

Giant size abdominal aortic aneurysm repair using open proximal anastomosis under hypothermic circulatory arrest: A report of two cases

Hakan Vural, MD,^a Tamer Türk, MD,^a Tuğrul Göncü, MD,^a Serhat Yalçınkaya, MD,^b Şenol Yavuz, MD,^a and Ahmet Özyazıcıoğlu, MD,^a Bursa, Turkey

Hypothermic total circulatory arrest and open proximal anastomosis techniques are not commonly used in abdominal or juxtarenal abdominal aortic aneurysm repair. Proximal aortic clamping is usually adequate for surgical repair of abdominal aortic pathologies. We present two cases of giant-sized abdominal aortic aneurysms, one was juxtarenal and one was a Crawford type IV thoracoabdominal aneurysm, that were repaired by using open proximal anastomosis under hypothermic total circulatory arrest and a transabdominal approach. This technique may be useful for both thoracoabdominal and large abdominal aortic aneurysms because it offers the opportunity to not clamp the aorta and operate in bloodless surgical field. (*J Vasc Surg* 2007;46:363-5.)

Hypothermic total circulatory arrest (HCA) is an accepted method for thoracoabdominal aortic aneurysm (TAA) repair that minimizes the risk of spinal cord and abdominal visceral ischemia.^{1,2} Open proximal anastomosis is generally used in repairs of ascending aortic or TAA under HCA conditions. These techniques, however, together are not commonly used for juxtarenal or abdominal aortic aneurysm (AAA) repairs because proximal aortic clamping is generally adequate for operative repair of abdominal aortic pathologies. Yet, sometimes aortic clamping may prove impossible because of the giant size of the aneurysm.

We present two cases of giant size AAA that were repaired under HCA by using an open proximal anastomosis technique through a transabdominal approach combined with median sternotomy.

CASE REPORTS

Patient 1. A 73-year-old man presented to our clinic with pain and a pulsatile abdominal mass. An abdominal ultrasound scan revealed a giant Crawford type IV chronic aneurysm. A computed tomography (CT) scan revealed an aneurysm extending from the inferior diaphragmatic border to the iliac bifurcation (Fig 1). The aneurysm was 16 cm long and was 11 cm in maximal diameter. The patient's medical history included an abdominal surgical intervention owing to gastric perforation.

The patient underwent operation for the abdominal aortic lesion through transabdominal approach combined with median sternotomy (Fig 2). Cardiopulmonary bypass was established by standard aortic and caval cannulation, then hypothermia was provided, and retrograde cerebral perfusion was started.

The aorta was opened under HCA when the anal temperature fell to 18°C. The open anastomosis of the proximal site of the graft was performed without using clamps. The field was clean because of HCA (Fig 3, A). Anastomoses of renal and visceral arterial branches with separate Dacron grafts (Vascutek, Terumo, Scotland) were performed during the HCA period (Fig 3, B). After completion of the proximal and visceral anastomoses, the distal graft was clamped, HCA was finished, and the distal anastomoses were performed. We did not use selective perfusion of the renal or visceral arteries or cerebrospinal fluid drainage.

Total bypass time was 139 minutes, HCA time was 39 minutes, and rewarming time was 55 minutes. The patient received mechanical ventilation and inotropic support for the following 48 hours. Six units of erythrocyte suspension were transfused during the hospitalization. His postoperative course was uneventful, and he was discharged on postoperative day 15. After 7 months of follow-up, no problem was encountered.

Patient 2. A 69-year-old man was admitted to our clinic because of abdominal and back pain and was diagnosed by CT scan as having a juxtarenal AAA with a maximal diameter of 10 cm. This patient had also had an abdominal surgical intervention owing to intestinal volvulus, leading to firm abdominal visceral adhesions.

This patient was operated on using the above-mentioned technique. In this case, total bypass time was 146 minutes, HCA time was 38 minutes, and rewarming time was 59 minutes. The patient was extubated 13 hours after the procedure and needed inotropic support for >36 hours. Five units of erythrocyte suspension were transfused during his hospitalization. The patient's postoperative course was uneventful, and he was discharged on postoperative day 12. After 12 months of follow-up, no problem was encountered.

DISCUSSION

Giant-sized AAAs are infrequently seen. The repair of these giant aneurysms presents a challenge during the surgery because aortic clamping can be very difficult owing to their size. Surgical repair of TAA and AAA is characterized by specific problems concerning operative techniques and circulatory support during the proce-

From the Department of Cardiovascular Surgery,^a Thoracic Surgery Division,^b Bursa Yüksek İhtisas Education and Research Hospital.

