Techniques in Teaching

JOSEPH RANSOHOF, M.D., M. VALLO BENJAMIN, M.D., AND ERWIN R. TICHauer, M.D.
Departments of Neurosurgery and Division of Biomechanics, New York University Medical Center, and Center for Safety, New York University, New York, New York

It is indeed a challenging task that the steering committee of our workshop has asked us to undertake and we thank them for the honor they have extended to us. We have been forced to learn a great deal in preparation for this presentation and I hope we will succeed in transmitting some of this information to our fellow program directors so that it may serve to enrich the round table discussions which are to follow.

Certainly most of us in this room received our instruction in the skills of neurosurgery mainly through the preceptor relationship with our teachers, watching, assisting, trying ourselves, being corrected and trying again with greater awareness of the problem. While this man-to-man relationship will always be the backbone of our method of teaching the techniques of neurosurgery, we can only benefit by a closer analysis of the factors involved in this relationship and the potential areas for its reinforcement at critical points in our student’s progress.

Decision-Making

As we apply our skills to fellow human beings, we cannot separate pure technique from decision-making; it is well known by students of motor learning that anxiety and undue tension severely interfere with motor performance. Placed is the surgical idiom we would say that one has great difficulty conducting a satisfactory operative procedure if one is not certain that the operation should have been carried out in the first place. It would seem worthwhile therefore to examine the decision-making process in neurosurgery as it relates to techniques and our ability to transmit this information to our trainees.

I have found it very helpful to utilize the concepts of systems analysis, or operational research and decision theory, in an examination of our decision-making procedures and technical choices. Systems analysis involves the distribution of the probability of success, weighing positive impact factors against negative impact factors for each move in a so-called “decision tree.” In general, the relative importance of each move decreases as we progress out the decision tree, each branching being dependent upon the prior decision in an all or nothing, go or no go relationship. There are special positive and negative impact factors which must be considered at each branching or nodal point. Such an analysis of the critical moves necessary to achieve a goal can be utilized in considering the problems of erecting a skyscraper or conducting a neurosurgical procedure.

If we construct such a decision tree for a neurosurgical procedure, for example, the removal of an acoustic neurinoma (Fig. 1), the first decision to operate or not will be based on multiple factors such as age, general medical status, duration of symptoms, etc., all weighing in a positive or negative impact on the possibility of success. Having made the decision to operate, we move out the tree to the choice of anesthesia where the decision will be based on the same factors which were weighed in the decision to operate plus those additional factors pertaining particularly to this nodal point. Having made a choice of anesthesia we move on to the next nodal point and so on to the completion of the procedure. A complete awareness and understanding of the factors at each nodal point would reduce the number of decisions reached intuitively or “by the seat of our pants” and would improve our ability to pass this information along to our students.

While one can list quite simply the steps required to construct a building or perform a surgical procedure and construct a decision tree, this does not take into account the exi-
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Fig. 1. Decision tree for surgery on acoustic neurinoma.

gencies which may arise during the conduct of the procedure which leads us to the concept of the “critical path,” another aspect of systems analysis.2 The critical path implies that whereas the logical sequence of steps involved in the conduct of an operation can be listed from 1 to 30, the execution of these steps may require altering their order as they appear in our decision tree or at times even their complete omission in order to achieve our ultimate goal. For example, routine use of dural tenting suture prior to dural opening would be omitted by the experienced surgeon if faced with rapidly mounting intracranial pressure and returned to or omitted later in the procedure when the life threatening crisis had been passed.

So much for this digression into systems analysis as we might apply it to neurosurgical procedures. A better understanding of the paths chosen at each nodal point will, I believe, make us better teachers, reduce the anxiety and stress inherent in each decision for the learner and hence enhance the motor performance essential for a high level of technical skill. To quote from Cratty3 in his book, Movement, Behavior, and Motor Learning: “The effect of anxiety and stressful situations upon performance is a function of the task, of the general anxiety of the individual, of the prior practice in the task and a basic understanding of the goals involved. Stressful situations interfere with task performance of superior performers and within complex tasks.”

Evaluation of Motor Skills

It can be safely assumed that most physicians embarking on a career in neurosurgery possess certain basic aptitudes as relate to motor performance which have attracted them to the field. Within the over-all group, however, it should be of considerable assistance in their training program to identify those who may need special assistance in perfecting their motor skills.

A considerable body of knowledge is available relative to man’s use of tools and we can only briefly consider some aspects of the field. There are five basic hand grasps,4 the two primitive ones, the lateral and the contact grasp, the intermediate or power grip, and the two high skill grasps, the instrument grasp and the tripodal manipulative grasp (Fig. 2). Due to poor work habits or lack of experience there may be postural limitations which prevent the application of these aptitudes at a high level of skill. An initial evaluation consists therefore of an assessment of working posture with attention to such points, for example, as the wrist being slightly flexed for optimal manipulation, the elbow depressed for movements along the coronal plane and elevated along the sagittal plane, etc.

A number of motor aptitude tests are available which indicate the student’s possible need for special training. Degree of awareness of sensory feedback can be evaluated by asking the trainee to push a coin against a positive stop instructing him to