In the presented case, valve function was normal and there was no evidence of paraprosthetic leakage. Due to the preceding operations, it was decided to implant a 19-mm St Jude Medical aortic valve prosthesis. This resulted, however, in a mismatch between valve size and body surface area and, consequently, in an artificial obstruction of left ventricle outflow.

Cooley and colleagues⁵ previously reported creation of double-outlet left ventricles in a number of patients with severe left heart outflow tract obstruction. The left lateral transthoracic approach, performed in this case, gives direct access to the descending aorta and makes the operation less complex. In creating this conduit, the surgeon has the choice of biologic or mechanical valves. This patient received a mechanical valve-containing conduit due to the mechanical valve in aortic position. Both the anemia and all hematological alterations disappeared after the operation. The gradient over the aortic valve returned to near-normal values and the left ventricular hypertrophy regressed.

Implantation of an apicoaortic conduit can be considered as a

valuable alternative to repeated aortic valve replacements in selected patients with complex stenosis of the left ventricular outflow tract.

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Selective perfusion of preoperatively identified artery of Adamkiewicz during repair of thoracoabdominal aortic aneurysm

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Research Group

In the surgical repair of thoracoabdominal aortic aneurysm (TAAA), preoperative localization of the artery of Adamkiewicz with intraoperative selective perfusion thereof has a bearing on the prevention of spinal cord injury. We report our method for delineating the Adamkiewicz artery with multidetector row computed tomography (MDCT) with selective perfusion through a distal perfusion cannula that is clinically available for off-pump coronary artery bypass. The method is expected to

minimize the ischemic time of the spinal cord and attenuate the reperfusion injury.

The tip of a distal perfusion catheter designed for off-pump coronary artery bypass (Medtronic Quickflow; Medtronic, Inc, Minneapolis, Minn) is soft and atraumatic, making it applicable for selective perfusion of the segmental arteries. The femorofemoral venoarterial bypass is branched off into selective perfusion of the segmental arteries with an independent roller pump and heat exchanger. In this way, selective hypothermic perfusion of the spinal cord is feasible. Our method of visualization of the Adamkiewicz artery is MDCT scanning with injection of contrast medium directly into the proximal descending aorta, or MDCT during aortography.¹ Compared with the methods used by other investigators who have used magnetic resonance imaging or MDCT,²⁻⁴ in which contrast medium was administered into a peripheral vein, our method provides a clearer image because of a high concentration of contrast medium in the small-caliber arteries.

MDCT during aortography is performed with an MDCT scanner (Lightspeed Qxi; GE Medical Systems, Milwaukee, Wis). At first, a 5F pigtail catheter is percutaneously inserted through the femoral artery on the scanning table of MDCT under fluoroscopic

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Received for publication June 4, 2003; accepted for publication July 14, 2003.

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J Thorac Cardiovasc Surg 2004;127:272-4

0022-5223/\$30.00

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doi:10.1016/j.jtcvs.2003.07.028

Figure 1. Curved planar reformation image demonstrates complete continuity of right 9th intercostal artery, its posterior branch, and artery of Adamkiewicz with characteristic hairpin-curve appearance.

Figure 2. Distal perfusion cannula 2.0 mm in diameter were inserted into intercostal arteries, and 4-0 polyethylene sutures were placed to tourniquet catheters. Ninth, 10th, and 11th intercostal arteries were reattached to three side arms of vascular graft.

guidance with a mobile fluoroscopic system (OEC9600; GE OEC Medical Systems, Salt Lake City, Utah). The tip of the catheter is placed distal to the left subclavian artery. Through the catheter, 100 mL iomeprol 400 mg I/mL (Iomeron; Eisai Co, Ltd, Tokyo, Japan) is injected into the aorta at a rate of 5 mL/s. Image acquisition is performed during a single held breath with 4.5-second scanning delays from initiation of contrast material injection. Lower descending aorta to abdominal aorta (from T8 to L3 level, the range involving the aneurysm) is scanned in a cephalad to caudal direction with a detector collimation of 4×1.25 mm with a table speed of 9.4 mm/s, pitch of 6, and image thickness of 1.25 mm. All images are reviewed on a workstation (Advantage Windows 3.1; GE Medical Systems) to investigate the continuity between the Adamkiewicz artery and its proximal segmental artery

with paging, multiplanar reformation, and curved planar reformation.

A 60-year-old-female patient was admitted for surgical treatment of Crawford type III TAAA. Preoperative MDCT during aortography showed the Adamkiewicz artery to originate from the right lateral branch of the 9th intercostal artery (Figure 1). For the surgical procedure, a standard left thoracoabdominal retroperitoneal incision was made. The femorofemoral venoarterial bypass was established with systemic heparinization.

The perfusion flow rate was $40 \text{ mL} \cdot \text{kg}^{-1}$, adjusted to keep the proximal systolic pressure normal. Systemic temperature was maintained above 34°C by a heat exchanger. A protein-impregnated Dacron polyester fabric graft (Hemashield; Meadox Medical, Oakland, NJ) 26 mm in diameter was used. In advance of

Figure 3. Postoperatively repeated MDCT angiography showed that Adamkiewicz artery originated from side branch of vascular graft.

aortic crossclamping, four vascular grafts with a diameter of 10 mm and a length of 5 cm were attached as branches of the tube graft, to be used for reattachment of the segmental arteries. A proximal aortic anastomosis was performed under segmental double crossclamping. Then the distal clamp was transferred to the level proximal to the celiac trunk, and the aneurysm was opened. The intercostal artery pairs at T9, T10, and T11 were patent. Distal perfusion cannulas 2.0 mm in diameter were inserted into the respective intercostal arteries (Figure 2). Polyethylene sutures (4-0) were placed to tourniquet the catheters. Segmental arteries were perfused with total flow ranging between 50 and 100 mL/min at a circuit pressure of 100 mm Hg. Reattachment of the 9th intercostal arteries related to the Adamkiewicz artery was carried out. Then the proximal vascular clamp was transferred distally for immediate restoration of spinal cord circulation. The 10th and 11th intercostal arteries were reattached to the other two side arms of the vascular graft, which were continuously perfused during the

anastomoses. Reconstruction of abdominal vessels was carried out with 4-0 polyethylene sutures. The aorta was declamped after distal aortic anastomosis. Postoperatively repeated MDCT angiography showed that the Adamkiewicz artery originated from a side branch of the vascular graft (Figure 3). Since April 2002 at our institution, 3 consecutive patients with TAAA have undergone graft replacement by the methods described. All patients survived surgery without any neurologic complications.

The benefits of identifying the Adamkiewicz artery by a non-invasive modality have previously been reported.^{2,5} MDCT during aortography improves the quality of imaging of the Adamkiewicz artery by arterial enhancement of contrast medium. A distal perfusion catheter designed for off-pump coronary artery bypass is ideal for selective perfusion of the segmental arteries. Perfusion of the preoperatively identified Adamkiewicz artery adds reliability as an adjunct to the prevention of paraplegia by maintaining the major blood supply to the spinal cord throughout anastomosis. Although further study is needed, the method described may refine surgical management of TAAA repair.

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