Competition of interest: none.

Reprint requests: Dr Hakan Vural, Bursa Yüksek İhtisas Education and Research Hospital, 16330 Bursa, Turkey (e-mail: ahvural@gmail.com). 0741-5214/\$32.00

Copyright © 2007 by The Society for Vascular Surgery.

doi:10.1016/j.jvs.2007.03.018

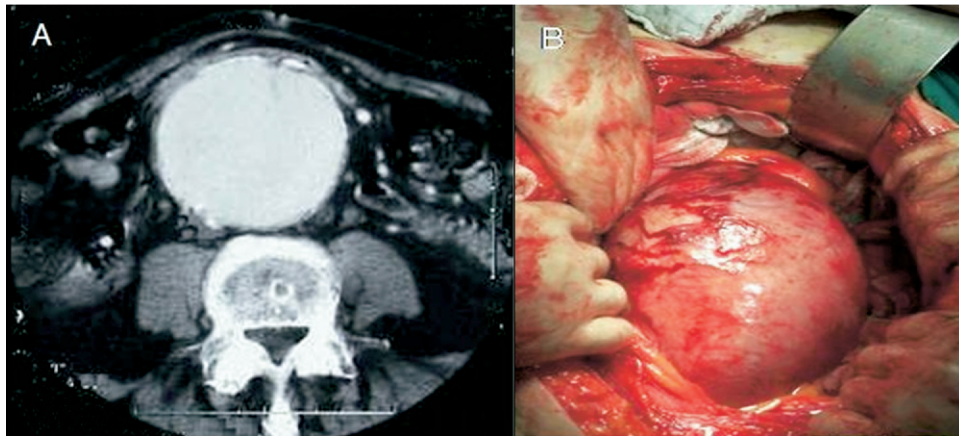


Fig 1. A, A computed tomography scan and (B) an intraoperative photograph show the giant abdominal aortic aneurysm in patient 1.

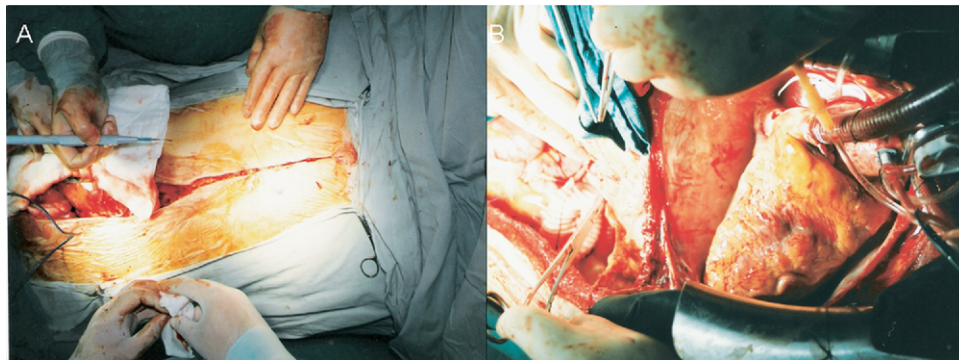


Fig 2. A, Transabdominal approach with median sternotomy incision. B, Aortic and caval cannulation with the abdomen exposed.

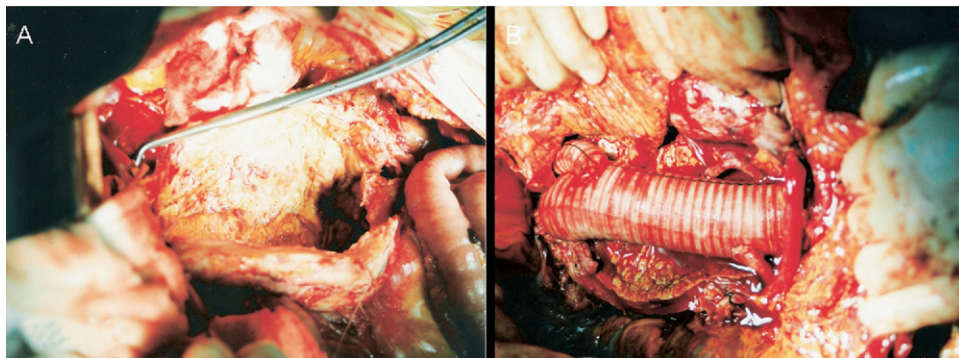


Fig 3. A, The aneurysm sack opened before the anastomosis. B, After all anastomoses are completed.

ture. The complications related to TAA are well defined in the literature, including spinal cord ischemic injury, renal failure, and mesenteric ischemia. Duration of ischemia is very important for the spinal cord, kidneys, and other viscera.^{1,2}

