Differential Flows in the Aortic Graft following Open Surgery of Infra-renal Aortic and Iliac Aneurysm

Vikas Deep Goyal*, Rajkumar Sharma†, Shelly Rana‡, Saurabh Sood§

†Department of Cardiothoracic and Vascular Surgery, Dr. Rajendra Prasad Government Medical College, Kangra, Himachal Pradesh, India, ‡Department of Surgery, Dr. Rajendra Prasad Government Medical College, Kangra, Himachal Pradesh, India, §Department of Anaesthesia, Dr. Rajendra Prasad Government Medical College, Kangra, Himachal Pradesh, India, †Department of Radiodiagnosis, Dr. Rajendra Prasad Government Medical College, Kangra, Himachal Pradesh, India

ABSTRACT

We present a case of combined abdominal and iliac artery aneurysm in 60-year-old male patient who previously had undergone bilateral below knee amputation of both legs due to embolization and subsequent gangrene. Patient was a chronic smoker and was also suffering from hypertension. Computed tomographic (CT) angiogram showed large aneurysm of the infrarenal aorta and right common iliac artery. Surgical intervention in the form of aneurysmorhaphy and aorto-biiliac grafting was done using 20 mm × 10 mm knitted gelatin impregnated bifurcation Dacron graft. The patient recovered well and was discharged after 10 days, post-operative CT angiogram done after 1 month showed difference of contrast enhancement in the anterior and posterior aspects of the graft, probably due to differential flows, turbulence, and stasis and thereby increasing the risk of graft thrombosis.

Keywords: Aneurysmorhaphy, aortic aneurysm, aorto-biiliac grafting, differential flows, iliac artery aneurysm, open surgery

INTRODUCTION

Combined aneurysms of the aorta and iliac vessels are uncommon. This case had separate aneurysms in the infrarenal abdominal aorta and right common iliac artery. Many techniques have evolved over time for the management of aneurysms from wrapping the aneurysmal sac, ligation and exclusion of the aneurysm, exclusion of the aneurysm with bypass grafting, aneurysmorhaphy, and recent advances like endovascular interventions in the form of stent grafts. Elective intervention is indicated in cases of abdominal aortic aneurysms of diameter >6 cm and iliac aneurysms >3 cm, other indications are a rapid increase in size (more than 1 cm increase in diameter per year) and pressure or compression on adjacent structures.

Urgent intervention is required for cases presenting with distal embolism, impending rupture, or ruptured aneurysm.

Recent advances in endovascular aneurysm repair have revolutionized the management of aortic aneurysms and in many centers, it has become the first line treatment. Results of open surgery have also improved overtime and long-term results are excellent with the open approach. Recent reports in the literature show that the mortality of the open approach in elective cases is <6% and comparative studies between open and endovascular techniques do not show a statistically significant difference between the two techniques in terms of early mortality, however, early morbidity of the endovascular approach is less than that of the open approach.

Late complications reported with open surgery include pseudo aneurysm formation, graft infection, thrombosis of the graft, whereas complications reported with endovascular techniques include reintervention for endoleaks, stent migration, thrombosis of the stent grafts, and even rupture of the stent graft. Hybrid techniques have
also evolved, and both the techniques are complimentary at times when one approach gives rise to complications other technique may be used to treat it.

