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Case Report | Open Access

Retroperitoneal approach for suprarenal abdominal aortic aneurysm in Marfan syndrome

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ABSTRACT

Suprarenal abdominal aortic aneurysms pose a surgical challenge, as it is difficult to reanastomose the renal arteries and to place a cross-clamp to the aortic segment involving the visceral arteries through the diaphragmatic crux. The retroperitoneal approach with a limited thoracoabdominal incision through the ninth intercostal space offers some advantages over the midline transperitoneal approach which we explain by presenting its use in a patient with Marfan syndrome and a true abdominal aortic aneurysm. This technique should be in the armamentarium of aortic surgeons as they have to face with ever-increasingly difficult cases in the endovascular era.

Keywords: Aortic aneurysm/abdominal, juxtarenal aneurysm, Marfan syndrome, retroperitoneal approach, suprarenal aorta, surgery.

Suprarenal abdominal aortic aneurysms (AAAs) pose a surgical challenge due to its location. It is difficult to reanastomose the renal arteries to the aortic graft and to place a cross-clamp through the diaphragmatic crux to the aortic segment involving the visceral arteries. The exposure is the key to success in repair of the suprarenal AAAs. Midline transperitoneal (TP) and lateral retroperitoneal (RP) approaches are used for exposure. Retroperitoneal approach with a thoracoabdominal incision through the ninth intercostal space offers some advantages which we explain by presenting its use in a patient with Marfan syndrome.

CASE REPORT

A 46-year-old female patient with Marfan syndrome without any complaints was admitted for elective surgery due to enlarging suprarenal AAA which reached a diameter of 5.3 cm (Figure 1). The patient had a Bentall procedure with a mechanical valve 10 years ago in our institution and was under follow-up since then. Warfarin was discontinued three days before the operation. A written informed consent was obtained from the patient.

The patient was positioned with the left shoulder elevated nearly perpendicular to the table and the pelvis tilted slightly to the left. The operating table was fully broken head down to increase the space between the costal margin and the pelvis. An S-shaped incision was made that commenced at the left lateral edge of the rectus abdominis muscle at the umbilicus and extended to the costal margin then to the ninth rib space (Figure 2). Electrocautery was used to incise the abdominal wall musculature. The left chest was entered through the ninth rib space. The RP plane was developed by blunt dissection under the diaphragm and toward the psoas muscle till the visualization of the aorta. The costal margin was divided together with a 5-cm radial incision of the adjacent diaphragm (Figure 3). Abdominal contents were retracted to the right. The suprarenal aorta was accessed by the division of the left crus of the diaphragm. The left renal artery, superior mesenteric artery (SMA), and celiac trunk (CT) were dissected free and controlled with silastic loops (Figure 4). After heparinization, the aorta was clamped proximal to the CT, another clamp was placed proximal to the aortic bifurcation. Aneurysmal aorta was entered, balloon-tipped catheters were inserted to both renal arteries for the infusion of 500 mL cold

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Ringer solution to each of them. A 22-mm Dacron® graft was sutured to the aortic neck just distal to the orifice of the SMA with 4/0 polypropylene by using a strip of Teflon felt to buttress the anastomosis. The proximal clamp was moved to the graft to commence the perfusion of the visceral arteries. Ischemia of the visceral arteries was 26 min. The distal aortic anastomosis was performed in a similar fashion. Both clamps were removed to perfuse the lower body. The left and right renal artery buttons were prepared. The right renal artery was revascularized by using an 8-mm Dacron® interposition graft and the left renal artery was anastomosed directly to the aortic graft (Figure 5). The right and left renal ischemia duration were 77 and 99 min, respectively. A drain was placed to the RP space. The abdominal wall was closed as in a routine fashion. The diaphragm was repaired with interrupted polypropylene sutures. No chest tube was inserted. The air in the left pleural cavity was evacuated during the closure of the posterior muscle layers as the anesthesiologist hyperinflated the lungs.

