Epidural Blood Patch for Acute Subdural Hematoma After Spinal Catheter Drainage During Hybrid Thoracoabdominal Aneurysm Repair

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CEREBROSPINAL FLUID (CSF) drainage is an effective adjunct used for spinal cord protection during open thoracoabdominal aneurysm (TAA) surgery. Subarachnoid hemorrhage is a rare but catastrophic complication of CSF drainage for which an epidural blood patch could be done to treat and prevent further progression of subarachnoid hemorrhage in an acute setting. The incidence and the risk factors for spinal cord injury after TAA stenting are not fully understood. CSF drainage in both open TAA surgery and stenting procedures should be done with care, diligence, and caution to avoid catastrophic complications.

CASE REPORT

A 63-year-old woman with a history of Marfan's syndrome presented for surgical repair of an aortic dissection. Her medical history was also significant for hypertension; end-stage renal disease requiring hemodialysis; gastrointestinal bleeding; and history of 2 prior strokes, 5 and 10 years before presentation. Her surgical history was notable for surgical repair of a type A aortic dissection with concomitant aortic valve replacement 12 years previously and an abdominal aortic aneurysm and dissection repair 11 years earlier. In addition, she had undergone stenting of both common carotid arteries and the left subclavian artery 2 years earlier because of an aortic arch dissection with extension into these vessels. During repair of her type A dissection, a Dacron graft (W.L. Gore & Associates, Flagstaff, AZ) was placed from the sinotubular junction to the distal ascending aorta. The patient continued to have dissection of her aorta from this point distally involving essentially the entire descending thoracic and abdominal aorta. Computed tomography (CT) angiography revealed that blood flow to the abdominal viscera was maintained from the true lumen of the aorta. The extent of the false lumen was filled with thrombus. The segment of dissection and aneurysm in the aortic arch and descending thoracic aorta had enlarged considerably over time, and a CT scan revealed a possible contained rupture. A multidisciplinary approach involving cardiac and vascular surgical teams planned a staged, hybrid surgical approach.

The patient was prepared for the surgery with appropriate intravenous and arterial access. Two large-bore intravenous catheters (14-G in both antecubital fossa) and a right radial arterial catheter were placed before induction of anesthesia with appropriate sedation. Anesthesia was induced with fentanyl and propofol, and oral endotracheal intubation was facilitated with pancuronium. An advanced venous access device with 3 large-bore lumen, 9F, 15-G, and 15-G, was placed in the right internal jugular vein. A continuous cardiac output pulmonary artery catheter with mixed venous oxygen saturation monitoring was floated through this advanced venous access device. Anesthesia was maintained with 100% oxygen in 1% isoflurane, and intravenous fentanyl was used for analgesia. Neuromuscular relaxation was maintained with pancuronium. The surgeons obtained femoral access, and this femoral arterial pressure was used when the right radial arterial pressure was lost during the right femoroaxillary arterial grafting.

The surgical phases included the following: (1) a right femoral-to-right axillary artery bypass using a Dacron graft, (2) a right common carotid-to-left common carotid artery bypass also with a Dacron graft (Fig 1), and (3) the placement of an endovascular stent covering the extent of the aortic arch pathology. However, during performance of the carotid-to-carotid arterial bypass, the patient became extremely hypotensive, and the surgical team suspected that rupture of the proximal descending thoracic aorta had occurred, and they rapidly obtained femoral arterial access. Through this access, an endovascular stent was deployed in the descending aorta to cover the disrupted area. This, along with resuscitative efforts, allowed for restoration of hemodynamic stability and allowed for completion of the carotid-to-carotid bypass. After this, another endovascular stent was deployed from the femoral artery to cover the pathology in the distal ascending aorta. The proximal extent of this stent overlapped the previous Dacron graft and terminated just proximal to the left subclavian artery. The rest of the patient's intraoperative course was unremarkable.

Because of the unexpected deployment of the extensive descending thoracic aortic endovascular stent, a lumbar CSF drain was placed by the anesthesia care team at the end of the procedure, after checking to be sure that coagulation was normal, to aid in maintenance of spinal cord perfusion pressure. The drain was placed without difficulty under sterile conditions at the L3-4 interspace using a 17-G Tuohy needle and an 18-G multiorifice Portex catheter (SIMS Portex Inc, Keene, NH). Once the CSF catheter was placed, 20 mL of CSF was removed with the goal of maintaining the CSF pressure at 10 mmHg by using a closed spinal drainage system, which would pop off when the pressure exceeded 10 mmHg. This was monitored closely in the cardiac surgical intensive care unit, and care was taken not to exceed a total drainage of 240 mL of CSF in a 24-hour period. The patient was extubated on the first postoperative day (POD) and was noted to be alert, oriented, and responding appropriately to commands. No neurologic deficits were noted. At this point, the total CSF drainage over the first 24 hours was 197 mL. The plan was to follow the authors' usual practice of continuing the drainage for another day and remove the catheter after 48 hours from the end of surgery in the absence of evidence of neurologic deficits. However, on POD 2, the patient was noted to have decreased alertness and inability to respond to some simple commands. No focal neurologic deficits were noted. At this time, the total drainage over the second 24-hour period was 227 mL. A CT scan (Fig 2) was performed to asses the altered mental status and showed bilateral subdural hematomas (SDHs) with no displacement of midline structures. Neurologic and neurosurgical consultants recommended continued close observation, frequent neurologic checks, and discontinuing CSF drainage. In discussion with the anesthesia team, the CSF drainage was stopped and the coagulation profile checked. The CSF catheter was removed on POD 3 when there were normal prothrombin time, partial thromboplastin time, international normalized ratio, platelet count, and no evidence of paralysis of the lower extremities.

