effectively set the virtual stage with patients and ensure that they are comfortable with this virtual consultation setting Demonstrate effective verbal and non-verbal communication with patients and their caregivers in a virtual space Perform virtual visits/consultations and ensure that appropriate data are recorded in a manner that facilitates data collection for use in research studies

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5.3. Multidisciplinary and Multiprofessional Care of Patients With Cancer

Abdul Rahman Jazieh

Nagi El-Saghir

Objectives	To be able to: Deliver the most optimal care for patients with cancer Combine the expertise of specialists of multiple disciplines involved to reach a most appropriate diagnosis and deliver the best available treatment and management of patients with cancer
Key Concepts	Demonstrate an understanding how to establish and implement collaboration and teamwork for multidisciplinary management of patients with cancer Describe how to establish specialised units (ie, breast unit) or multidisciplinary meetings (tumour boards) Demonstrate an understanding of the definition of specialised units: Multiple specialists involved in the care of patients with a particular cancer examine the patient, request and perform diagnostic tests, discuss treatment options Demonstrate an understanding of the definition of multidisciplinary tumour boards: Multiple specialists meet regularly, present patient cases, review findings, and test results, discuss and make treatment recommendations Recognise the tumour board members composition should include: medical oncologists, surgeons, radiation oncologists, radiologists, pathologists, other specialists involved in particular cancers. It is also advisable to have oncology nurses, palliative care physicians, physicians-in-training and medical students and clinical research coordinators in medical centres involved in clinical trials Recognise that tumour boards can be general tumour boards, or sub-speciality tumour boards, especially in large or academic medical centres. Molecular tumour boards are increasingly becoming necessary with recent advances in biomarkers, genomics, genetics and translational medicine Identify that modern information technologic advances allow cooperation of distant medical centres, and allows physicians practicing in smaller and peripheral hospitals to join via video-conferencing. In centres where all specialists are not available, mini-tumour boards, eg, involving radiologist, oncologist, surgeon, can be organised regularly Identify when to seek appropriate help from other specialists for their advice on patient management; this involves evidence-based medicine, expert opinions, literature review and available resources Demonstrate an understanding that physicians are encouraged to participate regularly, at least weekly, at a specific time such as early morning breakfast time, lunch time or evening in multidisciplinary meetings (conferences) Recognise the notion that health authorities and insurance providers in many countries require participation and multidisciplinary team recommendations in order to approve and cover treatment recommendations

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	Determine when to seek help for diagnosis and management of patients. Proper diagnostic work-up and various therapeutic procedures and interventions that are required for patient management are discussed and recommendations made Recognise the skills needed for efficient communication with multidisciplinary team members and the way recommendations are presented to patients by his/her primary physician Demonstrate an understanding of how to apply evidence-based recommendations and appraise evidence Demonstrate an understanding of how to work effectively with the group of professionals with different background, specialties and expertise Recognise that having a multidisciplinary team coordinator, plans for selection of cases, time management, and an effective leader are important for successful and productive tumour board meetings Recognise that documentation of recommendations on patients' charts and medical records are important Recognise that a multidisciplinary meeting advice is often a theoretical treatment proposal, but that details on patient preferences and specific health problems and health priorities are often lacking. The final treatment decision needs to be taken together with the patient after taking these additional factors into consideration Recognise that treating physicians should consider patients' preference and other clinical and practical factors when trying to implement the multidisciplinary board recommendations as the multidisciplinary board members may not be aware of all the relevant factors
Skills	Demonstrate the ability to: - Apply effective communication with the team members, as well as communication of results of discussions and recommendations to patients and their families and caregivers - Present pertinent clinical information to the team - Discuss and reach consensus decisions depends on an effective leader of the meeting - Select which patients should be presented to multidisciplinary team - Discuss when to adhere or alter multidisciplinary team recommendations. When such actions are thought needed, they should be justified and documented - Present an expert opinion and input within own speciality to multidisciplinary team discussion - Execute efficient time management to accommodate multidisciplinary team activities - Practise accurate and timely documentation of multidisciplinary team recommendations - Use and adapt evidence-based guidelines in specific patients' management in the context of multidisciplinary team

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5.4. Cancer Care Equity Principles and Health Economics

Nathan Cherny

Ophira Ginsburg

Objectives	To describe the importance of promoting sustainable, equitable quality cancer control and care, including factors that influence access to cancer services in resource constrained settings
Key Concepts	Demonstrate an understanding: - That care planning needs to be sensitive to economic costs to health care services and to individual payers - That value is a function of both cost and the magnitude of clinical benefit - That oncologists have a stewardship responsibility to promote responsible use of limited health care resources - That oncologists have a social responsibility to promote equitable access to quality cancer care, irrespective of sex, race, gender identity, sexual orientation, and social status - Of the economic costs of cancer care, at an individual and health systems level - Of the extent and factors that influence local and global disparities regarding access to cancer control and care - Of the economic costs of care for patients and their families
Skills	Demonstrate the ability to: - Apply the approaches to evaluate the value off anti-cancer treatments, including the use and limitations of quality adjusted life years - Predict the extent and limitations of local health care coverage for the costs of cancer care and the extent of patient exposure to financial toxicity - Use the tools to evaluate magnitude of clinical benefit such as the ESMO-Magnitude of Clinical Benefit Scale and the ASCO Value Framework - Discuss the regulatory processes for the licencing of new treatments and the differences between conditional/ accelerated approval (which require confirmatory studies) and full approval status - Use Health Technology Assessment approaches to evaluate relative value and, in some countries, to make decisions regarding the reimbursement or national insurance coverage of new treatments - Perform an unbiased evaluation regarding the magnitude of clinical benefit and the value of new treatments - Discuss the role of biosimilars and an approach to reduce the cost of care - Apply the World Health Organization Essential Medicines List in oncology and understand the process involved in developing this list - Discuss the economics of oncology therapeutics industry - Apply "Choosing Wisely" and understand its development process and local recommendations

