
THE ORTHOPAEDIC FORUM

Ulnar Nerve Transection in an Orthopaedic Surgeon Sustained During Surgery

A Case Report and Commentary

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Orthopaedic surgery is conducted in an exciting and challenging environment that can also be stressful and dangerous—a setting for substantial physical, emotional, and psychological injury. We present a cautionary story regarding the risks of injury in the operating room (OR), offer insights to reduce these risks, and discuss important lessons learned.

Case Report

The first scheduled case of the day was a left knee arthroscopy, medial meniscal repair, and allograft anterior cruciate ligament (ACL) reconstruction. The patient and the surgeon had decided on using a patellar tendon allograft, but the case initially had been posted as a hamstring ACL reconstruction. The posting discrepancy was resolved prior to the patient leaving the preoperative area, but the necessary OR equipment needed to be rectified.

My surgical team that day included a physician assistant (PA) as well as the OR team, which consisted of a nurse anesthetist, a circulating nurse, and a scrub nurse who had worked together for many years. A second-year resident would perform the diagnostic arthroscopy; then, I would repair the meniscal tear and reconstruct the ACL with a patellar tendon allograft while concurrently teaching the resident. The setup of the OR is shown in Figure 1.

A time-out was performed per standard practice. Afterward, the circulating nurse noted that the safety strap was still

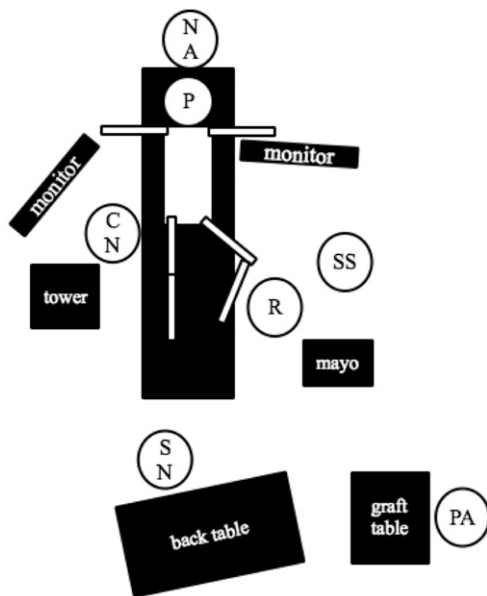
on the base of the operating table. She and the nurse anesthetist went under the drapes to pass the strap from one side of the patient to the other side.

The procedure began with the resident marking the location for each portal. The resident established the anterolateral portal with a #11-blade scalpel, and returned the scalpel to a basin in the safe zone on the back table using a “no-hands” technique, per routine. The resident inserted the arthroscope into the knee through the portal.

As the resident introduced the arthroscope into the joint, I mentioned that he had not made the superomedial incision for the outflow cannula, which was my normal routine. The resident requested the scalpel, but the scrub nurse was setting up instruments and was turned away from the operative field. To assist, the PA passed the scalpel to the resident from the back table, and the resident made the appropriate incision. Using this teachable moment, I noted that making both incisions at the same time saves steps and reduces the number of exchanges of the scalpel.

Once the outflow portal had been established, the resident turned to hand the scalpel to the scrub nurse, who was still organizing the arthroscopic equipment. The resident set the scalpel down on the Mayo stand and turned back to the patient to start the diagnostic arthroscopy, but no one saw him place the scalpel on the Mayo stand, and its placement had not been

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Key:
P=Patient
SS=Sports Surgeon
R=Resident
SN=Scrub Nurse
CN=Circulating Nurse
PA=Physician's Assistant
NA=Nurse Anesthetist
Fig. 1

Diagram of the OR setup and personnel.

called out. I began to coach the resident through the diagnostic arthroscopy. As the resident proceeded, I leaned away from the patient and casually placed my left (nondominant) elbow on the Mayo stand.

As my elbow came in contact with the Mayo stand, I was jolted by an electric-shock-like sensation from my elbow down my forearm to my ring and small fingers. I jumped back, uttered some choice words, and looked for an exposed live wire in contact with the Mayo stand. At that point, the scalpel fell from my elbow to the floor of the OR. I immediately knew what had happened. "It's my ulnar nerve." The room went silent—all were shocked by this sudden turn of events.

