

IV The ideal neurosurgical training curriculum

A. General aspects

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Introduction

There are two aspects to the development of an ideal curriculum for neurosurgical training which are fundamental to curriculum structure. Of course, local considerations may change specific sequences so the ideal curriculum is always more theoretical than practical. What is important is not to slavishly follow any guidelines for sequencing material but to understand the concepts of competency-based training as a way to assure the competency of training program graduates and to prepare them for the next phase of post-graduate medical education which leads to mastery of our field [9].

There are some theoretical teaching considerations which underlie the development of any curriculum [7]. Much is known about perceptual learning [1]. The general agreement is that the students learn best through memorization and understanding rules as a first step, followed by externally directed learning, usually in the form of lectures, conferences or core curricula. Then students progress to self-directed learning in which the trainees take primary responsibility for their education with guidance from faculty and mentors. How we learn and how we apply that knowledge are important issues in any educational system. One schema which is particular germane to neurosurgery proposes that we first begin by acquiring necessary skills such as history taking, the neurological examination, interpretation of imaging studies, and how to do procedures. We then learn to apply these skills through following sets of rules first laid down by experts and then developed for ourselves. From rules following the master surgeon should progress to

knowledge-based practice in which the product of all knowledge and experience is correctly applied often without a specific sequential thought process [2, 10, 11]. The synthesis of much material has occurred within the brain automatically and is then applied effectively, often without specific steps [4].

There is much information concerning various stages of learning and what it takes to progress from each stage [3]. In surgical training we take beginners with very little previous practical experience in neurosurgery and very little specific neurosurgical information to enter training. From the beginning the goal of neurosurgery training is the progression to competency to practice the field. It is of interest that there is very little information about how long it takes or what kind of application is required in terms of hours of training and practice to move from the beginning stage to competency [5]. Much more is known about the next phase in which the competent practitioner progresses to mastery of the field. Comparison of a number of diverse occupations indicates that it takes about ten thousand hours of practice and approximately ten years to move to clear mastery of a field. Therefore we have to always remember that the training program has a twin goal of producing a competent practitioner and preparing that practitioner for self-directed education which leads to the desired goal of master surgeon. Core curricula are fundamental to a competency-based training program, but in themselves do not represent competency. In order to become competent it is necessary to know the body of skills and knowledge which define competency. The American College of Surgeons, The American Association of Neurological Surgeons/Congress of Neurological Sur-

geons, and the Society of Neurological Surgeons have all developed core curricula for different phases of training. Whenever a curriculum is developed there is then a great tendency to treat that information as the maximum which is to be learned. In fact, core curricula always should represent the minimum and only lead the perceptual learner through externally directed learning. The next phase of self-directed learning is key to development of competency and for progressing to mastery after competency [10].

There is one other concept which is important to think about. How material to be learned is presented is very important. In the first phases of perceptual learning when memorization and rules following are important, it is essential to have didactic presentations which present both the minimum material to be learned and the rules to be followed. This can be achieved for example by rules presenting how the information should be applied to obtain a desirable outcome most of the time. However, these formal presentations have little value once learning becomes self-directed. There is good information that they do not impart new information effectively. The traditional lectures, grand rounds presentations, teaching conferences conducted only by senior neurosurgeons, and all other non-participatory conferences have limited impact on education, and cannot prepare the trainee for lifelong learning [10].

The ideal training program year by year

Ideally I believe that the concept of numbered post-graduate years should be eliminated and all students should progress within the neurosurgery training program as rapidly as their individual skills and acquisition of knowledge allow. However, we have to start somewhere in making a transition so it is reasonable to use the current post graduate year (PGY) concept as a format (Table 1). We should realize that in an ideal training program these designations should have no meaning. Rather we should think about what needs to be learned, what applications are required, and what independent judgements the trainee should be able to exercise. These are likely to be sequenced according to local needs and patterns of practice rather than conform to any idealized program. What is important is that the core curricula be mastered at a minimum and that residents proceed in training with escalating responsibilities as rapidly as their individual skills allow.

Table 1. *The current Johns Hopkins residency program*

PGY 1	12 months	General Surgery, Neurology (3 mos), Surgical Specialties
PGY 2	12 months	General, Tumor, Vascular, Spine Neurosurgery
PGY 3	12 months	Pediatrics, Functional, General Neurosurgery
PGY 4	12 months	Chief Residency, 4 months of each-Tumor, Vascular, Spine
PGY 5, 6	24 months	Required Research Training
PGY 7	12 months	Supervised Practice- 4 months each of Tumor, Vascular, Spine, Subspecialization

The current training program

PGY 1-the internship

What do trainees need to learn in the internship as it currently is structured in the United States? Trainees need to learn conduct in the operating room and fundamental operative skills. They need to understand fluid and electrolyte balance and nutrition. They should become familiar with the management of patients suffering trauma. They should learn to recognize and treat surgical complications and they should have experience in those surgical specialties which are most inter-related with neurosurgical practice later. In the United States it has been decided that the neurology experience should also occur in the first year. I personally do not believe that three months of neurology in the first year of training is sufficient to provide the ideal of the surgical neurologist which was a part of the founding concept of neurosurgery. However, it is quite reasonable that the management of stroke, central nervous system infections, and neurological intensive care all be learned in the first year. Extensive experience in general surgery beyond what is needed to master fundamental surgical skills is not required and there is little educational purpose to extended periods of patient care dealing with diseases which are not pertinent to neurosurgery. PGY 1 has been modified to provide six months of general surgery and 6 months of neurology/surgical specialties.

PGY 2, 3, 4

Current requirements in the United States are for 36 additional months of clinical training in neuro-