

Clinical Practice Guideline

Recommendations for the Perioperative Management of Pancreatic and Colorectal Cancer Patients

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Summary

Background: Colorectal and pancreatic carcinoma are the most common cancers of the gastrointestinal tract. Their surgical treatment carries a high morbidity: complications arise in 25% to 30% of cases, often prolonging recovery times and delaying the initiation of adjuvant therapy, leading, in turn, to worse oncological outcomes. The goal of multimodal perioperative management (mPOM) is to lower the postoperative complication rate through a combination of perioperative measures.

Methods: This guideline on the perioperative management of gastrointestinal tumors (POMGAT) meets all requirements for an S3 guideline as specified by the Association of the Scientific Medical Societies in Germany (*Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften*, AWMF). These include a systematic literature search, quality assessment of the included publications, an evaluation of the reliability of the evidence according to the GRADE approach, and a structured consensus process.

Results: Meta-analyses have shown that mPOM lowers the complication rates of both pancreatic and colorectal resections (RD 0.96 with 95% confidence interval [0.92; 0.99] and RR 0.66 [0.54; 0.80], respectively). This shortens the hospital stay after pancreatic

resections by a median of 2.33 days [−2.98; −1.69] and after colorectal resections by a median of 2.59 days [−3.22; −1.97].

Conclusion: Adherence to the POMGAT-S3 guideline for pancreatic and colorectal cancer surgery is associated with improved recovery, which can lead to a faster return to intended oncological treatment (RIOT) and thus to better long-term outcomes. These recommendations are not restricted to gastrointestinal cancer surgery; they can also be applied to visceral surgery for benign conditions, as well as to gynecological and urological operations.

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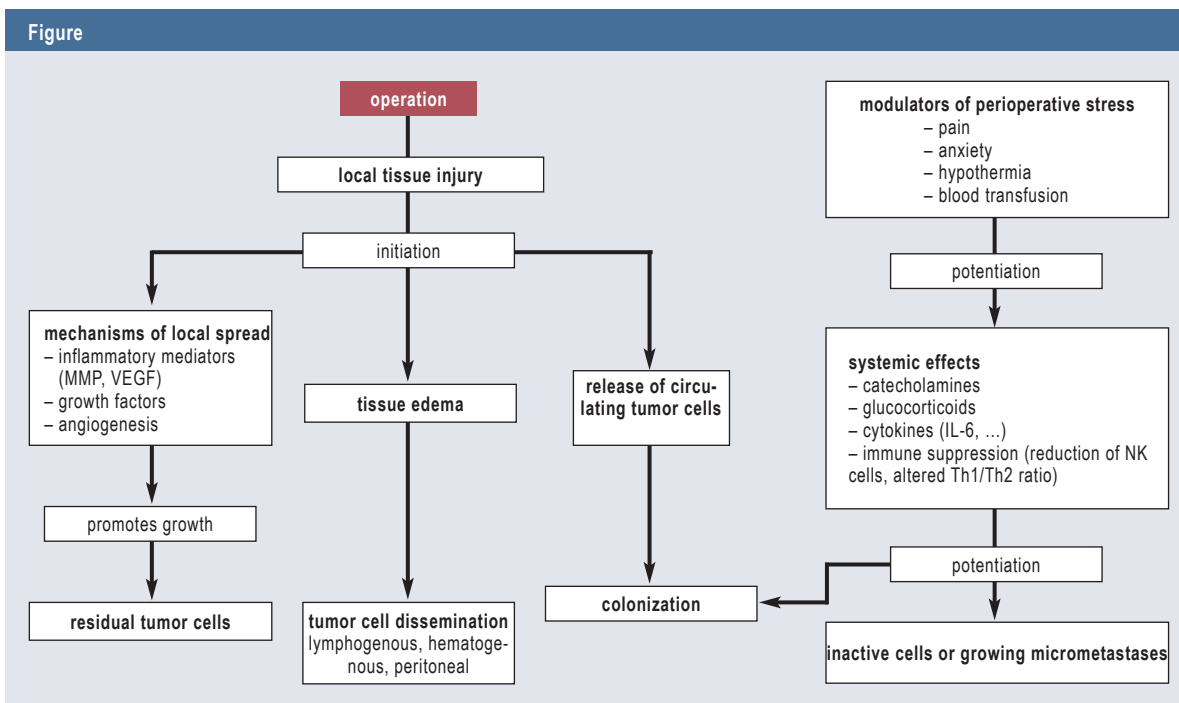
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Malignant solid tumors of the gastrointestinal tract are among the more common types of cancer, with 117 000 new cases in Germany each year. Pancreatic and colorectal carcinomas (CRC) account for two-thirds of the cases (1). Despite the ongoing development of medical and radiotherapeutic treatment options, surgery remains the only potentially curative treatment for nearly all cases of pancreatic or colorectal cancer. The morbidity of surgery, however, is high: from 20% to 60%, depending on the procedure (2). Complications can slow the patient's recovery from surgery, in turn delaying the start of adjuvant therapy and worsening the oncological outcome (3). Aside from such delays, the operation itself, its consequences (e.g., blood-product transfusions), and the associated perioperative stress also appear to increase the risk of tumor recurrence (*Figure*) (4).

The fast-track concept, first described by Kehlet et al. in 1995 (5), involves the optimization of perioperative factors; for patients undergoing colorectal surgery, it has

been shown to lead to a lower complication rate, shorter hospital stays, and a more rapid return to independent living (5). Its original four building blocks have since been expanded to more than 30 perioperative measures and adapted to other types of surgery, including oncological pancreatic surgery (6, 7).

