

CORRESPONDENCE

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Spinal Cord Injury in Patients with Undiagnosed Cervical Spine Fractures

To the Editor:—Muckart *et al.* blamed tracheal intubation for the spinal cord injuries sustained by two patients with undiagnosed cervical fractures, who were given anesthesia and having surgery for other injuries.¹ This conclusion is not tenable. Their frank report made it clear that no particular attention was given to the disposition of the head and body, so that it is possible that the period of intubation was the *only* time that reasonable alignment occurred. The fact is that Muckart *et al.* presented no evidence other than that the patients were paralyzed after surgery. The cause is unlikely to be simple—what caused the quadriplegia reported after awake intubation and positioning in a patient with a diseased but stable neck?² The possible case of spinal cord damage after direct laryngoscopy that Muckart *et al.* cite is suspect because the intubation (which failed) may have been necessitated by neurologic deterioration rather than being the cause of it and was complicated by severe hypotension, acidosis, and hypoxemia.³ Direct laryngoscopy produces little movement below C3,⁴ not “maximal movement and extension of the entire cervical spine.”¹

When treating patients with actual or suspected cervical abnormality, we should concentrate on maintaining spinal cord blood flow (SCBF). SCBF autoregulation is believed to be unreliable in disease, so that hypotension can cause cord ischemia; severe hypotension has caused quadriplegia in normal patients.⁵ This means avoiding

hypotension at all times and taking care with positioning. In some patients, the SCBF may be so unstable that even maintaining normotension, awake intubation, and positioning is insufficient to prevent quadriplegia.²

Muckart *et al.* did not tell us whether their patients became hypotensive. I should be surprised if they did not because both had serious injuries (multiple gun shot wounds and broken legs), and cord damage itself causes hypotension. If hypotension was closely related to intubation, this could constitute evidence in support of their belief that it caused the cord damage. However, it would also be possible that any hypotension at induction resulted from hypovolemia. My “most likely” explanation of the cord injury sustained by Muckart *et al.*’s patients is that their SCBF was at risk because of cervical trauma, and cord ischemia resulted from hypotension during surgery.

All patients with a history of neck trauma are at risk of the subsequent development of acute spinal cord injury, whether a fracture is present or not. Care should certainly be taken with intubation and positioning, but avoiding hypotension is probably even more important.

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In Reply:—Dr. Calder considers that tracheal intubation was not the cause of spinal cord injury in our report of two patients.¹ Rather, he suggests that intraoperative hypotension resulted in spinal cord ischemia. We consider this hypothesis unlikely.

Neither patient sustained hypotension during anesthesia and surgery, and in this regard we do not share Dr Calder's surprise. The patient with bilateral femoral fractures was injured 24 h before transfer to our institution, and internal fixation of the fractures was undertaken on a non-emergent basis in a hemodynamically normal patient. Contrary to Dr. Calder's belief, hypotension is an uncommon complication after an abdominal gunshot wound, which results in isolated small intestinal injury as occurred in our second reported case. On average, our institution treats 2,500 victims of penetrating torso trauma per year.² Only 8.2% require admission to the intensive care unit, 2.4% as a result of protracted hypotension.³ Of this latter group, less than 1% have sustained isolated small intestinal injury. Further, in 10 years of treating more than 3,000 critically injured patients, we have encountered only one instance of spinal cord injury presumed to be the result of hypotension.

We agree that direct laryngoscopy produces little movement below C3. Our statement concerning maximal movement and extension of the entire cervical spine is meant to indicate that during tracheal intubation, maximal movement of the cervical spine occurs at the time of direct laryngoscopy.⁴ It must be emphasized, however, that all studies of cervical spine movement during tracheal intubation in living humans have been performed in patients without injury. The motion of a fractured spine is unknown.

In the absence of post-mortem findings, which were fortunately not available in either patient, the etiology of spinal cord injury remains speculative. Indeed, we emphasized that a number of reasons may have accounted for neurologic damage. As noted by Dr. Calder, spinal cord blood flow is at risk because of cervical spine injury, and any movement of the cervical spine may compromise perfusion. The

precise nature of the lesion is irrelevant. The undeniable lesson to be learned from our report is that patients with undiagnosed fractures of the cervical spine are at high risk of spinal cord injury if adequate precautions are not undertaken during tracheal intubation. Academic debate as to the pathophysiology is no substitute for ensuring that the cervical spine is cleared before intubation, and if this is not possible, every attempt must be made to minimize the risk of neurologic injury.

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