Floppy aortic graft reconstruction for germ cell tumor invasion of the infrarenal aorta

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Significant aortic invasion by metastatic nonseminomatous germ cell tumors can present difficult problems intraoperatively in attempted curative retroperitoneal lymph node dissection. Aortic replacement with Dacron graft has been a successful method of dealing with this predicament. We describe a new approach of intraoperative floppy aortic graft reconstruction in a young patient with testicular germ cell cancer in whom a 14 cm pseudoaneurysm involving the infrarenal aorta developed after four courses of preoperative chemotherapy. This technique prevents significant lower extremity and pelvic ischemia during resection of the aorta and retroperitoneal tumor while providing the urologic surgeon with excellent exposure and minimal interference from the aortic graft. (J Vasc Surg 2003;37:889-91.)

INTRODUCTION

Preoperative treatment of advanced germ cell tumors with cisplatin, etoposide, and bleomycin has enabled consideration of curative resection in a group of patients who otherwise would not be surgical candidates because of bulky retroperitoneal disease. After normalization of the serum tumor markers α-fetoprotein and β-human chorionic gonadotropin (β-HCG) with chemotherapy, residual nonseminomatous tumor is present in 10% of patients, and teratoma is present in 40% of patients.[1]

It is not unusual to have retroperitoneal tumor extension to the aorta or vena cava because of the close proximity of the periaortic lymph node chains, and frequently it is necessary to dissect in a subadventitial plane to successfully remove the tumor and achieve adequate margins. A small percentage of patients will require replacement of the aorta, either because of inclusion in an en bloc resection or because of nonrepairable injury during subadventitial dissection.[2]

We describe a new approach of floppy aortic graft reconstruction in a young patient with bulky stage T3 testicular germ cell tumor in whom a large infrarenal aortic pseudoaneurysm secondary to tumor necrosis developed after preoperative chemotherapy.

CASE REPORT

The patient, a 20-year-old man, had a several month history of abdominal pain. Physical examination revealed a large abdominal mass and an enlarged left testicle. A staging computed tomography (CT) scan demonstrated bulky retroperitoneal disease with encasement of the aorta and multiple pulmonary metastases. Pathologic analysis after left-sided orchiectomy revealed embryonal cell carcinoma. After initiation of chemotherapy, consisting of three courses of bleomycin, etoposide, and cisplatin and one course of etoposide, cisplatin, and ifosfamide, there was a substantial decrease in β-HCG, from 21,000 to normal. At this point, however, the patient had an enlarging pulsatile mass in the epigastrium and left upper quadrant. Pulses were not palpable in the lower extremities, but there were no signs of acute ischemia. The patient's poor performance status after chemotherapy precluded enough exercise to produce claudication. Repeat CT demonstrated a 14 cm pseudoaneurysm involving the proximal aorta just below the level of the renal arteries and extending to the anterior abdominal wall (Fig 1). Although a fifth course of chemotherapy had been planned, it was elected to proceed with surgical resection because of risk for pseudoaneurysm rupture.

A left thoracoabdominal incision was made to provide adequate exposure. Control of the descending thoracic aorta was obtained before entering the abdomen. A large aneurysmal mass consisting of aorta and tumor was immediately visible (Fig 2). The left renal vein was divided to provide better visualization of the aneurysm neck. Two renal arteries were noted bilaterally, and all were isolated. Tumor involved the proximal right common iliac artery and extended to the left common iliac artery bifurcation. The left internal iliac artery was doubly ligated and divided in anticipation of left common iliac artery resection.

Heparin was administered, and the infrarenal aorta and iliac vessels were cross-clamped. The geometry of the tumor and neck of the aneurysm required placement of the aortic clamp proximal to the left inferior renal artery. The aorta was transected after entering the aneurysm sac. The proximal aortic margin was negative for tumor at frozen section analysis. A 14 × 7 mm bifurcated Dacron graft (Hemashield; Meadox Medicals, Oakland, NJ) was sewn to the proximal aorta, with no attempt made to shorten the aortic component. The right distal common iliac artery was transected, and the proximal end was oversewn. The right limb of the graft was sewn end-to-end to the common iliac artery, again without shortening the limb length. The same process was repeated for the left limb anastomosis to the left external iliac artery, and blood flow was restored. The resulting floppy aortic graft is shown in Fig 3.

