In Reply to the Letter to the Editor "Spontaneous Spinal Extradural Hematoma: A Rare Neurosurgical Emergency"

Letter:

We thank Dr. Prasad for commenting on our article "Spontaneous Spinal Epidural Hematoma: A Surgical Case Series of Ten Patients" published in the journal[1].

In our paper we retrospectively reviewed 10 cases of patients surgically treated for spontaneous spinal epidural hematoma (SS-EDH). We found that half of the patients had a good neurologic recovery and half had a poor neurologic recovery. The predictors that seemed to most strongly correlate with poor neurologic recovery were large hematoma size, hematoma located in the thoracic spine, and poor preoperative motor function.

Intuitively, surgical delay should be one of the strongest predictors of neurologic outcome in SS-EDH patients. The longer the hematoma compresses the spinal cord, the more severe the spinal cord ischemia ought to be. Accordingly, several previous studies have found a strong correlation between surgical delay and neurologic recovery, something that our study could not confirm.[2-7] There are several reasons for this. It might be the result of the small sample size, and thus a type II error, or it might relate to the nature of the disease.

The possibility of neurologic recovery after SS-EDH depends on the extent of spinal cord ischemia, which is dependent on the 1) rate, 2) duration, and 3) force of the hematoma (Figure 1). Rate is defined as the *speed* of hematoma progression. Duration is defined as the *length of time* of spinal cord compression. Force is defined as the *strength* or *power* of the compression caused by the hematoma on the spinal cord.

The rate, duration, and force of spinal cord compression have been most extensively investigated by Tarlov et al[8-11] in animal models. In humans, however, it is extremely difficult to perform such studies and we have had to settle for indirect markers. For example, the rate of compression has been defined as the time from symptom onset to maximal neurologic deficit. Duration might be seen as the time from maximal neurologic deficit to surgical intervention and force as the degree of maximal neurologic deficit. Yet even these indirect markers are challenging to assess, which is reflected in the mixed results from previous studies.

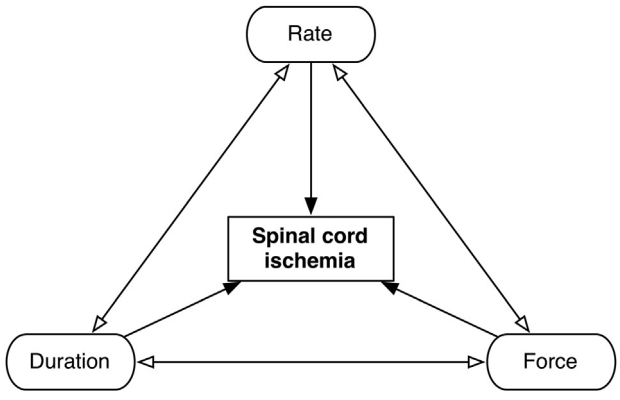

Figure 1. The rate, duration, and fore of hematoma compression decide the extent of spinal cord damage.

Other previously described prognostic factors are indirect markers related to rate, duration, and force as well. For example, in the narrower thoracic spinal canal a lower rate is required to achieve significant spinal cord compression. Hematoma size may also be seen as an indirect marker of force, although it tells little about rate and duration (although magnetic resonance imaging might be of aid in assessing hematoma age).[12,13] Preoperative neurologic function reflects the current state of the spinal cord, although it does not fully describe the extent of irreversible ischemia, as there are patients that recover from poor preoperative neurologic function.[1]

SS-EDH is an extremely rare acute neurosurgical condition. Its research is further hampered by varying data collection and definitions. Standardized common data collection and multicenter collaborations are necessary to improve our knowledge regarding this rare but devastating disease.

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