Endovascular repair of an acute infrarenal post-dissection aortic occlusion

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Abstract:

Acute aortic occlusion is an uncommon condition which can be fatal if not immediately treated. It is caused by either arterial embolism or thrombosis, with the latter being the most frequent one. One of the rarest causes of thrombosis of the aortic lumen is the isolated abdominal aortic dissection (IAAD). Commonly, it is presented with acute abdominal pain paired with severe acute bilateral lower limb ischemia. The treatment choices consist of the open surgery techniques, such as aortic replacement with interposition graft or bypass, or more recently with the endovascular means, such as tube or bifurcated stent graft placement. Thus, we present a case of a 66-year-old male patient with acute aortic occlusion, due to thrombosis of an infrarenal post-IAAD, treated with endovascular repair.

INTRODUCTION

Isolated abdominal aortic dissection (IAAD), defined as a dissection of the aorta below the level of the diaphragm, is a rare entity accounting for 1.1-4.0% of all aortic dissections[1,2,3]. Two types of IAAD can be identified regarding the location of the primary entry point[2]. Type I and II dissection is defined according to the relation of the entry point to the renal arteries[2]. In type I, the entry point is located proximal or equal to the orifice of the renal arteries and type II, below the lowest renal artery[2]. Symptoms may vary and include abdominal or back pain, lower extremity ischemia, bowel ischemia, acute renal failure, acute hepatic insufficiency or even paraplegia, depending on the level of dissection[1]. However, up to 41.1% of patients may be completely asymptomatic[4]. Based on the time of symptoms' onset, IAAD can be categorized in acute (≤14days), subacute (15 days - 3 months) and chronic (>3 months)[2]. Considering the etiologic mechanism, IAAD can be further classified into spontaneous, iatrogenic, and traumatic[4]. Almost 28% of patients suffering from IAAD present a simultaneous abdominal aortic aneurysm (AAA)[1].

Treatment choices consist of conservative management (best medical treatment combined with close surveillance), open repair, or endovascular aortic repair (EVAR)[1,2]. Conservative treatment consists of monitoring, antihypertensive and analgesic therapy and is usually regarded as the first line treatment option, for asymptomatic or symptomatic uncomplicated patients with IAAD [1,2]. Any sign of aortic rupture, periaortic hematoma, lower limb ischemia, malperfusion of the viscera and/or concomitant AAA with a diameter >30mm is characterized as complicated IAAD [1,2,5]. Primary intervention should be considered in those patients presenting complicated IAAD, with EVAR being the preferable treatment choice [1,2,5].

Thus, we present a case of a 66-year-old male with acute aortic occlusion due to post-IAAD, treated with endovascular repair.

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ISSN 2732-7175 / 2021 Hellenic Society of Vascular and Endovascular Surgery Published by Rotonda Publications

CASE PRESENTATION

A 66-year-old male patient presented in accident and emergency department of a region hospital complaining for acute abdominal pain and severe bilateral lower extremity ischemia, causing inability to stand and walk. The onset of symptoms was sudden while he was hiking, with no history of trauma. His medical history included hypertension, dyslipidemia, and smoking. The physical examination revealed mottled, cold limbs with a capillary refill time >3sec. No palpable pulses were detected in femoral arteries. Abdominal pain was detected to the lower abdomen, with no signs of peritonism. Laboratory exams showed an inflammatory response associated with a high CPK (939U/L). A computed tomography angiography (CTA) of the thoracic, abdominal aorta and iliac arteries was performed. The CTA revealed a post-dissection infrarenal aortic dilatation of 4,5cm in diameter and a complete occlusion of the lumen of the aortic bifurcation, as well as the whole length of the left common iliac artery (Figures 1, 2). The patient was initially managed with hypertension control and intravenous unfractionated heparin, while at the same time he was transferred to our center for prompt management.