Recent randomized and controlled trials (RCTs) have shown that high adherence to the individual measures (at least 70%) is associated not only with fewer complications and shorter hospital stays, but also with faster recovery, an improved immune response, and less perioperative stress (8). Moreover, large-scale cohort studies have shown that high compliance with modern concepts of multimodal perioperative management (mPOM) is associated with better oncological outcomes



Modulators of perioperative stress, after Hiller et al. (4)

IL-6, interleukin-6; MMP, matrix metalloproteinases; NK cells, natural killer cells; Th, T-helper cells; VEGF, vascular endothelial growth factor

after colorectal surgery for cancer, and especially for advanced CRC (9).

There are no more than a few recently introduced measures in visceral surgery for cancer whose benefit has been as well documented as that of mPOM. Nevertheless, adherence with mPOM in German hospitals is far below the required 70%; for some measures, it is as low as ca. 10% (10). Many reasons for this have come under discussion, including interdisciplinary and interprofessional self-interest, the increased logistical effort that mPOM requires, and the absence of clear, evidence-based practical recommendations (11).

The creation of an S3 guideline, containing a summary of the available evidence and recommendations derived from it, seems the best way to overcome these obstacles and optimize the implementation of the individual measures that together constitute mPOM.

Methods

The guideline meets all requirements for an S3 guideline as specified by the Association of the Scientific Medical Societies in Germany (AWMF) (12). These include, among other things, an interdisciplinary and interprofessional guideline group with the participation of patient representatives (*eTable 1*) and a transparent approach to conflicts of interest. The guideline mainly consists of evidence-based recommendations (EBR), for which a systematic review of the available evidence was carried out according to a defined procedure (*eTable 2*). Where the evidence was insufficient, recommendations were derived from expert opinion (EO) (*eTable 3*), and adapted from those of other high-quality guidelines. All recommendations were reviewed by a guideline committee and

subjected to a consensus procedure. Finally, a public consultation phase took place, and the comments received were discussed and incorporated by the guideline group (*eFigure*) (12, 13).

Perioperative recommendations in oncological colorectal and pancreatic surgery

Pre-hospital interventions

Multimodal prehabilitation

Multimodal prehabilitation comprises preoperative intervention options including nutritional optimization, maintaining or improving physical activity, avoiding toxic substances, and psycho-oncological support, among others (14). As there is no uniform definition either of the combination of interventions or of their duration, the available data are highly heterogeneous. Prehabilitation could not be shown to lower the global morbidity or mortality, or to shorten the hospital stay or the stay in intensive care (15). Only a questionable reduction in pulmonary complications could be shown; there was also a demonstrated improvement in the six-minute walk test. In the dedicated analysis of high-risk patients (age > 60 years, impaired cardiopulmonary exercise capacity), lower pulmonary and global morbidity was found, but with only low or very low confidence in the evidence according to GRADE (*eTable 4*) (16). In view of the state of the evidence and the high costs involved, it is recommended that patients should not undergo intensified multimodal prehabilitation (EBR, recommendation grade 0). This does not affect the recommendations on physical activity, a balanced diet, and avoiding noxious substances, which are to be regarded as best clinical practice.

Risk assessment

As recommended in the guideline of the United Kingdom's National Institute for Health and Care Excellence (NICE), a validated risk stratification instrument should be used for preoperative assessment, particularly of patients about to undergo complex oncological procedures, as these instruments yield accurate predictions of mortality (but not morbidity). The choice of instrument (POSSUM, P-POSSUM, NSQUIP, or similar) can be made by the treating physicians and surgeons (EBR, grade B). The results of risk stratification should be discussed with the patient to enable participatory decision-making for or against surgery (EBR, Grade B) (17).

Perioperative support from mPOM specialists

Such specialists include medical technical assistants or nurses who have acquired special knowledge in the field of perioperative medicine; they closely accompany patients throughout the entire perioperative process. In colorectal surgery, this shortens the hospital stay after an RCT by two days; support of this kind can thus be recommended (EBR, grade 0) (18). There is also an optional recommendation (EO) for the same kind of support for patients undergoing pancreatic surgery.

Preoperative interventions

Preoperative bowel preparation

The goal of bowel preparation is to lower the rates of postoperative infectious complications (surgical site infection, SSI) and anastomotic insufficiency.

Colorectal surgery: A possible approach is selective intestinal decontamination (SID), in which patients are given oral, nonabsorbable antibacterial and antifungal drugs for 3–7 days before surgery. This treatment, however, has been found to be associated with more frequent side effects without any reduction of SSI or anastomotic insufficiency. SID should therefore not be used (EBR, grade B). It was found in a recent Cochrane review that combined bowel preparation (mechanical bowel cleansing and oral antibiotics) reduces both SSI (RR 0.56; [0.42–0.74]) and anastomotic leakage (RR 0.59; [0.36–0.99]) compared to mechanical bowel cleansing alone. If preoperative bowel preparation is indicated, it should be carried out as a combined mechanical and antibiotic bowel preparation (EBR, grade B). This does not increase the risk of clostridial infection (19).

Pancreatic surgery: Mechanical bowel cleansing alone is of no benefit and should not be used (EO). There are no valid data on the use of oral antibiotics or SID, so no recommendation can be made.

