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Endovascular Treatment of Common Iliac Artery Aneurysm after open Repair for Ruptured AAA with Commercially Available Devices in Bulgaria - Case Report

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True iliac aneurysm; Ruptured abdominal aortic aneurysm; Endovascular treatment

1. Abstract

1.1. Background: True iliac aneurysms development is a major sign of aneurysm disease progression after open repair for Abdominal Aortic Aneurysm (AAA). We present our experience in endovascular repair of true iliac aneurysm after open reconstruction for ruptured AAA with commercially available stent graft devices.

1.2. Case Report: In March 2012, a 50 years old male underwent emergency operation due to ruptured, 8cm AAA. A 24mm Dacron tube graft was used. In January 2013 two stent grafts Advanta were placed in kissing configuration in the left external and internal iliac arteries (EIA) (IIA) (10/59; 8;59) due to development of common iliac artery aneurysm. A CT scan had been performed yearly after that. In 2020 we observed true aneurysm of the distal part of the aorta and the right common iliac artery and IIA. Elective surgery was performed. The proximal stent graft was anchored in Dacron tube graft right above the aortic bifurcation way below renal arteries. On the left, we bridged previously implanted Advantas by two new Advanta stent grafts (9/58). For the right side we used iliac extension to EIA and two Advanta stent grafts (6/59) to the biggest branch of IIA and coil embolization in the other branch for maximum sealing. Stent grafts deployment was successful. No operative morbidity and complications occurred. All aneurysms were excluded with no endoleaks. The IIA was preserved as planned.

1.3. Conclusion: Conventional open repair of AAA with tube prosthesis may be followed by development of true iliac aneurysms. Endovascular approach appears to be beneficial in patients with a history of hostile abdomen and in those at increased surgical risk. The remaining open question is whether the primary success of endoluminal stent-graft deployment of commercially available devices will be confirmed by long-term treatment results.

2. Introduction

Conventional abdominal aortic prosthetic reconstruction for Abdominal Aortic Aneurysm (AAA) repair is a reliable procedure. True iliac aneurysms development is recognized progression of the aneurysmal disease that occurs years after the initial surgery [1]. Reoperations are technically challenging procedures that require dissection through previously used operative sites. Furthermore, the patients are likely to develop more comorbidities than during primary aortic surgery. We present our experience in endovascular repair of true iliac aneurysm with commercially available stent graft devices. The initial surgery was open reconstruction for ruptured AAA with Dacron tube graft performed 8 years ago.

3. Case Report

In March 2012, a 50 years old male underwent emergency open surgery due to ruptured, 8cm AAA. A 24mm Dacron tube graft was used. He is an active smoker, heavily obese (BMI 40,1), has arterial hypertension and no other know concomittant diseases. In December 2012 a follow up CT scan was performed - patent tube graft, dilatation of the right Common Iliac Artery (CIA) (24mm) and internal iliac artery (IIA) (19mm), aneurysm of the left CIA (44mm). In January 2013 two stent grafts Advanta were placed in kissing configuration in the left external iliac artery (EIA) and IIA (10/59; 8;59) to treat the left CIA aneurysm. A CT scan had been performed yearly after that (Table 1). In July 2020 the size of the

right CIA/IIA reached 36mm and 22mm respectively. The patient did not have clinical or CT signs of graft infection. Through preoperative risk assessment the patient was classified as ASA III.

The time interval from primary operation to diagnosis of left CIA aneurysm was 1 year. The time interval from primary operation to diagnosis of true aneurysm of the distal part of the aorta and the right CIA and IIA was 6 years (Table 1).