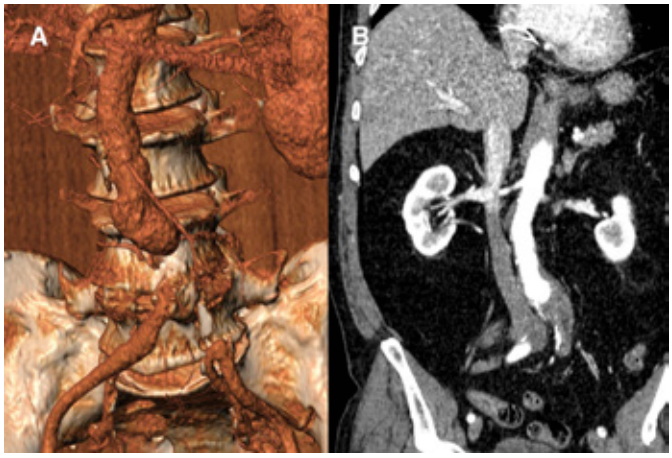

Figure 1. A) The 3D reconstruction of the preoperative CTA that was performed at the time of patient's admission, revealing a complete occlusion of the lumen of the aortic bifurcation and the left common iliac artery. **B**) In coronal view, the thrombosed post-dissection infrarenal aortic aneurysm of 4,5cm and the occlusion of the lumen of the infrarenal aorta was detected by the pre-operative CTA.

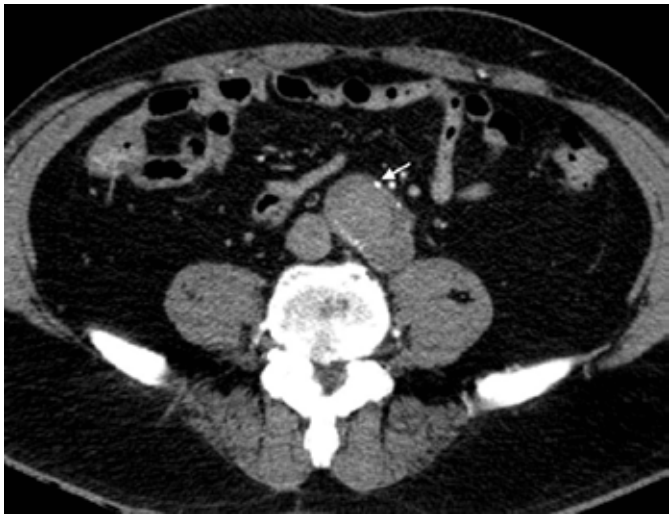

Figure 2. The preoperative CTA (axial plane), demonstrating the occlusion of the aorta and left common iliac artery.