Intravenous perioperative antibiotic prophylaxis

The goal of intravenous perioperative antibiotic prophylaxis (PAP) is to reduce surgical site infections, which arise after about 15% of visceral surgical procedures. To this end, the antibiotic should be administered during the hour prior to incision (EO). A single dose is sufficient for procedures of less than three hours' duration. Antibiotic administration should be repeated if the procedure takes longer than three hours or if there is significant blood loss. Antibiotics should not be continued postoperatively, as this is associated with a higher frequency of side effects (EO) (20).

Preparation of the operative field

As recommended by the WHO (2018) and by the Robert Koch Institute, hair in the operative field should not be removed preoperatively by shaving or chemical depilation, as this increases the risk of postoperative wound infection. Any hair removal that is necessary for surgical reasons should be done with an electric hair clipper with a disposable head (EO). No data are available on the optimal time or place (ward vs. operating room) for preoperative shaving.

The operative field should be disinfected with an alcohol-based disinfectant solution containing chlorhexidine (EBR, grade B). If the patient has a history of adverse reactions to such solutions, a povidone-iodine solution can be used instead (EBR, grade 0) (21, 22).

Intraoperative interventions

Placement of a drain

Drain placement is intended to aid in the more rapid diagnosis of intra-abdominal pathology or the reduction of fluid collections (e.g., in the case of a pancreatic fistula). The benefit of drainage has, however, been called into question in recent years.

Colorectal surgery: The placement of a drain has not been found to affect the rate of anastomotic leakage or wound infection in either colonic or rectal surgery (including extraperitoneal/deep anastomoses) Nor is there any effect on the need for reoperation, or on mortality (23). It is concluded that a drain should not be inserted in colorectal surgery (EBR, grade A).

Pancreatic surgery: The situation in pancreatic surgery is more complex, mainly because the pertinent clinical trials had heterogeneous inclusion criteria and the risk of developing a pancreatic fistula therefore varied across trials. Drainage was not found to yield any benefit with respect to morbidity, 30-day mortality or length of stay. It was found, however, that 90-day mortality after pancreatic head and pancreatic tail resection was lower after drainage (RR 0.23; [0.06–0.90]). Targeted drainage after pancreatic resection can thus be considered (EBR, grade 0).

An inserted drain can be removed early (within 4 days) after a pancreatic fistula has been excluded (24). As found in a Cochrane review of 3 RCTs involving a total of 399 patients, this results in fewer intra-abdominal infections, lower morbidity, and shorter hospital stays (EBR, grade 0).

Intraoperative anastomosis testing in colorectal surgery

Mechanical seal: The most dreaded complication after colorectal surgery is anastomotic leakage, which occurs in 10–23% of rectal anastomoses (25). To identify anastomoses at risk, the anastomosis should be checked for leaks intraoperatively (EO). How this is done (AirLeak test, intraoperative endoscopy, or similar) is decided by the surgeon. It is unclear what consequences should be drawn from a positive test (oversewing, resection, stoma creation) (26, 27).

Perfusion check: Along with a robust mechanical seal, good perfusion of the anastomosis is important as well for secure healing. Perfusion should, therefore, be

Table 1

Treatment options for postoperative ileus

Measures that are suggested	Measures that may be considered	Measures that are <i>not</i> recommended	Measures that are <i>not</i> suggested
• laxatives • chewing gum	• non-steroidal anti-inflammatory drugs for analgesia • coffee consumption • acupuncture • neostigmine (as a last resort)	• methylnaltrexone • propanolol • metoclopramide • erythromycin • simethicone • water-soluble oral contrast medium	• daikenchuto • prucalopride

checked in colorectal anastomoses (EO). Two means of checking perfusion are the observation of pulsatile bleeding on transection of the bowel and the obtaining of an intraoperative second opinion from a surgeon not involved in the operation. Perfusion can also be monitored intraoperatively with indocyanine green (ICG): this has been found to lower the rate of anastomotic leakage after rectal resections (RR 0.67; [0.46–0.98]; no data for colon resections) (EBR, grade 0). Many of the pertinent trials, however, were industry-funded and thus susceptible to bias. Moreover, the investment costs are high, and there is no objective threshold for evaluating fluorescence (28).

Postoperative interventions

Postoperative nasogastric tube

It is postulated that leaving a nasogastric tube in place after surgery prevents vomiting (e.g., because of delayed gastric emptying or intestinal atony) and thus protects against aspiration.

Colorectal resections: In colorectal resections, leaving a nasogastric tube in place has not been found to have any benefit, but it does increase the rate of pharyngolaryngitis and pulmonary infection. The tube should, therefore, be removed at the end of the operation (EO) (29).

Pancreatic resections: The nasogastric tube can be removed at the end of a Whipple procedure, as leaving it in does not reduce morbidity. There are insufficient data, and thus no recommendation, about whether to leave a nasogastric tube in place after pylorus-preserving pancreatic head resections, reconstructions with a pancreaticogastrostomy, or left pancreatic resections (EO) (30).

Urinary drainage beyond the time of surgery

A bladder catheter is used during surgery mainly for intraoperative monitoring of urine formation and for the avoidance of vesical overflow. Leaving it in place postoperatively increases the risk of urinary tract infection and impedes the mobilization of the patient. The catheter should, therefore, be removed in the first 24 hours after colorectal resection (no pertinent data are available with respect to pancreatic surgery). It can also be left in place for three days after surgery if there are

risk factors for postoperative urinary retention, such as male sex or low rectum resection/extirpation. In the absence of relevant evidence, neither transurethral nor suprapubic catheterization are recommended as the superior method (31).