HCA is a useful adjunct for operations of the TAA. The safety and efficacy of this technique compared with other

methods, such as simple aortic clamping, partial cardiopulmonary bypass, and regional hypothermia, is not clearly established.¹⁻³ Simple aortic clamping is sometimes not sufficient for AAA repair. After a thorough search of the literature available to us, we could not find any reports describing AAA surgery using HCA and open proximal anastomosis. Although HCA has some disadvantages, such

as in coagulation disorders and in lung complications, it seems to be a useful method in cases of reoperations and in cases such as presented here, when the aneurysm has a giant diameter.³ Open proximal anastomosis under HCA may be useful for the replacement of diseased giant-sized TAA and AAA because of the advantage of a nonclamping anastomosis with a bloodless surgical field.³⁻⁵

Use of the deep hypothermia in surgery for the TAA repair provides adequate protection of the spinal cord, kidneys, and abdominal viscera. In chronic TAAs or juxtarenal AAAs, the intercostal arteries and some vertebral arteries are usually not patent within the diseased segment owing to laminated thrombus, and distal spinal cord perfusion is already largely dependent on collateral channels.^{1,2,6,7} This is the reason why we did not use selective organ perfusion in these two patients.

Both patients were laterally positioned, and the size of the AAA and previous operations made it almost impossible to reach the contralateral renal arteries. Owing to the size of the AAAs, transaortic clamping would not suffice, and it was necessary to use HCA. We believe that HCA and open proximal anastomosis may be preferred in these situations, despite the clear disadvantages of HCA, as mentioned. The open proximal anastomosis also eliminates clamp injury and provides excellent surgical exposure.⁵

In a supine patient, it is hard to perform large-bore arterial and venous cannulation with retrograde cerebral perfusion without a median sternotomy. Because AAAs also require peripheral anastomosis, femoral arterial cannulation cannot be used either. We also could not use the subclavian artery and femoral vein for cannulation because retrograde cerebral perfusion would be extremely hard with subclavian artery cannulation, and femoral vein flow would not suffice in cooling and warming the patient properly. We believe the only practical way of establishing HCA and retrograde cerebral perfusion in the supine patient is a

median sternotomy with aortic and caval cannulation. Thus, we preferred the transabdominal approach combined with median sternotomy in both patients.

We do not advocate our technique as the first choice in treating all AAAs. We want to emphasize that in patients with giant AAAs and a history of abdominal surgery, a transabdominal approach combined with median sternotomy with open proximal anastomosis under HCA may be a useful method to visualize both renal arteries and all the intra-abdominal vasculature in a bloodless surgical field.

REFERENCES

1. Kouchoukos NT, Masetti P, Rokkas CK, Murphy SF. Hypothermic cardiopulmonary bypass and circulatory arrest for operations on the thoracic and thoracoabdominal aorta. *Ann Thorac Surg* 2002; 74:1885-7; discussion 1892-8.
2. Kouchoukos NT, Masetti P, Rokkas CK, Murphy SF, Blackstone EH. Safety and efficacy of hypothermic cardiopulmonary bypass and circulatory arrest for operations on the descending thoracic and thoracoabdominal aorta. *Ann Thorac Surg* 2001;72:699-708.
3. Okada Y, Kazui T. Case report of thoracoabdominal aneurysm operation using profound hypothermia and circulatory arrest. *Kyobu Geka* 1996; 49:1105-9.
4. Doi K, Rikitake K, Naito K, Norita H, Natsuaki H, Ito T. A report of 4 cases of aortic operation using open proximal anastomosis under the hypothermic circulatory arrest and left lateral exposure. *Kyobu Geka* 1999;52:751-5.
5. Murata S, Adachi H, Mizuhara A, Yamaguchi A, Kamio H, Into T. Replacement of descending thoracic aorta using open proximal anastomosis under hypothermic circulatory arrest. *Nippon Kyobu Geka Gakkai Zasshi* 1996;44:9-13.
6. Okita Y, Takamoto S, Ando M, Morato T, Yamaki F, Matsukawa R, et al. Repair for aneurysms of the entire descending thoracic aorta or thoracoabdominal aorta using a deep hypothermia. *Eur J Cardiothorac Surg* 1997;12:120-6.
7. Carrel TP, Berdat PA, Robe J, Gysi J, Nguyen T, Kipfer B, et al. Outcome of thoracoabdominal aortic operations using deep hypothermia and distal exsanguination. *Ann Thorac Surg* 2000;69:692-5.

Submitted Feb 5, 2006; accepted Mar 9, 2007.