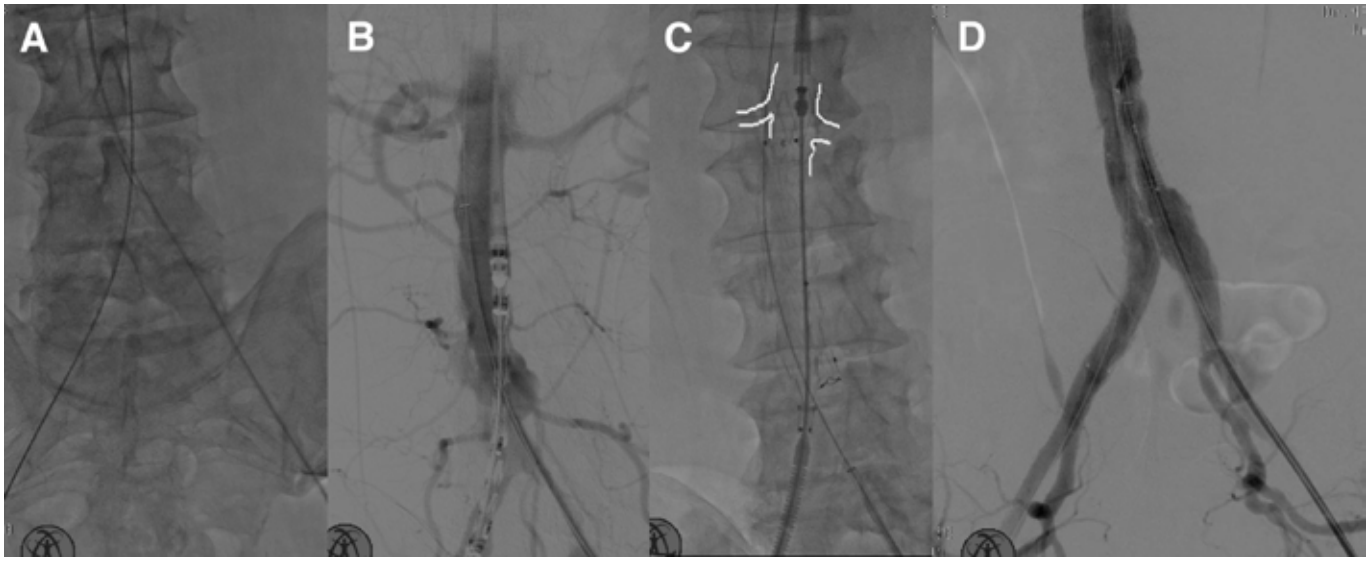

Figure 3. Intraoperative images showing **A)** the successful passing of guidewires through the thrombus bilaterally, **B)** the placement of the endograft before deployment, **C)** the main body of the endograft after deployment, and **D)** the completion angiography showing a complete restoration of the true lumen and satisfactory sealing.

Under general anesthesia, bilateral oblique inguinal incisions were performed and common femoral arteries were dissected. Access was gained by both common femoral arteries, with subsequent placement of sheaths. Using 0,018'' guidewires, access to suprarenal aorta was achieved from both sides through the thrombus. The wires were afterwards exchanged for super stiff 0.035'' guidewires. Pre-dilatation of the abdominal aorta and left common iliac artery was carried out with a non-compliant angioplasty balloon (8x80mm). A bifurcated 25x14x103mm endograft was then applied (Endurant IIs, Medtronic, MN, USA), combined with a 16-24x93mm left and a 16-20x93mm right iliac limb. The final angiography showed a complete restoration of the true lumen and satisfactory sealing, as well as normal blood flow to both iliac bifurcations (Figure 3).

The patient had an uneventful post-operative course, and he was discharged on the 2nd post-operative day. Thirty-day follow up showed no signs of endoleak and an adequate graft position and functioning (Figure 4). Long term follow-up was also uneventful in terms of aortic disease. The patient passed away two years after the procedure due to metastatic melanoma, whose no signs were present at the time of intervention.

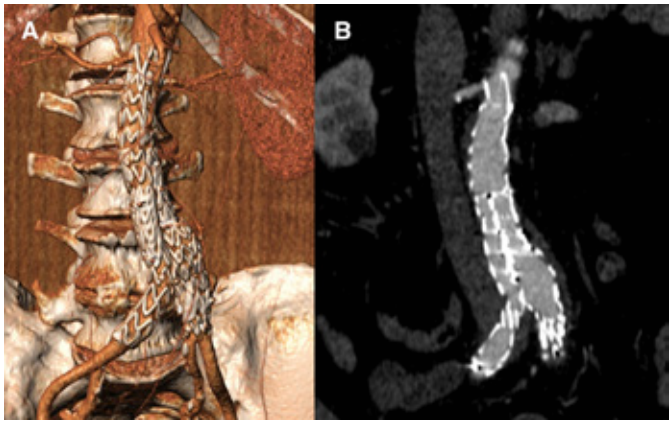

Figure 4. The CTA at 30-day follow up depicting a **A)** 3D reconstruction and **B)** coronal plane and demonstrating no sign of endoleak and an adequate graft position and patency

DISCUSSION

Acute thrombosis of the abdominal aorta is a rare and life-threatening condition which typically involves distal aorta, close to the bifurcation[6]. In terms of etiology, two major categories: in situ thrombosis and embolism[6]. Atherosclerosis of the aorta or iliac arteries (plaque rupture), abdominal aneurysm, dissection (thrombosis of the false lumen) or even direct trauma is the underlying cause of aortic thrombosis while a large saddle embolus is almost always the case for the latter[6]. One of the rarest causes of thrombosis of the abdominal aorta is IAAD which is defined as a dissection involving only the abdominal aorta[2]. The prevalence of IAAD in association with aortic dissection (AD) is 1.7%, while the incidence is estimated at 5,1 cases per 1.000.000 dissections annually[2]. IAAD can lead to complete occlusion of the aorta due to thrombosis of the false lumen with simultaneous compression of the true lumen, as might happened in the presented case[2]. In the current report, the patient suffered from an acute, spontaneous type II IAAD, complicated with lower limb ischemia.