The treatment of pain

Surgery via laparotomy: Patients who have undergone open visceral oncological surgery have less pain at rest and on exertion 24 and 48 hours after surgery if they are treated with continuous epidural analgesia (EA) rather than systemically administered analgesic medication (32). EA should therefore be used to minimize postoperative pain (EBR, grade B).

Abdominal binders have been shown with high-level evidence to lessen pain after midline laparotomy and should be used in such cases (EBR, grade 0).

Minimally invasive colorectal resections: In recent years, the transversus abdominis plane block (TAP block) has increasingly been used as a regional anesthesiological procedure for postoperative analgesia after minimally invasive (especially colorectal) procedures. It provides comparable analgesia to EA with a more favorable side-effect profile and can, therefore, be used as an alternative to it (EBR, grade 0).

The prevention and treatment of postoperative disturbances of gastrointestinal motility

Postoperative ileus (POI) typically follows abdominal surgery and causes increased morbidity, prolonged hospital stays, and higher costs (33). For this reason, its prevention and treatment are important. Given the multifactorial pathogenesis, there are a variety of treatment options (Table 1) (34).

Postoperative mobilization and respiratory therapy

Mobilization: The evidence reveals that, as a sole intervention, early intensified mobilization has no beneficial effect on morbidity, mortality, or length of stay. The available studies on this question, however, concerned a heterogeneous collection of interventions, patient collectives, endpoints, etc. (35). As there is no evidence either that early mobilization increases the risk of complications, and in view of its low expense, the recommendation is that it should be performed (EO).

Table 2

Relevant recommendations of the POMGAT guideline

Evidence	Intervention	Effect	Recommendation
Cochrane review (19)	preoperative bowel preparation (colorectal surgery)	- surgical site infection: lower risk with combined bowel preparation (RR 0.56; 95% CI [0.42; 0.74]) - anastomotic leakage: lower risk with combined bowel preparation (RR 0.59; 95% CI [0.36; 0.99])	A combined mechanical and oral antibiotic bowel preparation should be performed.
Cochrane review (24)	intraoperative insertion of a drain in the operative site (pancreatic surgery)	- postoperative 30-day mortality: no difference (RR 0.78, 95% CI [0.31; 1.99]) - postoperative 90-day mortality: lower with drainage (RR 0.23, 95% CI [0.06; 0.90]) - postoperative morbidity: lower after early removal (RR 0.49, 95% CI [0.30; 0.81]) - length of hospital stay: lower after early removal (MD -2.2 days, 95% CI [-3.52; -0.87])	The insertion of an intra-abdominal drain can be considered. This can be removed early (by the 4th post-operative day) if the amount of drainage implies a low likelihood of a pancreatic fistula.
Meta-analysis (23)	intraoperative insertion of a drain in the operative site (colorectal surgery)	- anastomotic leakage: no difference (RR 1.40, 95% CI [0.45; 4.40]) - wound infection: no difference (RR 0.82, 95% CI [0.45; 1.51]) - reintervention: no difference (RR 1.11; 95% CI [0.67 to 1.82]) - mortality: no difference (RR 0.77; 95% CI [0.41; 1.45])	In elective colorectal resections, no intra-abdominal drain should be inserted.
Meta-analysis (37)	mPOM as an overall measure (pancreatic surgery)	- overall morbidity was reduced by mPOM (RD 0.96; 95% CI [0.92; 0.99]) - postoperative hospital stay was shorter with mPOM (MD -2.33 days; 95% CI [-2.98; -1.69]) - delayed gastric emptying less common with mPOM (RD 0.89, 95% CI [0.80; 0.99]) - mortality: no effect (RD 1.00, 95% CI [0.99; 1.01])	Oncological pancreatic resections should be performed as part of an mPOM concept.
Meta-analysis (38)	mPOM as an overall measure (colorectal surgery)	- complications: fewer with mPOM (RR 0.66; 95% CI [0.54; 0.80]) - postoperative hospital stay: shorter with mPOM (MD -2.59 days; 95% CI [-3.22; -1.97])	Colorectal resections should be embedded in an mPOM concept.

95% CI, 95% confidence interval; MD, mean absolute deviation; mPOM, multimodal perioperative management concept; POMGAT, perioperative management of gastrointestinal tumors; RD, risk difference; RR, relative risk

Respiratory therapy: Recent meta-analyses have not revealed any benefit from postoperative respiratory therapy alone with respect to pulmonary complications, mortality, or length of stay (36). It need not be used as a sole treatment measure, particularly considering the expense of routine use (EBR, grade 0).

Multimodal perioperative management concepts as an overall measure

Pancreatic surgery: A recent meta-analysis found mPOM to be associated with lower morbidity (RD ["risk difference"] 0.96; [0.92; 0.99]) and better gastric emptying (RD 0.89; [0.80; 0.99]), with shortening of the hospital stay by more than two days (MD [mean absolute deviation] -2.33 days; [-2.98 to -1.69]) (37). Oncological pancreatic surgery should, therefore, be embedded in mPOM concepts (EBR, grade B).

Colorectal surgery: The results of a recent meta-analysis show a reduction in morbidity (RD ["risk difference"] 0.96; [0.92; 0.99]) and improved gastric emptying (RD 0.89; [0.80; 0.99]) under mPOM, which results in a reduction of more than 2 days in the length of stay (MD [mean absolute deviation] -2.33 days; [-2.98 to -1.69]) (37). Therefore, oncological pancreatic surgery should be embedded in mPOM concepts (EBR, grade B).