The scalpel must have been positioned in such a way that when I rested my left elbow on the Mayo stand, the blade penetrated my gown and skin and cut my ulnar nerve. Immediately, I had marked dysesthesias and numbness in my hand in the ulnar nerve distribution. My grip and pinch strength were very weak, but some intrinsic muscle function, including a weak but functioning first dorsal interosseous muscle, remained.

Once I realized what had happened, I asked the circulating nurse to call the hand surgeon (Dr. Ruch), who was in an OR down the hall, to come to our OR when he was available. We removed my gown and gloves and found a small (3-mm) incision at the back of the elbow that was bleeding slightly. We went out to the scrub sink to wash out the wound and apply an occlusive dressing. I discussed the situation with the hand surgeon, who would explore and repair the nerve later that day. We

thought that I had a partial nerve laceration because there was some intact intrinsic muscle function. I decided that with this level of function and with the team that we had in the OR, we would be able to proceed safely and complete the operation that already had begun. A sports medicine fellow was called from the clinic to come and assist; no faculty were readily available.

I rescrubbed and returned to the OR, instructing the team to focus on taking care of the patient, and we restarted the case. After an all-inside medial meniscal repair, the ACL reconstruction began. The fellow arrived as we finished passing the ACL graft and were preparing for interference screw fixation. The operation went well, despite the reduced grip and pinch strength of my left hand and fingers. At the end of the case, the patient's knee examination was symmetric with the uninjured right knee.

Later that day, the hand surgeon explored my ulnar nerve; it had been completely transected, except for a small strand of the epineurium, which allowed for the nerve to be lined up perfectly. He repaired the ulnar nerve, added a collagen neural wrap, and transposed the nerve to minimize tension on the repair.

Postoperatively, I had a functioning but weak first dorsal interosseous muscle. This unexpected partial functioning was due to a Martin-Gruber anastomosis¹, which led to some intrinsic hand-muscle function despite the completely transected ulnar nerve.

Two years after the ulnar nerve repair, I continued to have substantial dysesthesias and numbness in the ulnar nerve distribution, but had regained flexor carpi ulnaris function, as well as active small finger distal interphalangeal flexion as function of the flexor digitorum profundus returned. The intrinsic muscles in my hand showed substantial improvement beginning at about 11.5 months postoperatively. Specifically, the adductor pollicis and abductor digiti minimi muscles were actively contracting for the first time since the injury. My grip and pinch strength, which remained at 40% to 50% of normal prior to this intrinsic muscle reinnervation, have improved to approximately 80% of normal.

Commentary

From this case, we have learned many lessons about safety and prevention and our responses to adversity. We first focused on the literature about sharp instrument ("sharps") injuries, contributing factors, and strategies to address these factors to improve OR safety and the work environment, much of which is familiar. Immediate and subsequent individual and team responses revealed personal lessons learned in the areas of resiliency and health-care leadership.

Sharps Injuries

The International Safety Center's Exposure Prevention Information Network tracks occupational exposures in health care², including the circumstances of OR injuries. For example, the 2 most common sources of sharps injury are disposable syringes (37%) and suture needles (19%), followed by scalpels (7%). Individuals most likely to sustain these types of injuries are nurses or surgical attendants; 76% of the injuries are sustained by someone not actually using the sharp instrument. Most incidents occur during routine use (30%) or between the steps

of a multistep procedure (41%), as in the case described above. The most frequent site of injury is the hand (94%); at just 3%, the arm is an infrequent site of sharps injuries.

A total of 47% of scalpel injuries occurs during use, and 18% occur while a scalpel is being passed³. A systematic review of scalpel safety concluded that cut-resistant gloves and liners are effective, but they lessen the user's dexterity and tactile feel. Hands-free passing was equivocal, and a single-handed blade removal system was as effective as scalpel safety procedures in preventing scalpel-related injury⁴.

Strategies to Improve OR Safety and the Work Environment

All ORs should aspire to be safe environments to allow for the most effective and efficient care of surgical patients. We offer the following strategies to enhance the OR work environment.

Case-Specific Strategies

- Establish, emphasize, and comply with institutional sharps policies and specific OR team sharps procedures.
- Combine sharps policies with the use of a safety scalpel. Fuentes et al. have shown the potential for a substantial reduction in the risk of scalpel injuries if a safety scalpel is used³. Because most surgeons do not like the designs of the current safety scalpel, a corollary strategy is to design a better safety scalpel, which we are in the process of doing.
- Establish and emphasize institutional educational programs on workplace safety for house staff, including sharps policies.
- Establish and comply with a system for accurate posting of cases.
- Ensure that issues related to equipment and the patient are addressed before preparing and draping the patient.

