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Case Report

Anesthetic Management for Endovascular Stenting of Thoracic Aorta with Isolated Left Vertebral Artery: A Case Report

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ABSTRACT:
Patients with thoracic aortic dissection and anomalous left vertebral artery presenting for stenting pose unique anesthetic challenges. Such cases typically require a hybrid procedure, beginning with vertebral artery-to-common carotid artery transposition, followed by endovascular stenting. This report highlights the complex anesthetic considerations, including hemodynamic monitoring, neuromonitoring, and cerebral protection, necessitated by these additional challenges.

Keywords: thoracic aorta, IVLA-independent left vertebral artery, TEVAR(thoracic endovascular repair)

INTRODUCTION:

Aortic arch dissection may occur after traumatic events, requiring life-saving endovascular stenting and rigorous hemodynamic management. An isolated left vertebral artery introduces further complexity in maintaining cerebral perfusion. A hybrid approach, involving vertebral-carotid transposition followed by aortic stenting, is essential to preserve Circle of Willis integrity and reduce ischemic risk(.1)

Case Presentation:

A 38-year-old male presented with chest pain and shortness of breath following blunt chest trauma. A CT aortogram revealed a grade 2 aortic separation at the origin of the left subclavian artery, along with an anomalous left vertebral artery arising from the aortic arch near the dissection flap. Initial resuscitation focused on fluid administration and strict blood pressure control (targeting a systolic BP <120 mmHg and heart rate <60 bpm).

The patient underwent a left vertebral artery transposition (anastomosing the left vertebral artery to the left carotid artery), followed by thoracic endovascular aortic repair (TEVAR). The primary anesthetic goal was to maintain stable hemodynamics, ensuring adequate cerebral perfusion during carotid cross-clamping while preventing further dissection progression.

Preoperatively, a labetalol infusion (2–10 mg/hr) was used to control hypertension and minimize dissection risk. Anesthetic induction involved high-dose fentanyl to optimize hemodynamic stability and blunt the sympathetic response. Maintenance anesthesia included titrated sevoflurane (0.5–1%) and a fentanyl infusion (50–100 mcg/hr). Right radial arterial and femoral central lines were placed for invasive monitoring, and a low-dose noradrenaline infusion was used to maintain systolic blood pressure below 110 mmHg.

Monitoring strategies included standard ASA monitoring, invasive arterial pressure monitoring, urine output tracking, and cerebral oximetry. Noradrenaline infusion was carefully titrated to maintain a mean arterial pressure (MAP) around 60 mmHg, except during carotid artery clamping, when MAP was increased to above 90 mmHg. Cerebral protection during carotid cross-clamping (which lasted 30 minutes) was achieved using 250 mg of thiopental sodium and a high inspired oxygen concentration.

Following carotid transposition, the patient was transferred to the angiography suite for thoracic aortic

stenting, with MAP maintained around 60 mmHg during the procedure. Postoperatively, blood pressure was kept slightly higher (MAP 80–100 mmHg). After the procedure, the patient was extubated without any neurological deficit, and transferred to the intensive care unit for continued monitoring.

DISCUSSION:

Thoracic endovascular aortic repair (TEVAR) has emerged as a crucial treatment for traumatic type B aortic dissection, providing a minimally invasive alternative to open surgery(5). TEVAR is particularly beneficial for blunt thoracic aortic injuries (BTTAI), which have a high mortality risk. Studies support TEVAR's role in improving survival rates and reducing complications, with a pooled mortality rate of 6.95% in BTTAI cases.

Anomalous left vertebral artery, originating directly from the aorta, is observed in 3-6% of patients, with supra-aortic trunk variations occurring in 25.6-33.5% of cases(6). Recognizing these anatomical variations is critical in managing aortic arch conditions to prevent complications. The isolated left vertebral artery (ILVA) is the second most common supra-aortic trunk variant, with prevalence ranging from 0.8% to 6.3% in different cohorts. (7)

Hybrid procedures combining open and endovascular approaches are necessary for managing arterial take-offs and ensuring adequate cerebral perfusion(9). Debranching procedures, involving arterial rerouting, prevent competitive flow and retrograde leaks.

Key anesthetic objectives during aortic stenting include strict hemodynamic control, cerebral protection, and neuromonitoring(3). The vertebral-carotid transposition is crucial to preserving the Circle of Willis, particularly if the vertebral artery is dominant(1). Maintaining hemodynamic stability is vital to prevent further aortic dissection progression and organ hypoperfusion. Opioid-based induction mitigates stress responses, while invasive blood pressure and central venous pressure monitoring ensure optimal perfusion.(8)

"Permissive hypotension was employed before aortic stenting, while induced hypertension with noradrenaline infusion was used after stent placement to minimize complications(8). A thorough neurological assessment is necessary before extubation , ensuring hemodynamic and neurological stability. Common complications of arch endograft repair include endoleaks, transient ischemic attacks, strokes, and spinal cord ischemia (SCI). Postoperative ICU monitoring is crucial for detecting delayed sequelae.

This case presented a unique challenge of balancing two opposing hemodynamic goals: minimizing systolic pressure to prevent aortic dissection progression and rupture, while ensuring adequate mean arterial pressure to maintain cerebral perfusion during carotid clamping. A slow, opioid-based induction was used to ensure hemodynamic stability and blunt the sympathetic response. Blood pressure was maintained around an acceptable range (MAP around 60 mmHg) throughout the intraoperative period. Cerebral protection strategies, aside from increasing blood pressure, were employed during carotid clamping. Continuous hemodynamic and cerebral oximetry monitoring was done to maintain the parameters within the acceptable range. More importantly, continuous communication with the surgeon, especially before and after clamping, helped mitigate risks by ensuring optimal hemodynamic management. Post-aortic stenting, blood pressure was maintained slightly on the hypertensive side. Extubation was done following procedure with intact neurological status.

CONCLUSION:

This case highlights the anesthetic challenges in managing a traumatic aortic arch dissection complicated by an isolated left vertebral artery. A hybrid approach, combining vertebral-carotid transposition with endovascular aortic stenting, was the surgical and interventional option for preserving cerebral circulation post stenting. Balancing two conflicting hemodynamic goals—limiting systolic pressure to prevent further dissection while ensuring adequate cerebral perfusion during carotid clamping—required careful anesthetic planning. Key factors in optimizing patient outcomes included strict hemodynamic control, close monitoring of cerebral oximetry and metabolic parameters, cerebral protection strategies, and continuous communication with the surgical team. Postoperative ICU monitoring was crucial in maintaining hemodynamic stability and neurological integrity, emphasizing the need for a tailored anesthetic approach in complex vascular interventions.

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