

## Advances in Spinal Cord Protection from Perioperative Ischemic Injury

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### Keywords

- Thoracic aorta • Thoracoabdominal aorta • Type B dissection • Aneurysm
- Spinal cord injury • Spinal cord ischemia • Paraplegia
- Thoracic endovascular aortic repair

### Key points

- Thoracic aortic dissections and thoracoabdominal aortic repairs may be complicated by spinal cord injury leading to paraplegia or paraparesis.
- The anterior spinal cord is particularly vulnerable during periods of decreased blood flow, as happens during both open and endovascular repairs.
- Strategies to reduce the risk of spinal cord injury are based on augmenting blood flow during periods of ischemia.
- A multimodal approach, with augmented circulation and aggressive intercostal artery reimplantation, lumbar drainage of cerebrospinal fluid, and intraoperative neuromonitoring of motor evoked potentials, reduces the risk of spinal cord injury.
- This review summarizes the recent advances in our understanding of techniques to protect the spinal cord during major descending aortic surgery.

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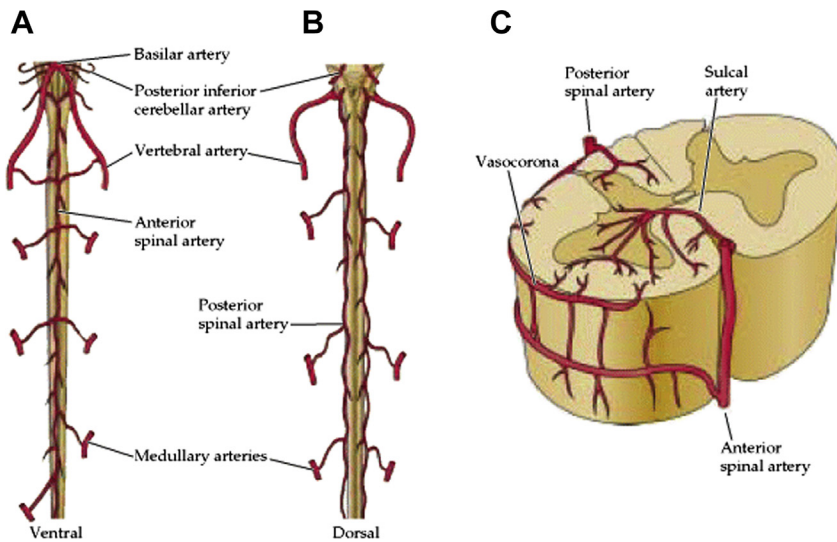
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## INTRODUCTION

Operative management of descending thoracic and thoracoabdominal aortic disease continues to be associated with significant mortality and morbidity. Paraplegia and paraparesis persist as the leading and most feared morbidities, despite advancements in surgical and anesthetic techniques. The goal of this article is to summarize important understandings in spinal cord protection and to review more recent advancements.

## ANATOMY AND PHYSIOLOGY OF THE SPINAL CORD

The arterial circulation of the spinal cord is provided by internal and external sources (Fig. 1) [1]. The internal blood supply comes from a single anterior spinal artery (ASA), which courses along the ventral aspect of the cord and ultimately distributes blood to the bulk of the cord substance through penetrating arteries, and paired posterior spinal arteries (PSA). The principal



**Fig. 1.** Blood supply of the spinal cord. (A) View of the ventral (anterior) surface of the spinal cord. At the level of the medulla, the vertebral arteries give off branches that merge to form the anterior spinal artery. Approximately 10 to 12 segmental arteries (which arise from various branches of the aorta) join the anterior spinal artery along its course. These segmental arteries are known as medullary arteries. (B) The vertebral arteries (or the posterior inferior cerebellar artery) give rise to paired posterior spinal arteries that run along the dorsal (posterior) surface of the spinal cord. (C) Cross section through the spinal cord, illustrating the distribution of the anterior and posterior spinal arteries. The anterior spinal arteries give rise to numerous sulcal branches that supply the anterior two-thirds of the spinal cord. The posterior spinal arteries supply much of the dorsal horn and the dorsal columns. A network of vessels known as the vaso corona connects these 2 sources of supply and sends branches into the white matter around the margin of the spinal cord. (From Purves D, Augustine GJ, Fitzpatrick D, et al. Neuroscience. 2nd edition. Sunderland (MA): Sinauer Associates; 2001; with permission.)

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