Total laparoscopic abdominal aortic aneurysm repair with reimplantation of the inferior mesenteric artery

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We performed a total laparoscopic reimplantation of the inferior mesenteric artery (IMA) during laparoscopic infrarenal aortic aneurysm repair. The postoperative course was uneventful, and angiograms showed a patent IMA after reimplantation. To our knowledge, total laparoscopic reimplantation of the IMA in human beings has not previously been described. (J Vasc Surg 2004;39:1115-7.)

Ischemic colitis is an infrequent but serious complication that can occur after aortic repair in about 2% of patients, with an attendant mortality rate of 50%.[1,2]

Recently aortic surgery entered the field of laparoscopic surgery. With the development of laparoscopic aortic surgery to treat aortic aneurysms, vascular surgeons are faced with the need to revascularize the inferior mesenteric artery (IMA) to prevent ischemic colitis.[3-5] Since February 2002 we have performed 45 total laparoscopic abdominal aortic aneurysm (AAA) repairs, 30 at our institution and 15 at other centers. At the beginning of our experience, only patients with simple AAAs were scheduled for laparoscopic repair. After the first 15 procedures we decided to include all patients with infrarenal AAAs for total laparoscopic repair. In one patient IMA reimplantation was necessary.

We present what we believe to be the first case report of total laparoscopic AAA repair with reimplantation of the IMA.

CASE REPORT

A 70-year-old man, weighing 92 kg (body mass index, 32.59 kg/m^2), a tobacco user, with chronic obstructive pulmonary disease, was referred to our institution for treatment of an infrarenal AAA. A computed tomography (CT) scan demonstrated an aneurysm 55 mm in diameter, with mural thrombus, and a moderately calcified aorta. At angiography the internal iliac artery and IMA were patent. The patient was scheduled to undergo total laparoscopic endoaneurysmorrhaphy with aortoaortic bypass, under general anesthesia. He was placed in a dorsal decubitus position, with an inflatable pillow (Pelvic-Tilt; O. R. Comfort, Glen Ridge, NJ) placed behind the left flank, which gives 50-degree to 60-degree rotation of the abdomen. Maximum right rotation of the operating table affords an abdominal slope of 70 to 80 degrees. The video monitor was viewed distally on the left side of the patient. The surgeon operated on the right side, facing the patient's abdomen.

A pneumoperitoneum was insufflated up to 14 mm Hg through a Veress needle. A 45-degree endoscope (Storz-France SA, Paris, France) was positioned on the left anterior axillary line, 3 cm below the costal margin. Two 10-mm trocars were placed at the supraumbilical and left paramedian level for insertion of the operator's instruments. A 10-mm trocar was placed under the xyphoid. At the beginning of the procedure an endoretractor (Endoretract II; USSC, Autosuture Co, Elancourt, France) was introduced through this port to maintain the left mesocolon. Another 10-mm trocar was positioned 6 cm below the navel to introduce one iliac clamp. A 10-mm trocar was placed in the left lower abdomen for insertion of the assistant's instruments. A left retrocolic dissection was conducted in line of the Toldt fascia down to the left renal vein. The infrarenal aorta, the IMA, and the two common iliac arteries were then exposed and dissected.

Before clamping, sutures were prepared for anastomoses and control of lumbar arteries. Multiple 3/0 or 4/0 polypropylene sutures (Prolene; Ethicon, Johnson & Johnson International, Brussels, Belgium) were knotted on Teflon pledgets.[6]

A bolus of heparin was administrated. An infrarenal aortic celioscopic clamp (Storz-France SA) was positioned. A stitch was placed in the left part of the aneurysm sac and pulled out through the right abdominal wall to open the aneurysmal sac after the aortotomy. Right common iliac clamping was performed with a celioscopic clamp through an infraumbilical trocar. A clamp was positioned percutaneously at the paramedian level, 6 cm below the navel, for left common iliac clamping. The IMA was clamped with a detachable bulldog clamp. The aneurysm sac was opened longitudinally on the left side. The mural thrombus was removed with a container. Lumbar arteries were externally controlled with clips (Ligaclip ERCA; Ethicon). The posterior walls of the proximal and distal aortic necks were incised. A total laparoscopic aortoaortic bypass was performed with a woven tube graft (Gelweave; Vascutek-Terumo, Incchinnan, Scotland).

