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Aorta: Case Report

Extended Cervical Access for Cerebral Malperfusion in Acute Aortic Dissection in a Circulatory Unstable Patient

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A 63-year-old man who had acute aortic dissection type A with signs of cerebral malperfusion and hemodynamic instability underwent immediate carotid artery cannulation. A Bentall procedure and total arch repair with frozen elephant trunk implantation were performed with extended cervical access to address supraaortic vessel involvement. We demonstrate that prudent cannulation and repair strategies can be successful even in the most complicated cases of aortic dissection.

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In patients presenting with aortic dissection and involvement of the carotid arteries with signs of cerebral malperfusion, prudent cannulation strategies may restore cerebral circulation and thus lead to a favorable neurologic outcome.

A 63-year-old man with a history of Parkinson disease was referred to our hospital (Heidelberg University Hospital, Heidelberg, Germany) with acute aortic dissection type A. He initially presented with severe chest pain and hypotension. Neurologic disorders were not evident. A computed tomographic (CT) scan of the aorta showed aortic dissection type A involving the aortic root, the ascending aorta, the aortic arch, the descending aorta, and the supraaortic vessels (Figure 1A). The right common carotid artery appeared occluded (Figure 1B). The patient was referred to our hospital on an emergency basis with vasopressor support and signs of tamponade and underwent immediate aortic repair.

After median sternotomy, opening of the pericardium led to an increase in blood pressure. Subsequently a small rupture of the ascending aorta occurred and was initially controlled by manual compression. Next, supraclavicular access to the left subclavian artery was established (Figure 2). Arterial cannulation of the left subclavian artery through an 8-mm polyethylene terephthalate (Dacron) graft and venous cannulation of the right atrial appendage were performed. Systemic cooling was initiated. The right common carotid artery was transected 2 cm proximal to the bifurcation through a cervical incision. Direct cannulation of the right common carotid artery was performed to restore cerebral blood flow. Using a balloon catheter tip, commonly used for selective antegrade cerebral perfusion, a flow rate of 220 mL/min was established. This led to a significant increase in cerebral oximetry values, which persisted throughout the procedure. After cross clamping of the aorta, 2000 mL of Bretschneider cardioplegia solution was administered through selective coronary catheters. The entry tear was located in the ascending aorta. During the phase of cooling, aortic root replacement with a manually sutured biologic valve conduit was performed. After reaching the target body temperature of 24.0 °C, the clamp was removed, and circulatory arrest was initiated.

A frozen elephant trunk (Thoraflex Hybrid, Terumo Aortic) was inserted into the true lumen of the aorta, and the distal aortic anastomosis was carried out in zone 2. The left common carotid artery was severely damaged, and proximal suturing proved impossible. Thus, an extraanatomic end-to-end aortocarotid bypass with transection of the common carotid artery and proximal ligation was performed through a cervical incision. Similarly, an extraanatomic aortocarotid bypass was performed

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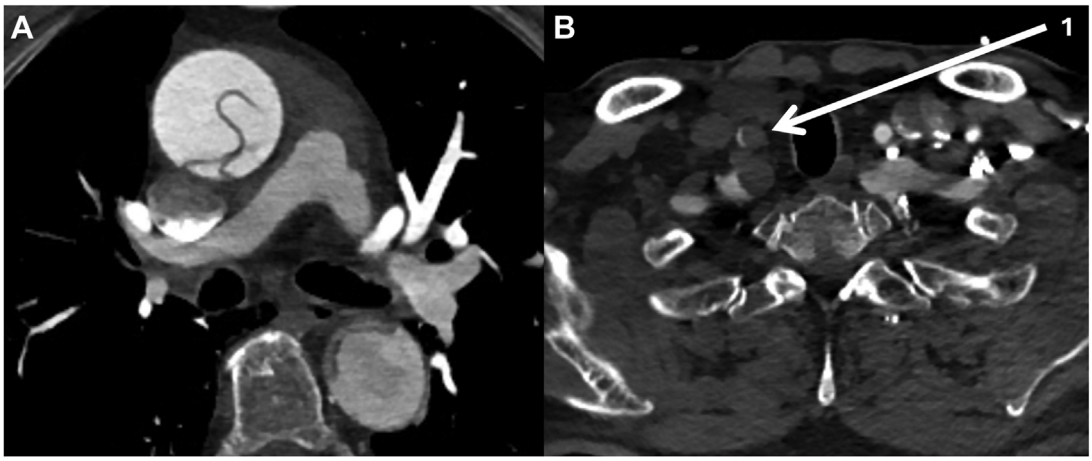


