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## Letter to the Editor: Priority Considerations of Patients with Peripheral Nerve Pathology in the Time of COVID-19



### LETTER:

Neurosurgical practices around the world have been affected by the COVID-19 pandemic, initially from canceling nonemergency surgical procedures to triaging and prioritizing surgical cases as health systems recover.<sup>1,2</sup> The response to COVID-19 was essential to attempt to efficiently allocate resources to critically ill patients and limit spread of the disease. The side effects of this process have been that neurosurgeons must take on new risks and ethical challenges and patients face unique challenges with new limitations to health care access.

Within neurosurgery, different subspecialties face their own challenges based on the types of patients most commonly seen. Emergencies are determined by subspecialty such as stroke, hemorrhage, trauma, and brain or spinal cord compression. Peripheral nerve pathologies are generally considered urgent or elective, but during this pandemic they have not been addressed in prioritization schemes.<sup>1</sup> Minimal attention has been given to peripheral nerve pathologies in not only neurosurgery but also plastic and orthopedic surgery. This perspective, unfortunately, has a significant impact on individual patients who still risk permanent neurologic deficit without timely intervention. We are just now able to appreciate the impact of this prioritization model.

### IMPACT ON PATIENTS

#### Trauma

Traumatic lesions can occur in open or closed injuries and include sharp or blunt injuries; these occur in up to 3% of patients admitted to Level 1 trauma centers.<sup>3</sup> Sharp injuries should generally be repaired promptly, whereas blunt injuries with nerves in continuity should be monitored over a period of weeks to months with serial clinical examinations and electromyography before making an operative determination. If transected nerves are not repaired, then there will not be any recovery of function. Timely surgery of sharp lacerations can frequently be done with an end-end repair. Delay in surgery of a transected nerve typically results in the need for interpositional grafting, which has less favorable results than an end-end repair. Cases requiring nerve reconstruction have a finite time window for optimal success, such as in the case of traumatic brachial plexus injury. General recommendations are for patients with these injuries to undergo reconstruction within 6 months of initial injury to maximize function; delaying care beyond this window generally results in less favorable chances of recovery.<sup>4</sup> Time is muscle, and delays in repair/reconstruction can lead to lifelong debility.

#### Entrapment

The majority of patients with nontraumatic nerve compression with mononeuropathy have been shown to have good outcomes.<sup>5</sup> These types of patients have symptomatic nerve entrapments, such as carpal tunnel syndrome, cubital tunnel syndrome, or

peroneal nerve entrapment at the fibular neck. However, cases with severe weakness and denervation changes on electromyography, indicating axonal injury, will have poorer outcomes without intervention. Active patients with entrapment of the dominant limb require maximal preservation of function for quality of life. In the current COVID-19 pandemic, these patients have been unable to receive timely diagnostic testing including electromyography and imaging. These testing modalities were initially often delayed by 1–2 months in an effort to limit disease spread and maintain safety of health care staff. Evaluation of patients is limited to virtual visits, so an accurate assessment of motor function is limited. As a result, assessment of these patients is largely a visual endeavor after focusing on taking a thorough history. In peripheral nerve pathology, these limitations delay appropriate care and could lead to permanent neurologic deficits.

#### Tumors

Intrinsic peripheral nerve tumors are most often benign lesions but can present as visible or palpable masses anywhere in the body. As a result, patients may notice these lesions, which can trigger severe pain or cause motor deficits, without a known cause. This uncertainty increases anxiety for patients even though they would likely have a benign disease. However, without the ability to obtain a thorough physical examination and timely diagnostic testing, these patients can also have delayed treatment. While a delay in treatment may be reasonable for patients without any deficits, patients with progressive deficits or those who have known malignant lesions can have much worse outcomes with delayed diagnosis and treatment.

#### Unknown Lesions

Patients can have progressive neuropathies of unknown etiology that require open surgical biopsy. The true timeframe of irreversible damage is hard to define, and patients with inflammatory, infectious, autoimmune, paraneoplastic, or malignant lesions causing pain or weakness have to be deferred. There is not enough prognostic information in these uncommon entities to understand the duration after which any damage is irreversible. Because of this lack of information, allocating resources of surgical staff, protective equipment, and testing is difficult to justify despite the potential irreversible morbidity that patients suffer, especially when resources are in short supply.