At the end of the procedure perioperative Doppler ultrasound scans (Ultrasonic Doppler Flow Detector, model 811b; Parks Medical Electronics, Aloha, Ore) showed that vascular flow to the left colon was compromised. Moreover, backbleeding from the

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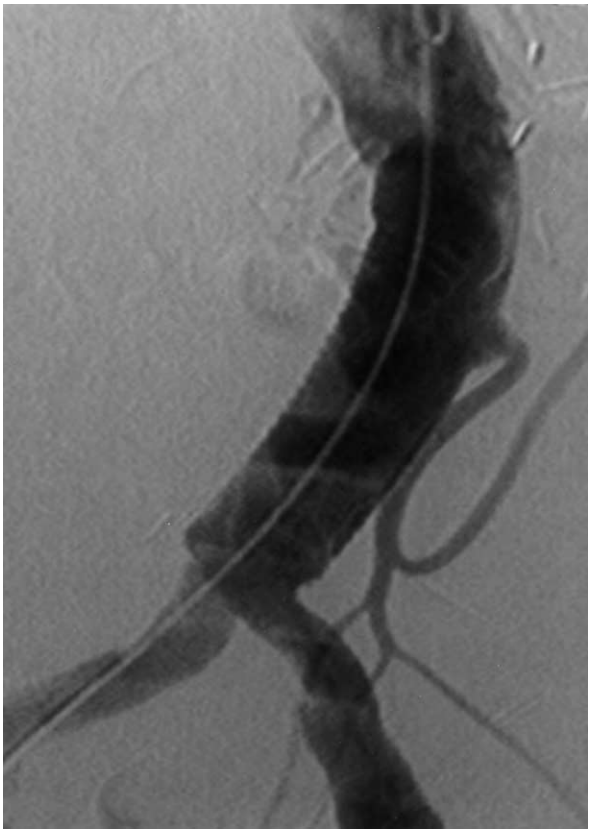

Postoperative angiogram shows aortoaortic bypass graft with inferior mesenteric artery reimplantation.

IMA was poor, and the colon was gray, without peristalsis. Colon viability was not ensured.

We decided to reimplant the IMA on the prosthesis. During the preparation of stitches intended for the IMA reimplantation the graft prosthesis was unclamped for 15 minutes. The clamps were repositioned. A small prothetotomy was performed on the left side of the tube graft. The IMA was prepared for implantation on the bypass. A button of aortic wall surrounding the ostium of the IMA was preserved for easier suturing. The laparoscopic IMA reimplantation was performed end-to-side. The anastomosis was begun at the heel, with free 5/0 polypropylene suture. The anastomosis was performed with two hemicircunferential polypropylene running sutures previously knotted on Teflon pledgets. At the end of the running sutures, stitches were tied together intracorporally. At the end of the procedure, reimplantation of the IMA demonstrated good anatomy, without kinking, and the left colon color was normal. Peroperative Doppler ultrasound scanning was performed to assess the patency of the reimplanted IMA. The patient was placed supine, and the left mesocolon was repositioned to avoid any contact between the prosthesis and the intestine.

The duration of surgery was 220 minutes. Aortic cross-clamping time was 80 minutes for the aortic bypass and 35 minutes for reimplantation of the IMA. Blood loss was 764 mL, and the patient was given 7000 mL of crystalloids.

Extubation was performed on the same day. The postoperative course was uneventful, with excellent recovery, minimal complaints of pain, and return to general diet on the fifth day. The postoperative length of stay was 11 days. A control angiogram (Fig) showed a patent IMA without morphologic abnormalities on the tube graft.

At 2-month follow-up recovery was complete and the patient had no clinical symptoms. No hemodynamic or morphologic anomalies were observed on follow-up ultrasound and CT scans.

DISCUSSION

Surgery to treat AAAs is associated with a higher risk for ischemic intestinal complications than other aortic procedures.[7] Revascularization of the IMA during AAA repair is judged necessary in 2% to 5% of patients.[8]

The role of the IMA in preventing colonic ischemia is highly controversial. Some authors attach much importance to the IMA in preventing colonic ischemia, and advocate systematic reimplantation of this artery if it is patent.[3,9] Others believe reimplantation of the IMA does not reduce the incidence of colonic ischemia.[10] Furthermore, multiple techniques have been developed to assess the adequacy of collateral blood flow to the left side of the colon,[11-13] but none appears absolutely reliable.

With the development of total laparoscopic AAA repair, vascular surgeons could be faced with the need to revascularize the IMA laparoscopically. In our patient IMA reimplantation was necessary because vascular flow to the left colon was compromised despite aortic unclamping and correct internal iliac artery perfusion. This was the only instance of colonic hypoperfusion in our series of laparoscopic AAA repairs. The incidence of this complication is in accordance with that reported in the literature. In these rare cases conversion to a minilaparotomy can be made. However, taking advantage of our experience with total laparoscopic aortic surgery, we decided to reimplant the IMA laparoscopically.

Dion et al[14] reported IMA reimplantation in a porcine model. In a preliminary study we demonstrated that laparoscopic reimplantation of the IMA in six cadavers was feasible (unpublished data). It was performed as in open surgery, with a button of aortic wall. With our laparoscopic approach the shifting of intraabdominal organs is facilitated, with the small bowel and left mesocolon dropped into the right part of the abdomen. The operator is facing the patient's abdomen and is not bothered by the orientation of surgical instruments. This stable exposure allows total laparoscopic endoaneurysmoraphy and anastomoses. However, the main risks of IMA reimplantation are twist and kinking when the left mesocolon is repositioned. To avoid this, reimplantation needs to be performed on the left side of the aortic prosthesis. However, the drawback to our technique is the lack of perioperative anatomic control when the mesocolon falls into place.

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