Summary

The evidence review and consensus process have led to interdisciplinary and interprofessional recommendations for perioperative care in oncological pancreatic and colorectal surgery that are now available for the first time at the S3 level (Table 2). This should help increase adherence to mPOM concepts, leading to lower morbidity, shorter hospital stays, and lower costs. More rapid recovery from surgery and a better perioperative immune response can be expected as well. Patients will more frequently be able to begin and complete adjuvant therapies on time ("return to intended oncological treatment," RIOT), and this should improve oncological outcomes (39). Broad acceptance and consistent implementation of the recommendations will be essential for the achievement of these benefits.

The measures described are by no means limited in their application to colorectal and pancreatic surgery; their benefits have been clearly shown in all types of oncological visceral surgery (40). Many of them can also be applied to urological and gynecological procedures, as well as to abdominal procedures for benign disease.

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Conflict of interest statement

TOV received third-party funding from German Cancer Aid for the preparation of the POMGAT guideline.

SP states that he has been reimbursed by German Cancer Aid for travel expenses to consensus meetings for the creation of this guideline.

TL is an employee of the German Cancer Society and an unpaid spokesman for the Guidelines Department of the Evidence-Based Medicine Network.

MN states that the AWMF has received payment for the neutral moderation of the guideline by MN. The AWMF receives long-term salary support from German Cancer Aid for a half-time research associate to assist the German Guideline Program in Oncology, the framework in which this guideline was created. Furthermore, the AWMF has received reimbursement of the expenses incurred by MN for travel to the consensus conference.

MF and MW declare that no conflict of interest exists.

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The *Deutsches Ärzteblatt*, like many other journals, does not subject clinical guidelines that have been submitted for publication to peer review, because S3 guidelines are texts that have already been widely evaluated, discussed, and agreed upon by experts in the relevant field.

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Supplementary material

eTables, eFigure:

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Supplementary material to accompany the article

Recommendations for the Perioperative Management of Pancreatic and Colorectal Cancer Patients

by Tim O. Vilz, Stefan Post, Thomas Langer, Markus Follmann, Monika Nothacker, and Maria A. Willis for the POMGAT Guideline Group*

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eTable 1		
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AIO, Working Group for Medical Oncology in the German Cancer Society; DGAI, German Society for Anesthesiology and Intensive Medicine; DGAV, German Society for General and Abdominal Surgery; DGCH, German Society for Surgery; DKG, German Cancer Society; ILCO, a German self-help association for stoma patients and people with bowel cancer and their relatives; POMGAT, Perioperative Management for Gastrointestinal Tumors

eTable 2

Evidence-based recommendations (EBR) of the POMGAT guideline for oncological pancreatic and colorectal surgery (40)

Intervention	Effect	Reliability of evidence	Degree of consensus	Recommendation
Multimodal prehabilitation	- mortality: no effect (OR 1.04, 95% CI [0.51; 2.12]) - complication rate (global): no effect (OR 0.79, 95% CI [0.60; 1.02]) - length of hospital stay: no effect (MD -0.07 days; 95% CI [-0.57; 0.44])	- moderate - low - low	consensus	There is no need for intensified, resource-intensive prehabilitation with structured programs.
preoperative risk evaluation	adaptation of the NICE guideline		strong consensus	A validated risk stratification tool should be used in addition to the clinical examination to plan the operation. The findings of risk stratification should be discussed with the patient to enable joint decision-making.
Perioperative support by mPOM specialists (colorectal surgery)	- mortality: no effect - overall morbidity: no effect - postoperative hospital length of stay: shorter with specialized professional support (5 [2–24] days vs. 7 [2–35] days)	- low - low - moderate	consensus	Patients who undergo colorectal resection as part of an mPOM concept can be supported perioperatively by a specialist in perioperative interventions.
Selective bowel decontamination (colorectal surgery)	- anastomotic leakage: no effect (OR 0.68, 95% CI [0.36; 1.30]) - superficial and deep wound infections (SSI): no effect (OR 0.91, 95% CI [0.21; 3.98]) - diarrhea increased by perioperative selective bowel decontamination (OR 2.45; 95% CI [1.26; 4.78])	- moderate - low - high	strong consensus	Selective bowel decontamination should not be performed before colorectal surgery.
Preoperative bowel preparation (colorectal surgery)	- SSI: lower risk with combined bowel preparation (RR 0.56; 95% CI [0.42; 0.74]) - anastomotic leakage: lower risk with combined bowel preparation (RR 0.59; 95% CI [0.36; 0.99])	- moderate - moderate	strong consensus	A combined mechanical and oral antibiotic bowel preparation should be performed.
Skin disinfection of the operative field	adaptation of the NIH guideline	moderate		Before the incision, the skin should be disinfected with an alcohol-based solution containing chlorhexidine. If this is contraindicated or not tolerated, a solution containing povidone-iodine can be considered.
Intraoperative insertion of a drain into the operative field (pancreatic surgery)	- postoperative 30-day mortality: no difference (RR 0.78; 95% CI [0.31; 1.99]) - postoperative 90-day mortality: lower with drainage (RR 0.23; 95% CI [0.06; 0.90]) - postoperative morbidity: no difference (RR 1.03; 95% CI [0.94; 1.13]) - length of hospital stay: no difference (MD -0.14 days; 95% CI [-0.79; 0.51])	- low - low - moderate - low	strong consensus	Insertion of an intra-abdominal drain can be considered. This can be removed early (by the 4th postoperative day) if the volume of drainage implies a low probability of pancreatic fistula.
Intraoperative insertion of a drain into the operative field (colorectal surgery)	- anastomotic leakage: no difference (RR 1.40, 95% CI [0.45; 4.40]) - wound infection: no difference (RR 0.82, 95% CI [0.45 to 1.51]) - reintervention: no difference (RR 1.11, 95% CI [0.67 to 1.82]) - mortality: no difference (RR 0.77, 95% CI [0.41 to 1.45])	- moderate - moderate - moderate - moderate	strong consensus	In elective colorectal resections, no intra-abdominal drain should be inserted.
Indocyanine green (ICG) for perfusion check (rectal surgery)	- anastomotic leakage: fewer anastomotic leakages in the ICG group (only RCT: RR 0.67; 95% CI [0.46; 0.98]) - rate of reoperation: no effect (RR 0.73; 95% CI [0.47 to 1.12])	- moderate - low	consensus	Vascularization can be checked intraoperatively by fluorescence angiography with the dye ICG.