FIGURE 1 (A) Preoperative computed tomographic (CT) scan showing a dissection flap in the ascending and descending aorta. (B) Preoperative CT scan showing dissection extension into the supraaortic vessels and subtotal occlusion of the right subclavian and (1) right common carotid artery.

on the right side, and lower body perfusion and rewarming were initiated. The left subclavian artery anastomosis was performed as an extra-anatomic bypass. Finally, the ascending aortic graft was anastomosed to the distal graft. During reperfusion, the innominate artery was anastomosed to the aortic graft. After rewarming and 75 minutes of reperfusion, weaning from cardiopulmonary bypass was uneventful. Chest closure was performed in standard fashion. Total procedure time was 502 minutes, cardiopulmonary bypass time was 306 minutes, and aortic cross-clamp time was 205 minutes. There was no phase of total circulatory arrest. Selective antegrade cerebral perfusion time was 208 minutes, and selective lower body perfusion was 84 minutes. Minimal body temperature was 23.7 °C.

The patient was transferred to the intensive care unit and extubated after 29 hours. He experienced no neurologic disorders postoperatively. A CT scan performed on postoperative day 1 showed a satisfactory result, notably proper cerebral perfusion and no signs of stroke (Figure 3). Postoperative recovery was slowed by the patient's severe symptoms of Parkinson disease. The patient was discharged on postoperative day 28.



FIGURE 2 Location of incisions for cannulation and extraanatomic bypasses. Image taken on postoperative day 8.

COMMENT

Cerebral malperfusion in aortic dissection is associated with an unfavorable neurologic outcome and increased mortality.[1] If the dissection or occlusion of the carotid arteries involves a distal segment, cannulation of the

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FIGURE 3 Postoperative computed tomographic scan 3-dimensional reconstruction showing postoperative arterial circulation: (1) extraanatomic right common carotid artery bypass, (2) extraanatomic left common carotid artery bypass, (3) –extraanatomic left subclavian artery bypass.

axillary artery or femoral artery may not address the issue adequately. In such cases, direct carotid artery cannulation before aortic arch surgery[2] allows for unobstructed cerebral perfusion and may prevent postoperative neurologic disorders. Specifically, carotid artery dissection or carotid artery thrombosis, together with clinical or radiologic signs of cerebral malperfusion, is an indication for carotid artery bypass.[3] It has been shown to be a safe and efficient procedure.[4] Notably, this technique is also feasible in patients presenting with neurologic disorders such as hemiparesis, thus potentially leading to complete reversibility of the symptoms.[4,5]

Instead of suturing a prosthesis to the dissected vessel to connect the arterial line, we transected the common carotid artery and placed a balloon catheter tip into the true lumen. This is a quick and secure way to restore cerebral blood flow. Our case also demonstrates that early direct carotid artery cannulation for reestablishing cerebral perfusion can be feasible in circulatory unstable conditions, such as tamponade or limited aortic rupture. This step should be performed very early in the procedure, even before sternotomy if hemodynamic conditions allow, because cerebral malperfusion often poses a more significant threat than aortic rupture. It may be feasible to extend the sternotomy from the start in some cases. We chose a separate approach to access the carotid artery more distally, both to circumvent the occluded segment and to find a relatively intact vessel to cannulate and use for anastomosis later. Once cerebral perfusion is established, aortic repair can be performed.

In patients with carotid artery dissection, direct anastomosis to the aortic graft may not be possible. Extraanatomic revascularization to a more distal segment of the carotid artery is a feasible approach in experienced centers.[3] In addition, these strategies allow for proximalization of the distal aortic anastomosis into zone 2, which improves exposure, speeds suturing, and reduces circulatory arrest time.

In summary, this complex case demonstrates that immediate direct carotid artery cannulation for cerebral malperfusion and extended cervical access may improve outcomes of patients presenting with acute aortic dissection and cerebral malperfusion, even in haemodynamically unstable conditions and with limited aortic rupture.

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PATIENT CONSENT
Obtained.

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