Heparinization was reversed with protomine, and en bloc resection of the tumor mass with aorta and involved iliac vessels

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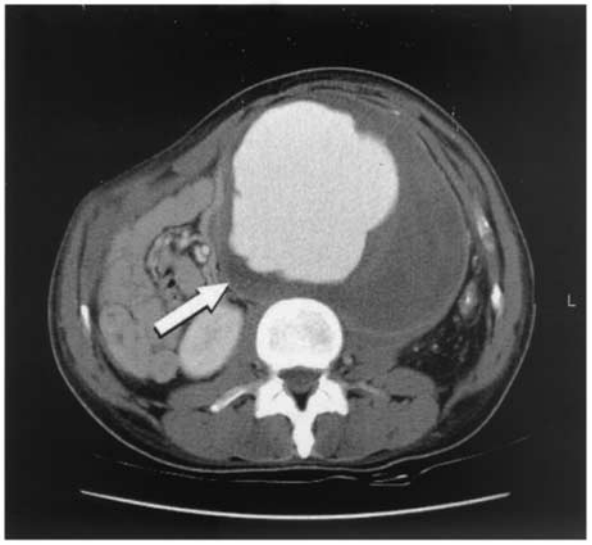

Fig 1. Abdominal CT scan after three cycles of conventional chemotherapy and one cycle of salvage chemotherapy at the level of the inferior pole of the right kidney demonstrates a 14 cm pseudoaneurysm *(arrow)* involving the aorta and tumor mass extending to the anterior abdominal wall. Retroperitoneal tumor is still evident. The nonvisualized vena cava is compressed and adherent to the mass.

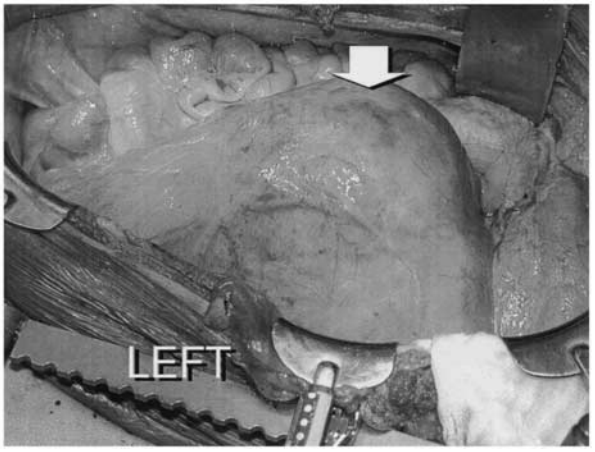

Fig 2. Pseudoaneurysm and tumor mass *(arrow)* are exposed via a left thoracoabdominal incision. Note displacement of the entire small bowel to the right side of the abdomen.

was performed. The floppy aortic graft was repositioned at different points during the dissection to provide optimal exposure (Fig 4). The vena cava was dissected free from the tumor and was found to be patent. The iliac veins could also be likewise preserved. The time required for dissection was 4½ hours.

After resection of the tumor mass, heparin was readministered, and the aortic and iliac limbs of the graft were clamped again. Because of the operative time and manipulation of the graft, it was elected to replace the bifurcated graft rather than shortening it.

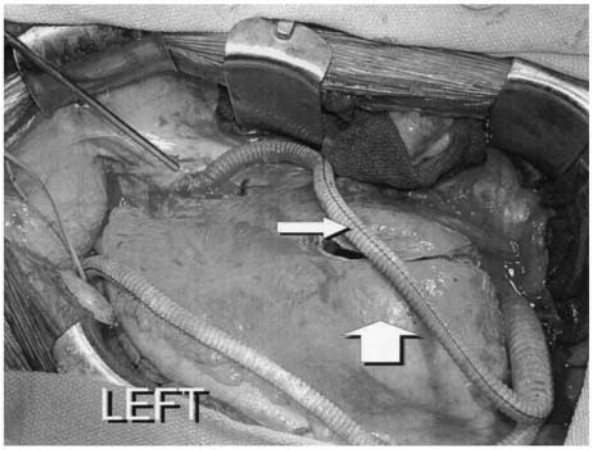

Fig 3. Floppy aortic graft is in place *(small arrow)* around the pseudoaneurysm-tumor mass *(large arrow)*, and circulation is reestablished to the pelvis and lower extremities.

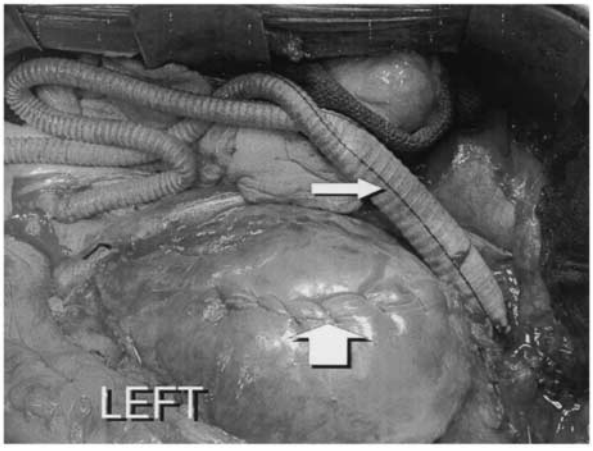

Fig 4. Floppy graft *(small arrow)* can be manipulated as necessary for retroperitoneal lymph node dissection. Aorta and tumor mass *(large arrow)* have been completely mobilized on the lateral margins and from the inferior vena cava.