Intervention	Effect	Reliability of evidence	Degree of consensus	Recommendation
Analgesia for open visceral oncologic surgery	• pain intensity at rest 24 hours after surgery: less pain with epidural anesthesia (EA) (MD -1.05; 95% CI [-1.35; -0.75]) • pain intensity on exertion 24 hours after surgery: pain on exertion reduced with EA (MD -1.68; 95% CI [-2.22; -1.14]) • EA-associated adverse events: EA-associated adverse events were more common in the EA group (RR 4.54; 95% CI [0.23; 89.62]). (SA: 0 to 0 versus EA: 0.54 to 37.99)	• low • low • very low	consensus	Continuous epidural analgesia should be used for perioperative analgesia in open visceral oncological procedures.
Analgesia for minimally invasive colorectal surgery	• pain at rest 24 hours postoperatively: no clinically relevant effect (VAS 1–10: MD 0.22; 95% CI [0.03; 0.4]) • pain on movement 48 hours postoperatively: no clinically relevant effect (VAS 1–10: MD 0.2; 95% CI [0.05; 0.35]) • postoperative hypotension: significant risk reduction with TAP block (RR 0.14; 95% CI [0.03; 0.58]) • postoperative retention of the urinary catheter: TAP block less (MD -14.27 hours; 95% CI [-21.66; -6.87]) • sensory disturbances: with TAP block significant risk reduction (RR 0.05; 95% CI [0.01; 0.28])	• moderate • moderate • moderate • low • moderate	consensus	For minimally invasive colonic resections or (deep) anterior rectum resections, a TAP block can be used for perioperative analgesia as an alternative to EA.
Abdominal binder after median laparotomy	• abdominal pain on the first postoperative day: less with abdominal binder (SMD -0.38; 95% CI [-0.69; -0.07]) • abdominal pain on the fifth postoperative day: less with abdominal binder (SMD -0.55; 95% CI [-0.89; -0.21])	• high • high	consensus	After median laparotomy, an abdominal binder can be applied to reduce pain.
POI – methylnaltrexone	• time to first defecation: no effect (MD -0.44 days; 95% CI [-1.26; 0.399]) • time to full resumption of diet possibly shorter (MD -26.50 hours; 95% CI [-33.63; -19.37]) • length of hospital stay: no effect (MD -0.28 days; 95% CI [-1.99; 1.42])	• low • very low • low	consensus	Immediate postoperative subcutaneous administration of methylnaltrexone to prevent POI after oncological colorectal resections should not be given together with systemic opioid analgesia.
POI – nonsteroidal anti-inflammatory drugs (NSAIDs)	• time to first defecation shortened by NSAID (MD -18.00 hours; 95% CI [-31.07; -4.93])	• high	consensus	The pre- and postoperative administration of NSAIDs can be used to prevent POI after oncological colorectal resections.
POI – propranolol	• propranolol may shorten the time to first defecation (MD -29.00 hours; 95% CI [-49.94; -8.06])	• very low	strong consensus	Propranolol should not be used to prevent POI after oncological colorectal resections.
POI – neostigmine	• neostigmine may shorten time to first defecation (MD -42.90 hours; 95% CI [-47.54; -38.25])	• very low	strong consensus	Neostigmine can be used as a last resort to treat clinically manifest postoperative (paralytic) ileus.
POI – prucalopride	• time to first defecation: no effect (MD -0.39 days; 95% CI [-1.15; 0.37]) • tolerance of solid food: no effect (MD -3.08 days; 95% CI [-9.60; 3.43])	• low • very low	strong consensus	Prucalopride should not be used to prevent POI after gastrointestinal tumor resections.
POI – metoclopramide	• gastric tube re-insertion rate: no effect (RR g.88; 95% CI [0.27; 2.92]) • tolerance of solid food: no effect (MD -0.20 days; 95% CI [-1.04; 0.64])	• moderate • moderate	strong consensus	Metoclopramide should not be used to prevent POI after gastrointestinal tumor resections.
POI – erythromycin	• time to first defecation: no effect (MD 0.99 days; 95% CI [0.90; 1.08]) • tolerance of solid food: no effect (MD 1.04 days; 95% CI [0.93; 1.15])	• moderate • moderate	strong consensus	Erythromycin should not be used to prevent (paralytic) ileus after gastrointestinal tumor resections.
POI – laxatives	• laxatives shorten time to 1st defecation (MD -1.12 days; [-1.42; -0.82]) • solid food tolerance: no effect (MD -0.07 days; [-0.38; 0.25])	• low • low	strong consensus	Laxatives should be given early as a component of multimodal POI prevention and/or treatment after oncological colorectal resections.
POI – simethicone	• time to first defecation: no effect (MD -1.80 days; 95% CI [-11.02; 7.42])	• high	strong consensus	Simethicone should not be used to prevent POI after gastrointestinal tumor resections.

