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Complications during neurosurgical training: How does one not succumb?

Catherine Veilleux MD MSc[1], Brij S. Karmur MD[1], Michael M.H. Yang MD MSc M.Biotech[1]

[1]Department of Clinical Neurosciences, Division of Neurosurgery, University of Calgary, Calgary, Alberta, Canada

Corresponding author: Catherine Veilleux, MD MSc, Department of Clinical Neurosciences, Division of Neurosurgery, University of Calgary, 2500 University Dr. NW, Calgary, AB, CAN
catherine.veilleux@ucalgary.ca

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Complications are defined as "unintended results of medical intervention that result in prolonged length of hospital stay, mortality, and/or morbidity". They may or may not be the result of medical errors.[1] Complications are common in neurosurgery, and invariably, neurosurgery resident physicians will experience them during their training. While patients are the primary victims of these events, healthcare providers, including residents, often suffer as well. Residents may experience emotional distress, shame, guilt and depression, making them, along with other caregivers, the second victims.[2,3] Complications amongst surgical trainees are not well studied. They have been associated with personal distress, decreased self-confidence, and decreased empathy, all of which can negatively impact patient care.[2] If complications are common and harmful for both patients and surgical trainees, why is this topic seldomly discussed?

As highlighted by Jean et al.'s recent study involving several world-renowned skull base and vascular neurosurgeons discussing complications within their subspecialty, the lack of open discourse on complications, often driven by medicolegal concerns and professional reputation, limits the opportunity to harness these events as powerful learning tools.[4] This underscores the need for candid discussions about complications to improve both surgical education and patient outcomes. The emotions experienced following complications are often profoundly uncomfortable, even for senior surgeons. Any healthcare provider who has faced a complication understands the sinking and sickening feeling that follows. We often replay every step of the process, from the initial presentation, preoperative workup, to the surgical steps and events leading to the complication. There is agony in questioning, "could I have done this differently," "should I have asked for another opinion," "would someone else have had this outcome in my shoes," and so on. As a trainee, these feelings may be heightened, in part due to inexperience, isolation that usually follows these challenging events, and the lack of teaching around how to deal with complications and medical errors. Additionally, many trainees fear complications may reflect poorly on their skill and competence, and fear judgement from others.

Neurosurgical trainees begin to have complications early in their residency journey. While junior residents are generally not held directly responsible for complications, they start to experience them, nonetheless. These may range from a misplaced external ventricular drain to an infected central line, or a significant residual chronic subdural hematoma after a burr hole evacuation. Junior residents often feel isolated, having not developed a strong rapport with the attending physician to have a frank and open discussion about their experience and feelings. This may lead to maladaptive coping mechanisms as they progress to more senior roles and experience complications with more serious consequences. Maladaptive coping mechanisms may include the inability to take ownership of one's complications, the tendency to shame co-residents when they are involved in a case with an adverse outcome, or even substance misuse.[3] As such, improving ways trainees learn how to cope with complications is essential.

We all have vivid memories of complications during our neurosurgical training. One of the authors (CV) recalls her first unsupervised, misplaced external ventricular drain just a few months into residency. On the verge of tears, she recalls running to her chief resident (MMHY),

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who pulled her aside into a quiet and private resident workroom. There, he shared his own experiences with misplaced drains, recounting not only his mistakes but also those of our colleagues, all of whom were respected surgeons. He provided a reminder that having complications is not a reflection of competence, but an inherent part of surgical training that we need to learn from. While we didn't minimize the complication, we discussed ways to prevent future misplacements and openly acknowledged the emotional toll complications can take on us as trainees. This gesture significantly eased the sense of isolation that typically follows these complications. Even with his reassurance, she recalls going home that night and purchasing two books: *Complications* by Atul Gawande and *Do No Harm* by Henry Marsh. Both these books reinforced an important lesson: our experience with complications as trainees isn't unique, and most importantly, surgeons are humans, vulnerable to complications despite their best efforts.

In addition to turning to books and colleagues to reduce feelings of isolation, other strategies have emerged to help trainees cope more effectively with complications. Creating a culture where physicians can openly share their complications in a nonjudgemental environment, with the goal of preventing similar complications, is essential. Many trainees want to share their experiences with more senior surgeons who can provide advice and guidance, but many worry their complications could be perceived as a deficiency. Mortality and morbidity (M&M) rounds are an opportunity for senior surgeons to model healthy ways to cope and to learn from complications. In these settings, attending surgeons should acknowledge complications as an inherent aspect of the complexity and unpredictability of performing surgery. Surgeons should be open about the complication, including any surgical misadventure. Trainees need to realize that even experienced surgeons can have complications, and it is acceptable and even encouraged to seek and receive support from others in a collegial manner. This approach may encourage trainees to model these behaviors when confronted with their own complications. Addressing both the emotional impact on the patient and the physician, in addition to examining medical facts, may also be beneficial. At the University of Calgary Neurosurgery Residency Training Program, we recently implemented a "trainee-only" M&M rounds. During these rounds, trainees share cases they were directly involved in that resulted in adverse outcomes. These rounds have allowed our group to identify and address systemic issues contributing to complications while also providing a space to acknowledge and process the emotional toll experienced by both the

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treatment team and the patient. This has allowed our resident team to foster a healthier approach when faced with complications.

As trainees gain graduated responsibility and perform more complex procedures in their junior years of training, they may start to wonder about their personal complication rates. One of the authors (CV) remembers her desire to understand her personal complication rate after a central line placed in the intensive care unit became infected. She found herself replaying every step of the procedure, wondering if she had contaminated the field at any point. From that moment on, she started documenting all complications she was directly involved in using her procedural log. She calculated her complication rates for each type of procedure. Little did she know, that file would become a lifeline in her more senior years. Whenever a complication arose, she would consult her records, compare her complication rates with the literature, and approach the situation more objectively. This process helped mitigate the uncomfortable emotions that often accompanied complications. Interestingly, recording and tracking medical errors can lead to a reduction in errors, potentially as a result of changes in behaviors.[1] While not all complications stem from medical errors, documenting and reflecting on them can serve as an objective tool to manage the emotional challenges they bring. This practice may be an effective way for surgeons-in-training to cope with the reality of complications and medical errors.

In summary, being confronted with our failures is never easy. The emotional impact of complications poses a significant challenge: trainees must develop healthy coping mechanisms, learn from their complications and errors when they arise, and adapt by either modifying their behavior or advocating for systemic change. One thing remains certain: complications will continue to be a part of the learning process for surgeons in training. Ways to support trainees and enhance their growth throughout this inevitable aspect of surgical education should be sought by residency programs.

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