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5.5. Global Cancer Control

Dario Trapani
Alexandru Eniu

Objectives	To be able to understand the global disparities in the cancer-related survival outcomes and the principal determinants of health delivery in low- and middle-income countries (LMICs) To describe the challenges of providing cancer treatment in LMICs, and the opportunity for value-driven priority setting
Key Concepts	Interpret the differences in the global incidence, mortality and survival from cancer Demonstrate an understanding of the principal determinants of health, including the social determinants, in all the income areas Recognise the need for, and the importance of National Cancer Control Plans to catalyse progress from coherent, consistent and comprehensive health policies Demonstrate an understanding of the public health approach in the prevention and control of cancer Identify the principal risk factors for cancer across different regions in the world, including from infectious diseases Demonstrate an understanding of the need to tackle disparities across the cancer continuum and based on a health-system approach Identify the major barriers in access to cancer care in resource-constrained settings, including the paucity in essential health interventions Recognise that cancer management is an essential component of the cancer continuum of care Recognise that not all cancer medicines bring the same benefits and that only some of them represent essential and priority health interventions, as highlighted by the WHO Essential Medicines List and informed by the ESMO-Magnitude of Clinical Benefit Scale and ASCO Value Framework Recognise the importance for efficient health spending for cancer care based on a value-driven principle for priority setting Demonstrate an understanding of the need for resource stratification of guidelines to align with local resources and maximise population health benefit Describe the WHO global tools and global initiatives for cancer control Recognise the critical need to develop multidisciplinary cancer care in all the settings and ensure quality in all health care Recognise the impact of social determinants on the cancer-related outcomes

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	Demonstrate an understanding of relevant cancer research that can drive health progress in LMICs
Skills	Demonstrate the ability to: Report and critically evaluate and report social, economic and medical determinants of health disparities at a global level Perform clinical decisions of multimodal treatments adapted to local resources and health system capacity through a value-driven approach Apply resource-stratified frameworks, guidelines, guidance and tools to aid in the therapeutic decisions when resources are constrained, and to limit financial toxicity Discuss and design research proposals relevant for LMICs, including for boosting implementation science broadly Participate in the broad dialogue on cancer control as a component of the professional and research practice, globally

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6. SPECIFIC SKILLS REQUIRED IN THE CURRICULUM

Fredrick Chite Asirwa
Michael P. Kosty

There are several skills outlined in each relevant chapter of the curriculum. This chapter presents additional specific skills required.

Objectives	To be able to prescribe anti-cancer agents for the treatment of solid tumours and haematologic malignancies including administration by oral and intravenous route; administration via Ommaya reservoir and lumbar puncture; administration intraperitoneally for select abdominal tumours and indications and complications of blood and products transfusion To describe the indications for and interpretation of (where applicable) the following procedures: 1. Bone marrow aspiration and biopsy 2. Thoracentesis 3. Paracentesis 4. Lumbar puncture 5. Fine needle aspirate (optional)
Key Concepts	Interpret bone marrow aspirates and biopsies, including the role of cytogenetic, immunohistochemical and flow cytometric analysis Recognise the effectiveness and potential toxicities of treatments administered intrathecally, including the appropriate doses, which agents can be safely administered

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	intrathecally, and potential toxicities of drugs administered intrathecally Recognise the specific indications for intraperitoneal therapy, including the limitations, contraindications and effectiveness of treatment administered by this route Recognise indications, complications and management of complication of blood and blood products transfusion in oncology practise Recognise indications, procedure and role of fine needle aspirate in oncology
Skills	Demonstrate the ability to: <i>Anti-cancer agent administration (throughout training)</i> Prescribe the indications for each anti-neoplastic agent prescribed, including the role of monotherapy and combination therapy; this familiarity should include appropriate dose adjustments for toxicity, haematologic, hepatic, and renal dysfunction Prescribe and safely administer anti-cancer agents by oral and parenteral routes <i>Bone marrow aspiration, biopsy, and interpretation (at least 10)</i> Interpret marrow aspirations and biopsies based on fundamental knowledge about haemato-pathology Discuss when to use fine needle aspiration and (optional) perform the procedure safely within a multidisciplinary team <i>Ommaya reservoir and lumbar puncture</i> Discuss the indications and (optional) perform the procedure safely within a multidisciplinary team <i>Paracentesis, thoracentesis (at least 10)</i> Discuss the indications for, complications of, diagnostic and therapeutic thoracentesis and paracentesis, including appropriate laboratory evaluation of the specimen obtained and (optional) perform the procedure safely within a multidisciplinary team Perform the techniques of paracentesis and thoracentesis (optional) Select which patients may benefit from the administration of intraperitoneal chemotherapy, and the use of sclerosing agents for management of malignant pleural effusions Discuss the complications of these techniques and their management <i>Blood Transfusion (throughout training)</i> Discuss the indications and the procedure for blood and blood products transfusion Discuss the complications of blood and blood products transfusion and their management

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Conception and design: All authors

Collection and assembly of data: All authors

Data analysis and interpretation: All authors

Manuscript writing: All authors

Final approval of manuscript: All authors

Accountable for all aspects of the work: All authors

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

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Open Payments is a public database containing information reported by companies about payments made to US-licensed physicians ([Open Payments](https://www.openpaymentsdata.cms.gov/physician/172188/)).

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