How to Get the Most Out of Your Orthopaedic Fellowship: Thinking About Practice-Based Learning

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Summary: Practice-based learning and improvement is an important skill set to develop during an orthopaedic trauma fellowship and is 1 of the 6 core competencies stated by the ACGME. The review of clinic cases is best done using a few simple models to develop a structured approach for studying cases. Three common sense and easy-to-use strategies to improve clinical practice are as follows: performing each case three times, studying the 4 quadrants of patient outcomes, and the application of the Pareto 80/20 rule. These principles help to develop a structured approach for analyzing and thinking about practice-based experiences.

Key Words: practice-based learning for orthopaedics

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INTRODUCTION

Getting the most out of an orthopaedic trauma fellowship is simple: learn as much as possible in 1 year: Although the concept is simple, the objective is not easy to achieve. The skill sets needed to be an orthopaedic traumatologist include (1) diagnostic skills combined with the knowledge of the relative indications for nonoperative and operative treatments; (2) technical skills that are used in surgery; and (3) mental skills for learning how to think about clinical problems. There are intangibles that are not included in this article, which contribute to the successful orthopaedic trauma surgeon.

Practice-based learning and improvement, 1 of the 6 ACGME core competencies, is a habit of lifelong learning that promotes clinical excellence. Quoting from the ACGME, one must be able to "investigate and evaluate their patient care practices, appraise and assimilate scientific evidence, improve their patient care practices, analyze practice experience and perform practice-based improvement activities using a systematic methodology." This short article will touch on several models that develop thought processes to improve clinical skills.

The foundation of orthopaedic trauma is based on a comprehensive study of literature relating to orthopaedic trauma. This requires understanding the tenets of evidence-based medicine and an appreciation of the hierarchy of evidence that progresses from unsystematic clinical observations and opinions to systematic reviews of randomized trials. Understanding the principles of research and statistical interpretation of data allows for the correct application of clinical research to your patient. This search for information is continually updated by our memberships in the American Academy of Orthopaedic Surgeons and the Orthopaedic Trauma Association, which are excellent educational resources and provide collegial networking to improve patient care. I strongly recommend becoming facile with the resources available through the websites provided by the American Academy of Orthopaedic Surgeons and Orthopaedic Trauma Association.

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LEARNING TRANSITIONS

An important element of practice-based learning and the transition to a lifelong learner is an understanding of how each one of us personally learns and what methods each one of us finds to be most effective; rather it is reading, attending lectures, participating in webinars, case discussions, or learning laboratories.

As college students, we were expected to spend about 2–3 hours of study time for each hour of class time. Examinations in college peaked at nearly a weekly basis during medical school and then rapidly declined during our residency, with for the most part, one orthopaedic in-training examination per year. This trend continues after ABOS Board Certification when we transition to 10-year recertification examinations to maintain our orthopaedic board certification. Because class time and lecture time decrease during our careers, direct observation of clinical scenarios, evaluating patients, and participating in surgery (either as an observer, assistant, or surgeon) becomes the major component of our education. Maintaining a surgical diary of cases helps to form a personal record of what works and focuses attention on the details observed during surgery. Even if you have not done this in the past, you should consider strongly doing this during your fellowship year. You will refer many times to the "Pearls" you record in that book. Participation in clinical care should direct study to "work from the patient and use the literature as a tool to solve the patient's problems."

Although most literature is focused on a large series of cases, personal experience provides each of us with only a few cases to use as the subjects for practice-based learning. An approach to practice-based learning that is based on several models provides an organized framework for the study of your clinical cases. These models are based on common sense and are easy to understand.

1. The practice of performing each surgical case three times.
2. The use of Outcomes Quadrants (Fig. 1).
3. The application of the Pareto 80/20 principle.

The first mental model of practice-based learning is to do each case three times. It is divided into 3 steps: (1) preoperative planning; (2) performing the surgery; and (3) reviewing the case. This model is dependent on the philosophy "that there is no perfect case" and requires a disciplined search for factors to improve the procedure. Reviewing a fracture case typically includes the following questions: Were all fracture lines understood? Was the choice of surgical approach and patient positioning optimal—or would a different approach have made the reduction easier? Was there a better technique for achieving the reduction? Assessment of the preoperative plan and the surgery should be done immediately after each case when details are quickly remembered, and then again when postoperative imaging is complete. Frequently, when the analysis is done several days later, one becomes more objective and critical, by using the benefit of hindsight.

The second mental model combines the patient's clinical result with the result that the surgeon expected, and because each of these results can be categorized as either good or bad, it is possible to construct an outcomes quadrant of 4 possibilities (Fig. 1) quadrant I: good expectations and a good result; quadrant 2: bad expectations and a bad result; quadrant 3: bad expectations and a good result; and quadrant 4: good expectations and a bad result.