Figure 1. Sagittal computed tomographic image of the suprarenal abdominal aortic aneurysm. The arrow shows the superior mesenteric artery.

The patient tolerated the procedure well. The postoperative urine output was good and the creatinine level was 0.67 mg/dL. The patient did not receive

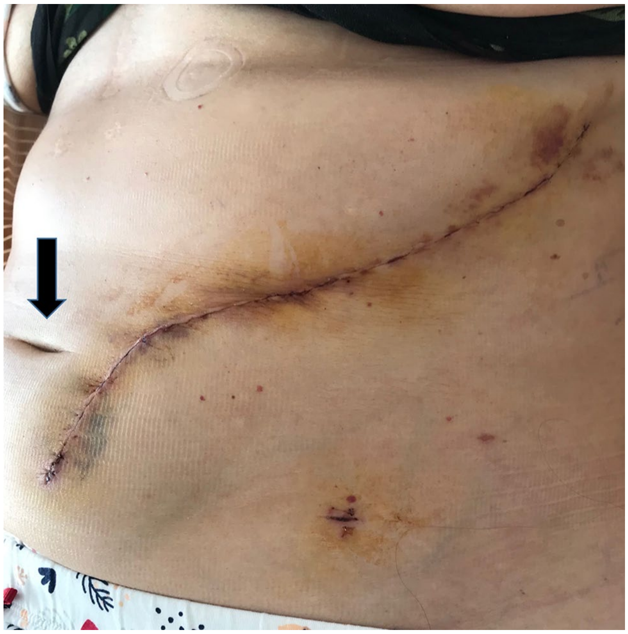

Figure 2. S-shaped incision from the left lateral edge of the rectus abdominis muscle at the umbilicus to the costal margin then to the ninth rib space. The arrow shows the umbilicus.

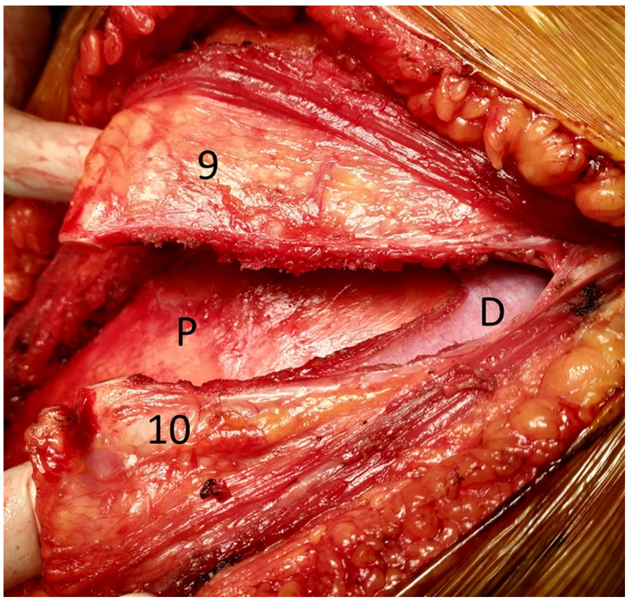

Figure 3. Intraoperative view (from the left) of the ninth rib space and radially divided diaphragm.
P: Peritoneum; D: Diaphragm.

