

robotic positioned arms are connected to the operating table rails and prepared into the sterile field, one for a 30 degree endoscope (Aesop Endoscope Positioner®, Computer Motion) on the right, and two instrument arms on the left side of the patient. The arms are then simply rotated away to allow aortic dissection with conventional laparoscopic techniques. Via small groin incisions, the common femoral arteries are dissected free bilaterally. Laparoscopic retroperitoneal dissection of the aorta is performed following the creation of a peritoneal "apron" that is being suspended to the anterior abdominal wall. This technique, using six 10 mm trocars, has been described in detail by one of the authors (CG). Lumbar arteries at the proposed site of aortic clamping are ligated with clips and the inferior mesenteric artery is temporarily occluded. The aorta is clamped just distal to the renal arteries and below the inferior mesenteric artery and an aortotomy made. A 14 × 7 mm polytetrafluoroethylene (PTFE) prosthesis is anastomosed end-to-side by means of robotically steered instruments consisting of a needle driver on the right and a grasper on the left, as well as a voice-controlled robotically positioned endoscope (Micro Joint Heavy Needle Driver®, Micro Joint De Bakey Grasper® and Aesop Robotic Endoscope Positioner®, Computer Motion). The robotic positioned arms are controlled from a separate control console. Following completion of the aortic anastomosis the two graft limbs are tunnelled to the groins where a conventional end-to-side anastomosis is performed to the common femoral artery.

## *Results*

There were no operative complications. Operating times were 220 to 360 (mean 250) minutes, respectively, with aortic clamp times of 35 to 110 (mean 47) minutes. The long clamp time in one patient was due to technical problems with the camera system. Time to set up the robotic positioner arms and connect the robotic instruments was 17 (± 5) minutes. Blood loss was less than 200 cc's in all cases. A normal diet was resumed on the second postoperative day (POD) and four of five patients were discharged home between POD 4 and 7. One patient died on postoperative day 3 due to a massive myocardial infarction. At autopsy, pin-point coronary stenoses were found that had been missed during pre-operative cardiac work up. The aortic anastomosis was found to be intact.

## *Discussion*

In a continued search to reduce operative trauma, minimally invasive procedures such as laparoscopy assisted and hand assisted laparoscopic aortofemoral bypass have been developed whereby the entire aortic dissection is performed laparoscopically except for the aortic anastomosis, requiring an abdominal incision of 7 cm or more. Indeed, creation of an aortic anastomosis with conventional laparoscopic techniques is demanding, in particular when laparoscopic experience is limited. The addition of robotic technology, however, provides an ergonomic and natural interface between the surgeon's hands and the instrument tips, as well as increased freedom of motion due to wrist action of the robotic instruments. In the patients described, the aortic anastomosis was performed successfully by a vascular surgeon (WW) with limited laparoscopic training and experience, under supervision and assistance, however, of two surgeons with ample laparoscopic (MAC and CG) and robotic (CG) skills. Clearly, considering the limitations of this small report, nothing