**CASE REPORT**

We present a case of combined abdominal and iliac artery aneurysm in 60-year-old male patient who previously had undergone bilateral below knee amputation of both legs due to embolization and subsequent gangrene. Patient was a chronic smoker and was also suffering from hypertension. Clinical examination revealed large pulsatile mass in the periumbilical region with palpable femoral and popliteal pulsations. Computed tomographic (CT) angiogram (Figure 1a) was done, and it revealed large separate aneurysms of the infrarenal aorta (Figure 1b), diameter more than 8 cm and right common iliac artery (Figure 1c), diameter more than 5 cm. As the size of the aneurysm was large, and there was a risk of impending rupture, surgical intervention in the form of aneurysmorrhaphy and aorto-biiliac grafting was planned. This case was not suitable for endovascular repair as the proximal landing zone was inadequate and would have required branched stent grafts to renal vessels to prevent occlusion of renal vessels. Blood pressure of the patient was preoperatively stabilized with beta blockers and bronchodilators were also started to reduce pulmonary complications. The patient was operated under general anesthesia supplemented with epidural analgesia along with invasive arterial pressure and central venous pressure monitoring. Transperitoneal exposure of the aneurysm was done through midline laprotomy, adhesions between the aneurysm and surrounding structures were dissected. Blood pressure was controlled with nitroglycerine infusion and inhalational anesthetic drugs. Proximal control was obtained just below the renal vessels, and distal control was obtained in the iliac vessels of both sides. Patient was heparinized with 5000 IU of heparin, clamps were applied to the infrarenal aorta just below the renal vessels and iliac vessels as the anesthetists brought down the systolic pressure to 80 mmHg to prevent plaque rupture and embolization into the renal vessels and distally. Both the aneurysms were opened, large clots and atheroma was removed from the aneurysm sac and redundant wall of the aneurysms was excised. Repair was done using 20 mm × 10 mm knitted gelatin impregnated bifurcation Dacron graft (Vascutek). Proximal anastomosis was done to the infrarenal aorta just below the renal vessels and distal anastomosis were done to the external iliac artery on the right side and common iliac artery on the left side. Proximal anastomosis was done first followed by distal anastomosis in an end to end fashion, all the anastomosis were done using 5-0 polypropylene sutures in a single layer and continuous fashion. Declamp was also done slowly, and dopamine infusion was given at 2 µg/kg/min to prevent sudden hypotension. Total clamp time was approximately 35 min, no extra sutures or pledgets were used for hemostasis and there was no needle hole oozing. The graft was slightly bigger in size and length, the graft was covered with omentum to prevent infection as the surrounding tissues were not healthy. Post-operative period was uneventful; patient recovered well and was discharged after 10 days. Patient came for follow-up 1 month after the procedure with palpable pulsations in the femoral and popliteal vessels and completes relief of symptoms. Post-operative CT angiogram was done and showed patent graft (Figures 2a and 2b); however, there was the difference of contrast enhancement in the anterior and posterior aspect of the graft (Figures 3a and 3b). Patient was advised conventional aortography for further evaluation, but patient did not want any further intervention.

**DISCUSSION**

The difference in contrast enhancement on CT angiogram in the anterior and posterior portion of the graft in this
There is limited literature available on differential flows in the aortic graft after open surgery and majority of the literature is on competitive flow after coronary artery bypass grafting. Juleff et al. studied the influence of competitive flow on graft patency in iliac vessels in animals and concluded that competitive flow does influence graft patency and predisposes to graft thrombosis. Graft thrombosis can be managed either by the graft thrombectomy, thrombolysis, graft revision, or extra-anatomical bypass. The results of the graft thrombectomy reported in the literature are not encouraging, and thrombolysis has been preferred, however, persistent graft thrombosis may require redo surgery.

Morbidity and mortality of open repair of infra-renal aortic aneurysm have decreased over time due to improvement in surgical techniques, better grafts/conduits, and anesthesia management even in elderly patients above the age of 75 years. This case was not suitable for endovascular repair as the proximal landing zone was inadequate and would have required branched stent grafts to renal vessels to prevent occlusion of renal vessels, distally also branched endograft to iliac vessels would have been required. We opted for aorto-biiliac grafting in this case instead of aort-bifemoral grafting, also there is a report in the literature on advantages of aorto-biiliac grafting over aortobifemoral grafting for repair of aorto-iliac aneurysm with reduced chances of infection and better results.

Adequate experience of both the techniques (open and endovascular) helps in judicious utilization of the most appropriate technique in a particular patient depending upon the general condition of the patient, anatomy of the diseased vessel, co morbidities, and availability of the grafts or stents and also in the management of complications.

CONCLUSION

Oversized aortic graft either length-wise or in diameter along with other factors like angulation, stretchability of the graft and limited distal outflow can lead to differential flows, turbulence, stasis, and thrombosis following open surgery of infra-renal aortic and iliac aneurysm. Open surgery still has a definitive role in the management of aneurysms not suitable for repair by endovascular techniques.

REFERENCES