The tremendous value of using the outcomes quadrant is that it allows an analysis of each case and does not require the accumulation of a case series. A description of some orthopaedic trauma cases follows. In quadrant 1, we expect to deliver an excellent result for the patient and an excellent result is achieved. This is illustrated by the treatment of a closed femoral shaft fracture with closed intramedullary nailing where excellent alignment, early union, and good functional results are all achieved. These results are to be expected with intramedullary nailing, but to prevent success from leading to complacency, the model of doing every case

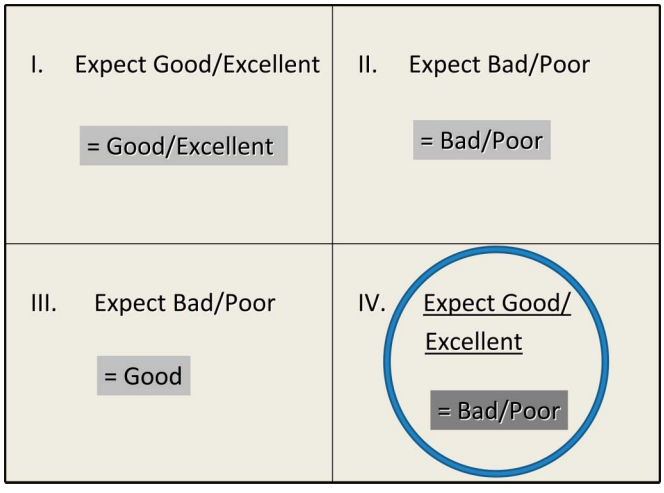

FIGURE 1. Outcomes quadrants. Adapted from Bosk. Forgive and Remember, Chicago, IL: University of Chicago Press; 1979: 116.

three times—preoperative planning, surgically performing the case, and then analyzing the case in review. By applying the philosophy that there is no perfect case, factors are identified that lead to continual improvement. Quadrant 2 relates to the analysis of expecting a bad result and a bad result occurs. Despite excellent and uncomplicated treatment, many mangled extremity injuries, as an example, end up with poor functional results and devastating consequences to the patient. Again superimposing the model of performing each case 3 times will lead to previously unrealized technical pearls or improving your ability in communicating the consequences of these injuries to your patient. The management of a type IIIB open pilon fracture would be one such example. Type 3 quadrants are when we expect a bad or poor result and for some unknown reason achieve a good result. This is most likely seen in the care of multiply injured patients where in some unexpected manner we achieve good clinical results. Usually, an analysis of the care that we have rendered in these cases indicates that the principles of wound debridement, open reduction and internal fixation, and technically excellent surgery combined with the judicious timing of surgical procedures and good postoperative management were all maintained. Again the exercise of performing the case three times often leads to improvement in diagnostic skills, and the technical performance of surgery as we gain experience and advance along the learning curve. It is essential to have a critical assessment of quadrant 4 outcomes when there were expectations of a good result and a bad outcome occurred. These cases require a careful analysis of our operative complications. First, was the diagnosis correct? Was the fracture appropriately classified and were all the fracture lines appropriately understood? This is followed by a critical analysis of our judgment and indications for either operative or nonoperative treatment and the subsequent performance of either of these choices. For example, if there was a displaced intraarticular pilon fracture but an error may have been made in the timing of surgery, or the selection of surgical approach, or the mechanics of plate application, or the technical expertise in joint reconstruction. An analysis of our postoperative management is also necessary, and this requires that we examine if physical therapy was appropriate and that we were vigilant in our postoperative care.

Niels Bohr a noble laureate in physics once defined an expert as a person who had made all the mistakes in a very narrow field.

The positive use of these bad outcomes can be applied as psychology studies indicate that learning a variety of skills seems to indicate that the most effective way to get better is to focus on mistakes. This becomes more important in the care of unusual injuries as it is not the quantity of practice but the quality of practice that can help each of us to improve.

Again using the framework of performing each case three times only helps us to understand the actions that were taken but at each step of the way challenges us to explore other alternatives in treatment that were available at that time period. This generates an increasing number of tactics to be used in future cases. With time and experience, decision trees can be constructed that give options based on each surgeon's particular skills and interests. This form of

decision making in determining treatment attempts to anticipate the success of treatments and their inherent complications. It also promotes the development of thinking to generate alternative plans when the initial course of treatment does not work. In this manner, complications can be anticipated ahead of time, and it can be determined if the treatment of a given complication is appropriate for a specific patient. For example, if the open reduction of a pilon fracture is complicated by infection and wound dehiscence a free flap may be required, but in the case of a patient with vascular disease free tissue transfer is unlikely to be successful, a fact that may modify the initial decision to perform an open reduction. By realizing that amputation is a more likely result of an infection for a patient with vascular disease, we can then think backward to treatment options more likely to minimize the risk of infection.

Even with a limited number of patients, a mental model for a systems approach can be based on the Pareto concept of the vital few and useful many. Often referred to as the 80/20 rule in economics, it contends that 80% of the results are produced by 20% of the effort or causes, and an early example was that 20% of the families in Pareto's time controlled 80% of the wealth. This systems approach has been applied to many different systems, and examples include that 20% of work effort produces 80% of the output; 20% of customers are 80% of revenue, or in medicine, 20% of patients use 80% of the resources. For use is practice-based learning consider looking at complications. A number of factors may lead to poor patient outcomes, but a numerical analysis will indicate in many cases that 20% of the possible causes explain 80% of the patient complications that one might actually see in their practice. Frequently, the construction of a histogram will indicate that the 3 most common causes may be responsible for the vast majority of bad results (e.g., infection, nonunion, neurological injury) in contrast to a long list of potential complications that rarely occur (hardware failure, use of incorrect implants, failure to give antibiotics, regional pain syndromes). The application of this mental model allows the clinician on an annual basis (although it could be done over any period of time) to address the 3 factors that cause most of the problems in their practice. This is an excellent system to help one learn from their own practice-based experience to avoid the repetition of mistakes thereby continually improving patient care and safety.

Although there are many methods and strategies to improve clinical practice, performing each case 3 times, studying the 4 quadrants of patient outcomes, and the application of the Pareto 80/20 rule are mental models that fulfill the ACGME requirements to analyze practice-based experience and achieve practice-based improvement.