Possible risk factors for the development of IAAD are hypertension, dyslipidemia, diabetes, smoking, atherosclerosis, prior abdominal surgery, history of catheterization, pre-existing aneurysm, connective tissue disorders, chronic obstructive pulmonary disease, and positive family history of aortic dissection[4]. Wu et al. reported in a recent meta-analysis that 41.1% of the patients presented with IAAD were completely asymptomatic. Most common symptoms were abdominal pain (50.,8%), back pain (30,5%) and chest pain (21,7%), claudication (17,3%) and lower limb ischemia (13.5%), paraplegia (6.8%) and renal failure (2.6%). Physical examination revealed a pulse deficit in 15.9% of cases, abdominal tenderness (7.9%), hypotension (7%), and abdominal pulsation (3.1%)[4]. In this case, the patient suffered from a bilateral acute limb ischemia, with undetectable peripheral pulses and an abdominal pain.

Treatment options consist of conservative treatment, open surgical repair and EVAR. Conservative treatment represents the initial approach for most patients, consisting of antihypertensive therapy (b-blockers and vasodilators to lower the systolic blood pressure) and analgesic, under careful monitoring. Medical treatment can be the treatment of choice in patients with chronic or asymptomatic, or even those with uncomplicated IAAD[1,3]. However, almost 18% of these patients will need to be surgically treated during the follow-up[1]. In a retrospective study of 138 patients with spontaneous IAAD, Kang et al. reported that during a mean follow up of 25 months, only 1.4% of patients, treated conservatively, and had a complete aortic remodeling while 81.9% had no morphologic change or remodeling[7]. Meanwhile, false lumen enlargement was observed in 8.7% of patients and longitudinal progression of the dissection in 6.5% of patients[7]. Rupture can occur in 10% of IAAD cases and has been correlated with higher mortality[8].

Indication for surgical treatment is set in cases of complicated IAAD[1,2,5]. The presence of abdominal pain with no signs of remission after conservative treatment and the involvement of the suprarenal aorta could also be considered as relative indications, as they can lead to a worse outcome if left untreated[5,9]. Although the exact diameter threshold for intervention in these cases is not yet clearly defined, most studies suggest that the cut-off should be set at 3cm[1,2,3,5]. As far as best surgical approach is concerned, no guidelines exist while the minimally invasive nature of EVAR has gained popularity for IAAD management[5]. A single tube graft can be used in some cases to cover the total length of the dissection, if confined only to the abdominal aorta[3]. The distance from the lowest renal artery as well as the aortic diameter is important in choosing between infrarenal and suprarenal fixation and choosing an adequate graft diameter[3]. An aorto-uni-iliac stent graft is also a choice for EVAR while cover stents may be also considered, depending in the specific anatomy[2,3]. In cases where the aorta does not meet the suitable anatomic criteria for EVAR, OR could be performed[1]. However, open repair is associated with higher morbidity and mortality rate (2% for EVAR vs. 9% for open repair)[1]. Trimarchi et al. reported that patients managed invasively present a better overall prognosis compared to them treated conservatively[10].

Even in the case of complete thrombosis of the aorta, endovascular recanalization of the true lumen and access to the suprarenal aorta is usually feasible if the intervention is carried out in an acceptable time from dissection. In this case, the patient presented with acute ischemia of both legs, showing a complete thrombosis of the infrarenal aorta, as well as in left common iliac artery. However, the access through the intraluminal thrombus was easily achieved, the intervention was performed within 24 hours from symptoms onset. During the acute phase, the presence of thrombus is not an obstacle for endograft deployment, despite a potential embolization of the renal or internal iliac arteries. For this reason, we decided to initially perform a moderate recanalization of the lumen, using an angioplasty balloon and then, deploy an endograft with supra-renal fixation, without performing balloon dilatation near the proximal and distal landing zones.