Cuffs of graft were left in place on the aorta and iliac vessels, and a new Dacron bifurcated graft was used to reconstruct the aorta and iliac vessels (Fig 5). Care was taken to remove redundant graft during this process. The left renal vein was reanastomosed, and protomine was given. The graft was fully covered with omentum brought in through a fenestration in the transverse colon mesentery.

Examination of the specimen revealed replacement of the anterior and lateral aortic walls with tumor, with near occlusion of the origins of both iliac arteries. Pathologic analysis demonstrated abundant necrotic tissue and surrounding fibrous connective tissue, and a few viable tumor cells. The postoperative course was complicated by serous drainage through the upper abdominal portion of the incision, which resolved by postoperative day 4, and a large left pleural effusion that required drainage. Both lower

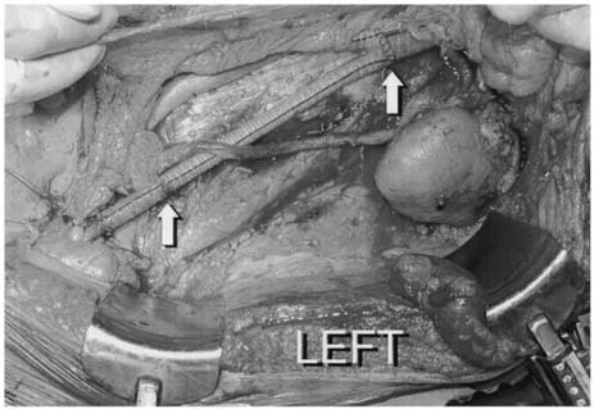

Fig 5. Floppy graft has been replaced and redundant portions removed. New graft is sewn to cuffs left from the original graft *(arrows)*. Omentum covers the right limb of the graft.

extremities now had palpable pulses. The patient continued to do well at the last follow-up 7 months after surgery, with no evidence of recurrent disease and tumor markers remaining normal.

DISCUSSION

Aortic involvement with germinal cell tumor requiring aortic resection is uncommon. Kelly et al[3] reported 6 of 97 patients over 5 years who required en bloc aortic resection during retroperitoneal lymph node dissection. In their series spanning 29 years, Beck et al[4] reported 15 of 1250 patients who required aortic resection, and 2 of 78 patients in a series reported by Morin et al[5] required aortic replacement.

Kelly et al[3] describe what is probably the usual method of aortic resection. The tumor mass is mobilized from the vena cava, proximal and distal dissection end points are established, and the specimen with aorta is removed by dividing posterior attachments and lumbar vessels after systemic heparinization. Aortic reconstruction is then performed with either a tube or a bifurcated graft, as appropriate.

Prevention of prolonged lower extremity ischemia is a major concern in a retroperitoneal dissection that may take a substantial amount of time because of intense fibrotic reaction from preoperative chemotherapy and the desire to preserve adjacent but uninvolved structures. Ting et al[6] report a case in which the inferior vena cava was used to replace involved aorta in the setting of tumor invasion of the duodenum with enteric spillage during resection. That patient developed bilateral lower extremity compartment syndrome and required fasciotomy after an aortic clamp time of 3 hours.

Use of an initial floppy aortic reconstruction before beginning retroperitoneal node dissection has several advantages. The main benefit we noted in this case was easier mobilization of the tumor and aorta by removing the requirement that native aortic continuity be kept intact. The large size of the aortic pseudoaneurysm would have otherwise made resection much more difficult, and inadvertent entry into the diseased aorta may have been difficult to control.

Lower leg ischemia time is more equivalent to that incurred during aortoiliac bypass grafting to treat occlusive or aneurysmal disease, enabling careful and unhurried resection of the aorta and tumor from the anterior spinal ligament. Systemic heparinization is not required during this portion of the procedure, which may decrease hemorrhage related to dissection.

After removal of the specimen, the aortic graft is revised to eliminate the redundant portions to prevent kinking associated with late graft dilation and subsequent obstruction and thrombosis.[7] We elected to replace the Dacron graft with a new one because of the chance of inadvertent graft contamination during retroperitoneal node dissection. A small amount of original graft cuff was left proximally and distally for convenience in performing the new anastomoses.

CONCLUSION

We describe a new technique, initial floppy aortic graft reconstruction, in a patient with germinal cell tumor invading the infrarenal aorta complicated by large pseudoaneurysm formation. After en bloc resection of the retroperitoneal tumor mass and aorta, the aortic graft was revised to remove redundancy and covered with omentum. This method has the primary advantage of affording excellent exposure for retroperitoneal lymph node dissection, and it removes the requirement of keeping native aortic continuity. Lower extremity and pelvic ischemia can be kept to a minimum, because blood flow is preserved during dissection of the inferior vena cava and removal of the tumor mass and aorta from posterior attachments and lumbar vessels.

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