The patient underwent a repeat CT scan the next day. This scan showed an increase in the size of the SDHs bilaterally. During this time, the patient remained afebrile with systolic blood pressures in the range of 100 to 140 mmHg and mean arterial pressures in the range of

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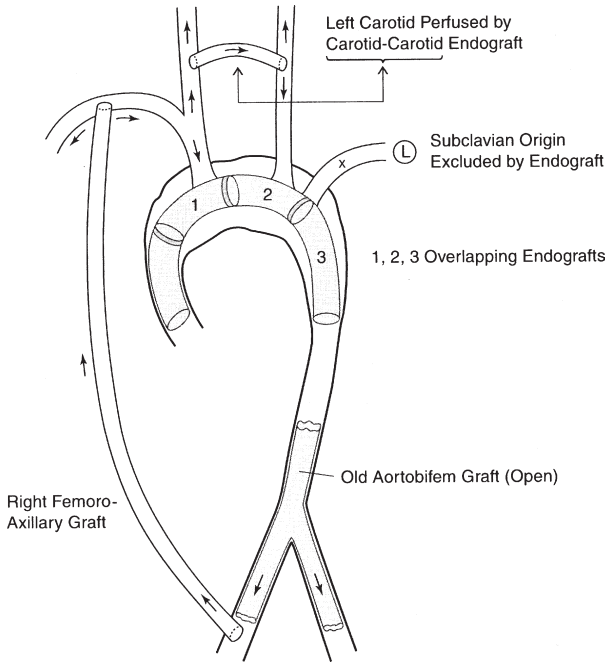

Fig 1. Schematic of aortic surgery performed: 1, 2, and 3 are three overlapping new endografts occluding all the branch vessels. The right femoroaxillary graft is the arterial graft created to promote flow into the branch vessels from the femoral artery and was tunneled subcutaneously. Carotid-carotid graft promoted flow from the right carotid to the left carotid.

70 to 80 mmHg. Secondary to her declining mental status, the patient was reintubated. In the hours after reintubation, neurologic assessment noted that the patient could open her eyes to vocal stimulation, that her pupils were equal in size and reacted briskly to light, and that she could follow simple commands. Postoperative laboratory evaluations revealed normal coagulation tests. Planned reinstitution of anticoagulant medications for the patient's mechanical aortic valve was postponed for fear of aggravating the clinical scenario. An electroencephalographic study was also performed and showed generalized encephalopathy with no focal slowing. A third CT scan performed on the fourth POD showed another increase in the size of the SDHs, which now involved the convexities of the hemispheres, the parafalcine and supratentorial regions, the posterior margin of the clivus, and the spinal canal. Cervical and upper thoracic spine extra-axial hematomas were confirmed by subsequent magnetic resonance imaging of the spine. No abnormality was noted in the area of the lumbar spine where the CSF drain had been placed.

Despite these findings, the patient's neurologic status remained stable. Because of this, the patient's multiple medical problems, and her recent history of complex aortic surgery, the surgical care team and neurosurgical consultants decided to continue close observation but with the understanding that any deterioration in clinical status or worsened radiographic findings would necessitate surgical intervention.

The anesthesia team was consulted for consideration of the role of a possible epidural blood patch. A combined discussion among the anesthesia, neurology, neurosurgery, and cardiac surgery teams resulted in consideration of placement of an epidural blood patch in an attempt to prevent further expansion of the SDH. The decision was made to proceed, and informed consent from the family was obtained for the placement of an epidural blood patch. The patient was placed in

Fig 2. A head CT scan performed on POD 2 showing an 11-cm wide subdural collection in the left occipital region as well as collections in the anterior and posterior falcine and the right frontoparietal regions. R, right; A, anterior; P, posterior.

the lateral position, and under sterile conditions the epidural space at L3-4 was identified by using loss of resistance to saline with a 17-G Tuohy needle. Another anesthesiologist obtained 25 mL of autologous blood from the patient's forehand under sterile conditions. This was placed in the epidural space without any complications.

A CT scan (Fig 3) performed on POD 5 showed an improvement in the appearance of the multiple extra-axial hematomas without displace-

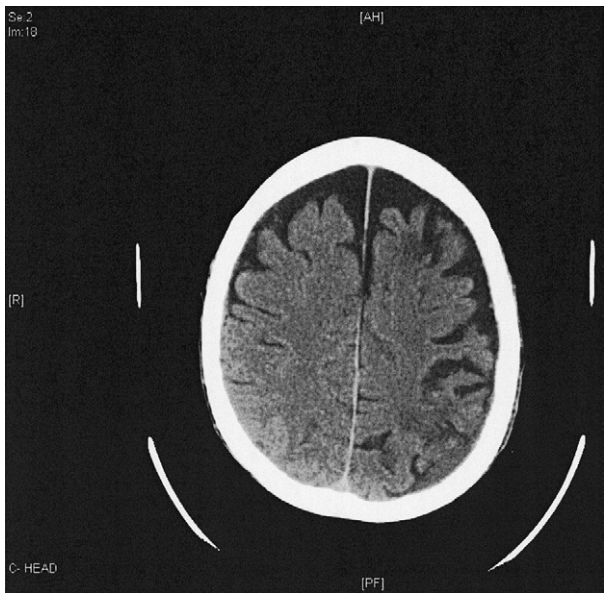

Fig 3. A head CT scan performed 1 day after the placement of an epidural blood patch showing resolution of the previously seen subdural collections.