CONCLUSION

IAAD is a rare aortic pathology and requires high clinical suspicion and appropriate imaging to perform the adequate diagnosis. According to this case and current literature, EVAR,

even in the setting of complete aortic thrombosis, may be a safe and effective solution in patients with IAAD.

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Endovascular repair of traumatic infrarenal aortic dissection with aortic stenosis in a 11-year-old girl with a balloon-expandable covered aortic stent

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Abstract:

Blunt abdominal aortic injuries (BAAI) are a rare phenomenon, with an extremely low incidence on the pediatric population. Injuries vary from partial intimal transections to frank aortic ruptures with hemodynamic instability. The limited current literature does not allow for official guidelines on the treatment of such injuries, albeit the open surgical approach has been widely used, especially in unstable patients. Endovascular treatment of these lesions could pose as a safe alternative, especially in hemodynamically stable children. We present a case of an 11-year-old girl with a traumatic aortic dissection with concurrent aortic stenosis of the true lumen (>90%), where an endovascular approach was chosen, with the placement of a balloon-expandable covered stent.

INTRODUCTION

The incidence of traumatic lesions of the abdominal aorta following blunt abdominal trauma, usually after high-speed motor vehicle accidents, is low, occurring even less frequently in the pediatric population, with just 40 cases being reported until 2014.[1, 2] Currently there is no consensus or "gold-standard" for the treatment of such injuries, mainly because there are concerns for the long term consequences given the continuing growth process of the child. Injuries resulting in hemodynamic instability should be urgently treated.[3–6] A "watchful-waiting" approach has been also proposed, based on individual patient circumstances, with delayed surgical management.[7–9]

Regarding the traumatic aortic dissection of the abdominal aorta, occurring from an intimal tear, emergent open surgical treatment has been the most opted modality, in approximately 46% of a 40-patient analysis on pediatric patients.[2] Reports on endovascular treatment of thoracic aortic[10,11] and abdominal aortic[12–14] blunt injuries have been published with satisfactory results in terms of short-term survival and postoperative complication rates. Furthermore, thoracic endovascular aortic repair/ TEVAR of blunt thoracic injuries in the adolescent population have also shown satisfactory results in terms of postoperative mortality, morbidity and complication rate[15], paving the way for an individualized endovascular treatment of blunt aortic injuries of the abdominal aorta.[16]

We hereby present the case of an 11-year-old girl suffering a traumatic aortic dissection and a concomitant >90% true lumen stenosis following a high-speed motor-vehicle accident, successfully treated with a balloon-expandable aortic covered stent.

CASE REPORT

An 11-year-old girl referred to our department due to a post-traumatic aortic dissection with concurrent aortic stenosis of the abdominal aorta, resulting from a blunt abdominal trauma due to a high-speed road traffic accident, while she was sitting in the back seats of the car wearing an adult seat belt. The preoperative contrast-enhanced abdominal CT scan had revealed mesenteric injury, free peritoneal air and fluid and an aortic dissection in the mid-portion of the infra-renal aorta with a concomitant stenosis of >90% of the true lumen, but with no signs of aortic rupture or retroperitoneal hematoma (Figure 1,2). The patient had been previously treated in a district hospital for the mesenteric injury and small-bowel injuries (primary restoration with small bowel resection (50-60cm)), with an uncomplicated postoperative hospital stay. Regarding the vascular injury, an initial conservative approach was chosen, aiming towards a delayed surgical treatment. After discharge the young patient presented intermittent claudication of bilateral lower limbs at shorter than 100 meters due to the substantial stenosis provoked by the intimal flap. The decision for a minimally invasive, endovascular approach was made, given the minimally invasive procedure, the young age of the patient and the "hostile" abdominal environment due to the recent exploratory laparotomy.

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ISSN 2732-7175 / 2021 Hellenic Society of Vascular and Endovascular Surgery Published by Rotonda Publications