Intervention	Effect	Reliability of evidence	Degree of consensus	Recommendation
POI – osmotic contrast agent	- time to first defecation: no effect (MD –1.18 days; 95% CI [–4.03; 1.67]) - tolerance of solid food: no effect (MD –2.22 days; 95% CI [–5.42; 0.98])	- high - high	strong consensus	Osmotically active X-ray contrast agents should not be used to treat POI after gastrointestinal tumor resections.
POI – daikonchuto	- time to first defecation: no effect (MD –9.41 hours; 95% CI [–25.27; 6.44]) - tolerance of solid food: no effect (MD –36.73 hours; 95% CI [–95.11; 21.66])	- very low - very low	strong consensus	Daikonchuto should not be used to prevent POI after gastrointestinal tumor resections.
Respiratory therapy	- postoperative pulmonary complications: no effect (RR 1.00; 95% CI [0.88; 1.33]) - postoperative mortality: no effect (RR 0.73; 95% CI [0.42; 1.25])	- moderate - low	strong consensus	After abdominal and thoracic surgery, respiratory therapy in the form of incentive spirometry is not needed as a stand-alone measure to prevent postoperative pulmonary complications.
mPOM as an overall measure (pancreatic surgery)	- overall morbidity lower with mPOM (risk difference [RD] 0.96; 95% CI [0.92; 0.99]) - postoperative hospital length of stay lower with mPOM (MD –2.33 days; 95% CI [–2.98; –1.69]) - delayed gastric emptying less common with mPOM (RD 0.89; 95% CI [0.80; 0.99]) - mortality: no effect (RD 1.00; 95% CI [0.99; 1.01])	- very low - very low - very low - very low	strong consensus	Oncological pancreatic resection should be performed as part of an mPOM concept.
mPOM as an overall measure (colorectal surgery)	- fewer complications with mPOM (RD 0.66, 95% CI [0.50; 0.80]) - postoperative hospital stay: shorter with mPOM (MD –2.59 days; 95% CI [–3.22; –1.97])	- low - moderate	strong consensus	Colorectal resection should be embedded in an mPOM concept.

95% CI, 95% confidence interval; MD, mean absolute difference; mPOM, multimodal perioperative management concepts; NICE, National Institute for Health and Care Excellence; NSAID, nonsteroidal anti-inflammatory drugs; OR, odds ratio; POI, postoperative ileus; RCT, randomized controlled trial; RD, risk difference; RR, relative risk; SA, spinal anesthesia; SMD, standardized mean difference; SSI, surgical site infection; TAP block, transversus abdominis plane block; VAS, Visual Analog Scale

eTable 3

Consensus-based recommendations (EO, expert opinion) of the POMGAT guideline for oncological pancreatic and colorectal surgery (40)