#### Pain

Painful neuropathy in many cases is chronic and often accompanies the previously mentioned pathologies. Pain is a core function of the peripheral nervous system and, when significant, can have psychologic and physiologic consequences. Refractory pain, unrelieved by medical therapy, is not generally considered an emergency. It should, however, be considered an urgent indication in some situations just as refractory cervical or lumbar radiculopathy or trigeminal neuralgia in a patient who cannot eat. During the COVID-19 crisis, however, pain was not a sufficient reason for operating room and resource use, so the alternative for patients was to escalate narcotic and neuropathic pain medication use.

## DIFFICULTIES IN PRIORITIZATION

Despite recognizing the difficulties patients with peripheral nerve pathologies face, gaining diagnostic and treatment prioritization for these patients is challenging. During the initial peak of COVID-19, health systems faced significant operational challenges. Personal protective equipment and ventilator availability was prioritized, and most challenges focus on prioritizing life over necessarily quality of life.<sup>6</sup> Operating rooms were reserved for life-threatening surgical emergencies or overflow of COVID-19 patients. What were previously inpatient surgeries became outpatient surgeries to protect resources and limit the risks of disease communication. Many health care workers were transitioned to other roles, not necessarily within their scope or subspecialty of training in order to accommodate the massive influx of critically ill patients.<sup>2</sup> The difficulty in securing basic resources, even of cleaning supplies and basic protective equipment, due to supply chain constraints and ballooning demand meant the natural push for hospitals to heavily restrict nonemergency care.

Because of the need to prioritize life over quality of life, patients with nonemergent needs were relegated to coping with their ailments and biding time until health systems could stabilize. Patients with traumatic peripheral nerve lacerations, an indication that would previously be thought of as requiring urgent treatment, faced case denials due to resource constraints. An international survey of hand surgeons found that most surgeons were limited to emergency treatment and 57% of respondents employed conservative treatment for indications for which they would have otherwise normally operated.<sup>7</sup> Brachial plexus reconstructions for patients soon exiting the optimal window of opportunity for recovery were delayed care by months, which is known to lead to poorer outcomes. Despite knowing that delaying treatment for these conditions results in worse outcomes, many hospitals were unable to prioritize these patients and some were unwilling. Blood transfusion and intensive care unit restrictions also limited the ability to carry out complex reconstructions with nerve and free muscle transfers in cases of complete injury. Services had to fight for case prioritization and in peripheral nerve surgery, plastic surgery, orthopedic surgery, and neurosurgery had to argue for operative allowances both within and outside of their respective departments.

We are now seeing how patients' lives were and are affected as they are finally able to seek care. Some patients who were unable to get biopsies or timely treatment of malignant conditions experienced disease progression. Other patients exited the optimal time window for nerve repair or nerve reconstruction and had to move on to other, less favorable options. Patients with debilitating pain express their suffering after experiencing months of sharp, electric, and burning pain common in nerve pathologies. Many patients also express how their physical therapy was canceled, and as a result, recovery was dramatically stunted; in addition, new problematic contractures often developed, necessitating additional treatment. While most patients understand that state of affairs and that COVID-19 had a vast impact on the health

system, those of all ages should be recognized as now having to live with permanent disabilities that would have otherwise been reversible with intervention.

It would be hard to claim that diverting resources to life-threatening conditions was the wrong decision. However, it is important to recognize patients with significant peripheral nerve pathology now live with even worse functional deficits that will have persistent effects as society attempts a return to normalcy. Even now, as some regions of the country recover, patients still express hesitation in seeking treatment or undergoing diagnostic testing. Patients express their fear of entering the hospital for diagnosis or treatment as they perceive the risk of contamination to be prohibitive.

## CONCLUSION

As a result of COVID-19, the delivery of neurosurgical care is changing along with health care as a whole. While emergencies in cranial and spinal disease can be life-threatening, patients with peripheral nerve pathologies risk irreversible loss of function if their needs are not addressed in a reasonable timeframe. Considerations should be made to preserve life and limb instead of choosing between life or limb. The loss of extremity function, such as a hand, can be devastating and long-lasting. It is important to consider the nuances of peripheral nerve pathologies when determining resource allocation and prioritization frameworks to deliver quality neurosurgical care.

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