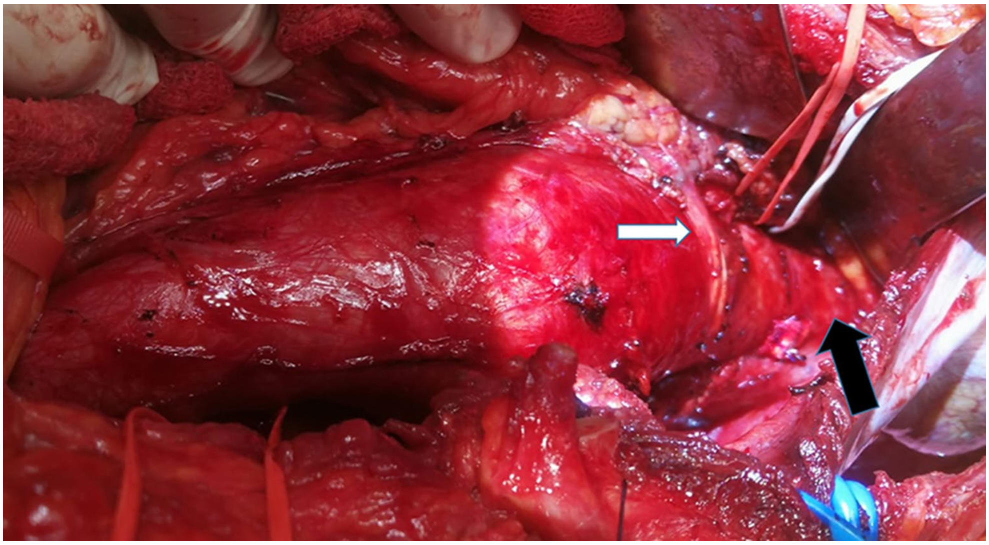

Figure 4. Intraoperative view of the aneurysmal aorta (from the left). Celiac trunk and superior mesenteric artery were looped with white and red silicone loops, respectively.
Black arrow: Clamp site. White arrow: Left renal artery.

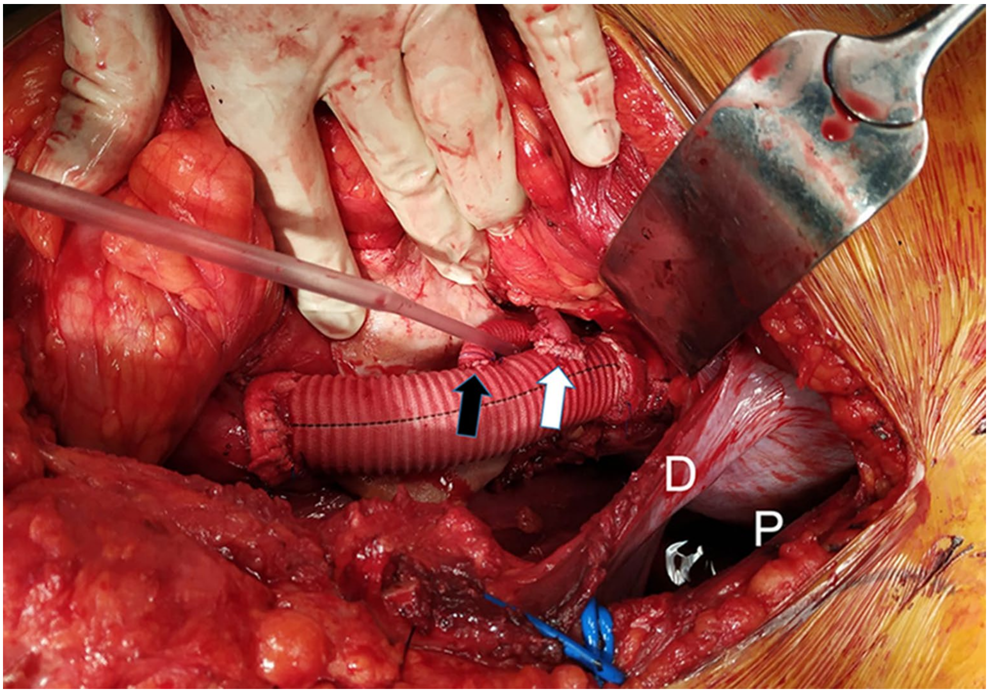

Figure 5. Intraoperative view of the aortic graft (from the left).
Black arrow: Dacron® graft to the right renal artery. White arrow: Direct anastomosis of the left renal artery to the aortic graft. D: Diaphragm, P: Pleural cavity.

any blood or blood products and was discharged five days after the operation. There was no complication related to the diaphragmatic incision. She remained asymptomatic and stable at her clinical follow-up appointment five months after the operation.