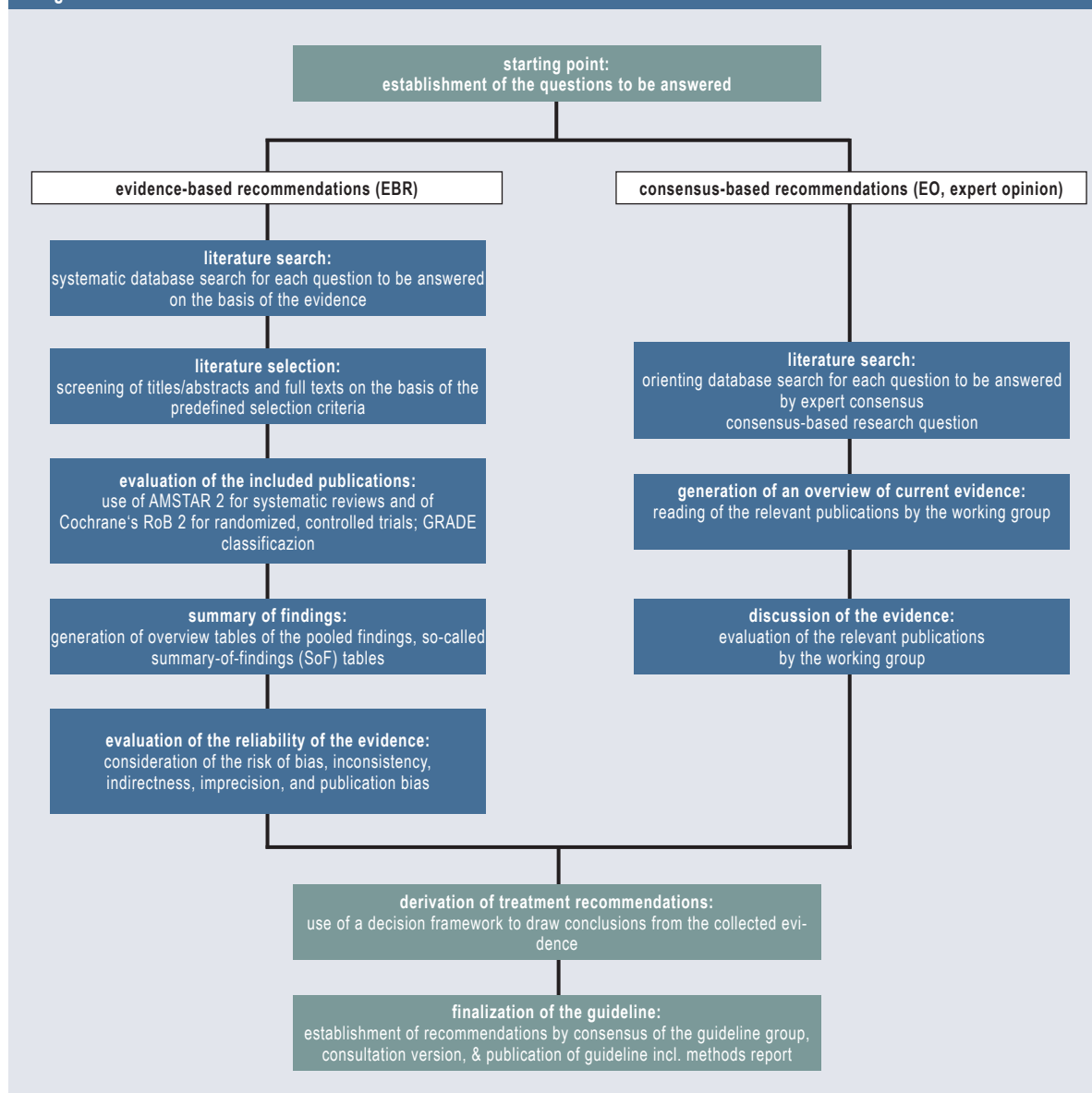
Intervention	Recommendation	Consensus
Care by mPOM specialists (pancreatic surgery)	For patients undergoing pancreatic oncological resection as part of a multimodal perioperative management concept, support by a specialist in perioperative interventions may be considered.	strong consensus
Selective bowel preparation (pancreatic surgery)	No preoperative mechanical bowel preparation should be performed before pancreatic tumor resection.	strong consensus
Perioperative antibiotic prophylaxis	Intravenous perioperative antibiotic prophylaxis (i.v. PAP) should be administered preoperatively (in the 60 minutes leading up to the incision). The i.v. PAP should be repeated according to the half-life of the substances used or, in the event of heavy blood loss, again intraoperatively if necessary. I.v. PAP should not be continued postoperatively.	strong consensus
Preparation of the surgical site – hair removal	Preoperative hair removal should be avoided. If hair removal is necessary for surgical reasons, electric clippers with disposable heads should be used. Preoperative shaving should be avoided.	strong consensus
Intraoperative anastomosis testing – mechanical seal (rectum)	After a rectal anastomosis has been created, it should be checked intraoperatively for leaks with the Air-Leak test, a methylene blue test, or endoscopy.	strong consensus
Intraoperative anastomosis testing – perfusion (colorectal surgery)	The anastomosis should be checked for perfusion after rectum and colon resections.	consensus
Nasogastric tube (pancreatic surgery)	After pancreatic head resection as a classic Whipple procedure, the nasogastric tube can be removed at the end of the operation.	strong consensus
Nasogastric tube (colorectal surgery)	For elective colorectal surgery, a nasogastric tube should be removed before the patient awakens from anesthesia.	strong consensus
Urinary catheter (colorectal surgery)	A transurethral catheter should be removed in the first 24 hours after colorectal resection. If any risk factors for urinary retention are present (male sex, low anterior rectum resection, rectum extirpation), urinary drainage can be prolonged until three days after surgery.	strong consensus
POI prophylaxis – coffee consumption	Coffee (up to 3 × 150 ml) can be offered after abdominal surgery from the recovery room onward.	consensus
POI prophylaxis – chewing gum	After colorectal resections, patients should chew gum for 10–15 minutes 3–4 times per day in the first five days after surgery.	strong consensus
POI prophylaxis – acupuncture	Acupuncture can be used after abdominal surgery.	consensus
postoperative mobilization	Patients should be mobilized early after surgery.	consensus

mPOM, multimodal perioperative management concepts; POMGAT, perioperative management for gastrointestinal tumors

eTable 4		
The GRADE classification, modified from Kunz et al. [16]		
Confidence in the evidence	Explanation	Consequences
Very low	The effect estimated by the study findings probably differs markedly from the true effect. Further studies will most likely change the effect estimate in one direction or the other.	● One cannot have confidence in this grade of evidence. ● The findings do not provide a useful basis for decision-making, e.g., for or against any particular treatment.
Low	There is some degree of confidence that the result may be close to the true effect. Further studies may still change the result to a relevant degree.	● “Intervention X may have effect Y.” ● The use of conclusions of this type for decision-making should be viewed with caution.
Moderate	The result is close to the true effect.	● “Intervention X probably has effect Y.”
High	The result is very close to the true effect.	● “Intervention X has effect Y.”

GRADE, Grading of Recommendations, Assessment, Development, and Evaluation

eFigure



Procedure for the generation of evidence- and consensus-based recommendations.

AMSTAR, A Measurement Tool to Assess Systematic Reviews; GRADE, Grading of Recommendations, Assessment, Development, and Evaluation; RoB, risk of bias