Acute spinal cord injury (SCI) is a devastating condition that can result in severe and permanent sensory, motor and autonomic dysfunction. The pathophysiology of SCI is a complex interplay of micro-molecular cascades resulting in endothelial, neuronal and axonal dysfunction. Following SCI, expedient decompression to relieve the spinal cord has been shown in pre-clinical and clinical studies to improve long-term neurological outcomes (Ahuja et al., 2017). A decade has elapsed since the STASCIS study showed that a significantly greater proportion of SCI patients (19.8%) who undergo early decompressive surgery (<24 hrs) attain a 2-or-more grade improvement in ASIA impairment score (AIS) at 6 months as compared to those who receive late surgery (8.8%) (Fehlings et al., 2012). These findings paved the way for the concept of TIME IS SPINE, which parallels the core principle of “Time is Brain” in stroke management and succinctly encapsulates the crucial importance of time in treating acute SCI. What started as an initial effort to encourage expedited critical and surgical care for SCI patients eventually led to its incorporation into clinical practice guidelines for the management of traumatic SCI. The guidelines were developed through a multidisciplinary consensus process and recommended that patients with SCI must undergo surgery within 24 hrs regardless of level and severity of injury (Fehlings et al., 2017).

The decade after STASCIS witnessed the accumulation of studies that provide further credence to the concept of TIME IS SPINE. Harnessing the potential of data mining, our team recently interrogated 4 large SCI databases and pooled individual data for 1548 patients (Badihivala et al., 2021). After adjusting for several important confounders, we confirmed that surgical decompression within 24 hrs was associated with greater improvement in mean motor score and sensorimotor recovery at 1-year follow-up as compared to patients operated beyond 24 hrs (Badihivala et al., 2021). Interestingly, a recent randomized controlled trial provides additional powerful evidence for early surgery in SCI. Haghnegahdar et al. recently published results on a randomized controlled trial (RCT) that enrolled 73 individuals with T1-L2 traumatic SCI. In this study, 37 patients underwent early surgery (<24 hrs) and 36 were allocated to late surgery (24–72 hrs). The authors reported a significantly higher rate of patients having a >2 grade improvement in AIS (p=0.025) in the early group (24.3%) as compared to the late surgery group (5.6%) (Haghnegahdar et al., 2020).

Of note, newer evidence suggests that the 24-h limit may not be as rigid as it was originally conceived. In this regard, several small studies have been published supporting ultra-early surgery defined as either <8 hrs or <12 hrs with outcomes showing favorable neurologic recovery. A more recent study using the NSQIP database in 4108 adult SCI patients from 2010 to 2016 showed that the risk of major and immobility-related complications rises steeply after a 12-h period elapses from time of injury to surgery (Balas et al., 2021a). While these findings certainly provide new insight into the elusive “ideal therapeutic time window”, the pragmatic application of this “ultra-early surgery” in the real-world setting remains to be seen.

In order to reap the same benefits as previously shown in earlier studies, appropriate pathways must be established to refer patients to specialized spine units where early decompression and/or stabilization can be performed. This requires a system reorganization and commitment to ensure that both prehospital and in-hospital times are reduced and streamlined. In a recent survey of 353 North American trauma centers, only 2/3 of patients with SCI were shown to receive the appropriate treatment of early decompression (Balas et al., 2021b). Unfortunately, this represents a discord in knowledge translation and demonstrates the importance of addressing some administrative factors that may hinder this process, which includes transfer delay to SCI centers, delay before surgical plan completion and waiting time for the operating room (Thompson et al., 2018).

Though the current studies provide compelling evidence in support of early surgery, a critical knowledge gap remains on several issues. First, a well-accepted and validated definition of adequate decompression remains controversial among many spine surgeons. Likewise, with the
advances in neuromonitoring, the role of spinal cord perfusion pressure monitoring to determine adequate cord decompression needs further exploration using prospective cohort studies. And lastly, the utility of expansile duraplasty as an add-on procedure during spinal decompression warrants additional investigation to establish whether this translates to better neurological/functional recovery in SCI patients.

In summary, spinal cord injury management remains a challenging problem for all spine surgeons. Because the time from injury to surgery has a significant impact on outcomes, decompression should not be delayed and must be offered in a timely manner to all patients with SCI. In the present era of “TIME IS SPINE”, surgeons around the world must be able to deliver the message clearly and effectively across the board that time is of the essence in the surgical care of spine patients, and that healthcare systems should be organized to facilitate delivery of this fundamental service.

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Declaration of competing interest

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