These case-specific strategies, if followed, should reduce the likelihood of a similar injury occurring in the future. However, if we only mention these strategies, our analysis would be incomplete. Generalized strategies combined with our case-specific ones should result in ORs that are safer, more effective, efficient, and enjoyable places in which to work.

General Strategies

Implement Proven Policies and Standard Operating Procedures

Proven policies and procedures are necessary in ORs to limit human error by preventing a reliance on memory, especially in an environment where multitasking is common, stress levels are high, and drift can and does occur. The key is that policies and interventions must be proven to improve OR safety and effectiveness, which will lead to greater acceptance and avoid negative secondary effects.

Communication and Emotional Intelligence

The case described above clearly points out the need for better emotional intelligence and enhanced communication in our

ORs. While we did some things that were helpful (e.g., a time-out and a start-of-the-day briefing on the technical aspects of the day's cases), the communication and emotional intelligence elements of self-awareness and empathy could have been better.

One general strategy to improve communication and to create better emotional intelligence among team members is to begin each day with a team briefing. The briefing ensures that all team members know each other and can review the ordinary requirements for the day's cases, raise issues or concerns, and review policies and procedures, including the sharps policy. We now call this the "Reveille Brief," used to wake everyone up for the day ahead. Ironically, we did have a team briefing to start the day described above; however, the briefing was not complete, and did not include all of the team members.

The Reveille Brief also can serve as a time for all team members to take a breath and be more deliberate in preparing for the day. Our circulating nurse specifically highlighted that there is an increasing sense of rush and chaos in all of our ORs, especially at the start of the day; therefore, there is a need to moderate the pace to ensure that everyone on the team is prepared for the day and for each surgical case. Most everyone agreed that moderating the pace during the preparatory period would be helpful in reducing stress in the OR, especially when there are deviations from the plans and normal routines, such as the need for new or different instruments.

In addition to the Reveille Brief, time-outs before each case, if taken seriously, are effective ways to improve communication throughout the day, and may be another time when important policies and procedures can be emphasized. The time-out also can serve as a pause to moderate against an overly aggressive pace in the OR. In the case described above, our time-out was taken seriously, but did not include the sharps policy; additionally, all of the team members were aware that the patient had not been adequately secured to the table and that all of the instruments were not ready.

Another aid to communication is to have "call outs" and "call backs" as part of the sharps handling policies and procedures. For example, when passing sharp surgical instruments, team members should call out loud enough for all to hear, "sharp in the safe zone," and wait for a confirmatory call back of "sharp in the safe zone" or another similar statement that is appropriate and agreed upon in advance by the team.

Better emotional intelligence across the team includes another important general communication strategy—encouraging all team members to speak up at any time when they identify something that can improve patient care or when they see a potentially dangerous situation. In this case, the resident was reluctant to call out when returning the knife. He would have been more likely to emphatically call out if he had had a better understanding of his own role and the concerns of the other team members, combined with an open environment to voice his concerns.

Develop a Trusting, Patient-Centered Culture

Business management guru Peter Drucker is credited with having said that, "Culture eats strategy for breakfast." Individuals

and institutions that develop and foster trusting, patient-centered cultures emphasizing teamwork and emotional intelligence will benefit by having accepted and effective strategies (policies, procedures, and educational efforts) that have been collectively created and implemented. Creating this type of culture requires extensive commitment, time, and energy; however, the return on the investment is transforming for all involved.

Second-Victim Effects

Prior to this injury, members of our team had little awareness of the concept of the “second victim.” Wu⁵ originally described the second victim as one who is involved in an unanticipated adverse event who feels traumatized, even to the point of feeling responsible for having failed or second-guessing his or her own skills and knowledge⁶. In the case described above, once the operating team realized the extent of the accident, everyone felt traumatized by the event. All of the team members later commented that they were concerned that their actions had contributed to the injury, and subsequently, each of the “second victims” showed evidence of predictable strategies that were both defensive (keeping the error to themselves, avoidance, etc.) and constructive (asking colleagues what they might have done, seeking out advice, etc.)^{6,7}. Expanding our emotional intelligence to include awareness of, and empathy for, second victims can enhance team interactions and improve our OR work environments.