DISCUSSION

Suprarenal abdominal aorta is located in a compact anatomic region. It is surrounded by abdominal viscera anteriorly, vertebral column posteriorly and diaphragmatic crux bilaterally. Either midline TP or lateral RP approaches can be used for the exposure of this region. The midline TP approach gives an excellent exposure of the infrarenal aorta and both iliac arteries and enables to place a supraceliac clamp at the diaphragmatic hiatus. The left renal vein, bowel mesentery, and pancreas lie anterior to the juxtarenal aorta. The left medial visceral rotation (the Mattox maneuver), which requires extensive dissection, is needed to expose the suprarenal aorta with the TP approach.[1]

The lateral RP incision provides unparalleled access to the abdominal aorta up to the supraceliac level, without entering the peritoneum and dissecting the other intraabdominal organs. The left renal and the left iliac arteries can be visualized directly. A hostile abdomen from multiple laparotomies, fatty omentum and bowel mesentery, pre-existing stomas, and redo aortic surgery after previous TP surgery do not constitute a problem. The incision involves fewer dermatomes than a midline incision, thereby reducing postoperative pain.[2] The fluid and temperature losses encountered by an open peritoneum are less with RP approach.[3]

The modifications of ninth intercostal incision have specific advantages other than the above-mentioned advantages of the RP approach.[2-4] Radial division of the diaphragm provides better exposure and increases the space available for clamp application to the suprarenal aorta.[3] This would also potentially facilitate the removal of suprarenal fixation wires of failed endovascular aneurysm repair grafts, when indicated.

Removal of segments of the rib, as in the 11th rib approach, to enter the retroperitoneum is not necessary and the underlying intercostal nerves remain covered which may result in less neuropraxic injury. The 11th rib approach requires a bigger incision on the wall of the chest and abdomen, as well as the resection of the two third of this rib. We have seen flank muscle denervation and bulging which resembled incisional hernia in patients who underwent 11th rib resection.

Renal protection by means of perfusion with cold crystalloid solutions was shown to be as effective as perfusion with cold blood.[5] Therefore, we used cold Ringer solution to perfuse both kidneys. Postoperative creatinine levels did not increase, despite relatively long renal ischemia.

True AAA in patients with Marfan syndrome is relatively rare and most AAAs in this disease are secondary to aortic dissection in the thoracic area.[6,7] Hagerty et al.[7] reported a case series of 12 Marfan patients with true AAA. In their report, by using a PubMed search, they found only eight case reports (including 13 patients) of AAA in patients with diagnosed or suspected Marfan syndrome from 1976 to 2009. Therefore, as of 2016, 25 cases were reported in the literature. As in our patient, these AAAs have a tendency to occur in relatively young patients[6] and the renal arteries were involved in about half of these aneurysms.[7]

The aortic root and thoracic aorta are typical sites for aneurysms in patients with Marfan syndrome. The outlook for patients with Marfan syndrome has improved due to better awareness and successful prophylactic root replacement for aneurysm disease.[8] Due to the increased longevity, periodic screening for AAA in Marfan patients who have undergone prior aortic root replacement or those with descending thoracic aortic disease was proposed.[7] Screening for AAA could include an abdominal sweep performed during the transthoracic echocardiogram.[9] Since there is no established consensus on endovascular repair for Marfan-related AAA, conventional graft replacement is accepted to be the gold standard.[6]

In conclusion, the RP approach with a limited thoracoabdominal incision through the ninth intercostal space is advantageous for the repair of AAAs involving the suprarenal aorta. This technique should be in the armamentarium of aortic surgeons, as they have to face with ever-increasingly difficult cases in the endovascular era.

Declaration of conflicting interests

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