Personal Reflections

I learned and relearned many lessons of resiliency because of this case.

Ask for Help When You Need It

I had a tremendous support network. I called on others, and they responded. I also asked for help and found it through my faith in God. The adage, “To ask for help is a sign of weakness” is wrong. Asking for help when help is needed can be a sign of great wisdom and helps us to be resilient.

Consciously Work to Maintain a Positive Attitude

I was more resilient because I tried to stay positive. One technique that helped was the “3 Good Things” method. This is a strategy where one remembers and writes down 3 good things that happened that day just before going to sleep; the later this is done, the more those good feelings will carry over into the next day. This method has been an effective resiliency technique in individuals with or without other mental health concerns⁸.

Intentionally Focus Externally Instead of Internally

Focusing on the patient first, and then on the well-being of the team members, helped us all to take care of our patient and not dwell on my injury. Focusing externally and selflessly contributes to resiliency as we concentrate on things we can control instead of detrimentally dwelling on negative attitudes and things we cannot control (blame, self-pity, the future, etc.).

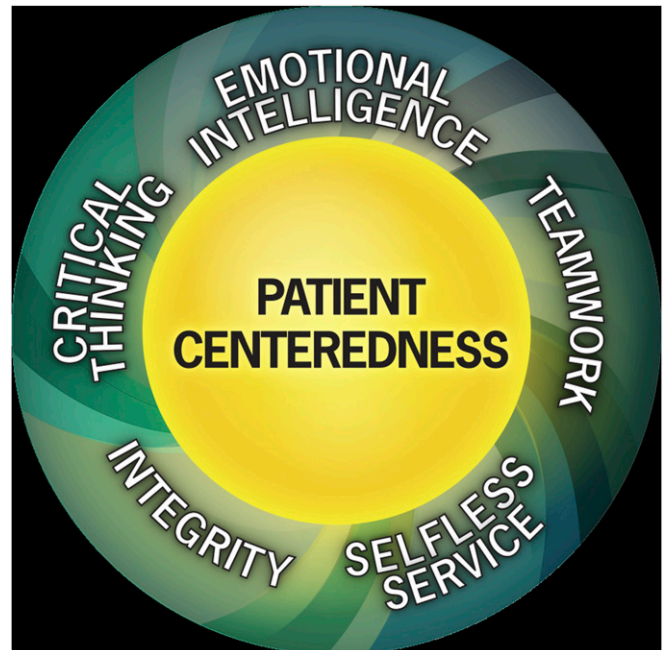


Fig. 2
The Duke University Healthcare Leadership Model.

Focus on the Competencies Inherent to Effective, Ethical Leadership in Health Care

Over the last 5 years, we have developed a research-based Healthcare Leadership Model⁹ that emphasizes the core principle of patient-centeredness and the core competencies of emotional intelligence, teamwork, selfless service, integrity, and critical thinking (Fig. 2), all of which played a role in the case described herein. The collective work we have done in leadership development has enhanced my own leadership skills, made me more resilient, and helped me to react more effectively to this injury than I would have without this understanding. On reflection, had this incident occurred 10 years ago, before this in-depth work in leadership development, I would have responded negatively by focusing on blame, overconcern for uncontrollable future factors, and self-pity. Using the leadership model as a framework for learning from this case can facilitate enhanced understanding, behavioral change, and leadership skill development; the model serves as a vehicle for better, safer ORs and helps us to respond as effective, ethical leaders in challenging situations.

Conclusions

- Be more aware of sharp, potentially dangerous instruments with which we work, and take actions that will lead to safer ORs.
- Make ORs better and safer by taking specific actions to implement policies and procedures that will become long-lasting through efforts to emphasize emotional intelligence, effective communication, and patient-centered cultures that are focused on trust and teamwork.

- Be aware of factors that increase the chances of human error, including reliance on memory, multitasking, stress, and drift, and take actions to address these factors.
- In health care, we work with incredible people and we need to take care of each other. In addition to being patient-centered, be focused on the well-being of team members, be aware of the “second victim,” and take actions to preserve the well-being of all members of the team.
- Develop resiliency to handle better the challenges we face.
- Develop leadership skills to improve the care we provide for our patients and to make better the places in which we provide that care. ■

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