Table 1: Timeline of aneurysm development based on CT scan

Year	Size of distal aorta	RCIA	RIIA	LCIA	LIIA
2012	25mm	19,4mm	16mm	44mm	25mm
2013	25mm	19,5mm	16,3mm	Advanta 10/59mm	Advanta 8/59mm
2014	26mm	19,7mm	16,3mm	Patent graft, no endoleaks	Patent graft, no endoleaks
2015	26mm	19,7mm	16,3mm	Patent graft, no endoleaks	Patent graft, no endoleaks
2016	27mm	26,4mm	20,4mm	Patent graft, no endoleaks	Patent graft, no endoleaks
2017	27.8mm	26,8mm	20,4mm	Patent graft, no endoleaks	Patent graft, no endoleaks
2018	31mm	30,8mm	20,4mm	Patent graft, no endoleaks	Patent graft, no endoleaks
2020	41mm	36mm	22mm	Patent graft, no endoleaks	Patent graft, no endoleaks

The patient underwent elective surgery. The procedure was performed in an angiographic equipped operating theater. Under general anesthesia - open right femoral access (for the main body), open left axillary access (for 7Fr Destination 90cm in order to have length to the internal iliac artery) and percutaneous left femoral access 7Fr (for Advanta implantation) were performed. The proximal stent graft was anchored in Dacron tube graft right above the aortic bifurcation and way below renal arteries. We had some concerns about stent graft behavior in Dacron prosthesis but stability of the system was excellent. We suggest that it is important to preserve the IIA whenever possible so we used parallel grafts technique for the right side. For the left side we bridged previously implanted Advantas with the left leg of the main body by two new Advanta stent grafts (9/58). For the right side we used an iliac extension to EIA and two Advanta stent grafts (6/59) to the biggest branch of IIA and coil embolization (Concerto Helix) in the other branch for maximum sealing of IIA aneurysm.

Stent grafts deployment was successful. There was no operative morbidity and no complications occurred during operation. On completion angiography, all aneurysms were excluded with no endoleaks. The IIA was preserved as planned. The operation duration was 150 mins with 200ml blood loss. The patient circulation was stable without a fall in systolic arterial pressure perioperatively. Postoperatively, the patient went to medium care unit, on a normal diet and mobilized on the first postoperative day. Pre-discharge ultrasound exam, performed on the second postoperative day showed patent grafts and no signs of endoleaks. DAPT was prescribed for 6 months. A CT scan on first and sixth months showed patent stent grafts with no endoleaks, complete closure of the aneurysmal sacs and patent IIA on both sides.

4. Discussion

True iliac aneurysm development years after the initial open reconstruction of AAA is a robust manifestation of aneurysmal disease progression.

AAA and iliac aneurysms are a common degenerative disease that leads to its dilatation and, ultimately, to rupture. Mortality from a ruptured AAA approximates 90% [1]. AAA rupture can be prevented by elective open surgical or endovascular aneurysm repair, which have an overall combined mortality of 5% [2]. Surgical repair is considered appropriate when the aortic diameter exceeds 55 mm. In general, at this threshold, the risk of rupture exceeds those of surgery related morbidity and mortality [3]. However, for the individual patient this threshold is a poor predictor of risk, as some AAAs rupture at a diameter below 55 mm and others progress to over 70 mm without rupture occurring. waiting until the aortic diameter reaches 55 mm before elective repair could be too late for some patients and lead to unnecessary surgery in others. There is a need for a patient-specific predictor of AAA progression. Circulating biomarkers could provide such prediction and offer a tool for targeted therapy.

The results of studies on CIA expansion rate are difficult to compare because in most series: (1) the diameter at which a CIA is considered aneurysmal is not clearly defined; (2) the methods used to measure arterial diameter vary considerably; and (3) even when there is a definition of CIA aneurysm, it differs from one author to another. For instance, Provan et al [4] defined a CIA of 15–30 mm in diameter as ectatic and 30 mm as aneurysmal. Santilli et al [5] considered any CIA with a permanent localized dilation larger than 15 mm in diameter as aneurysmal, and any CIA with a diameter greater than 25 mm was aneurysmal according to Krupski et al [6]. One year after the initial open repair for ruptured AAA we diagnosed aneurysm of the left common iliac artery (40mm). Kalman et al6.1 found a high incidence (30.8%; 12 of 39) of late iliac aneurysms after a mean 129 months, and they emphasized the importance of the surgeon's choice between tube insertion and more distal repair at iliac or femoral artery level when the iliac arteries show some ectasia already at the time of the original repair. In our case the patient developed left common iliac aneurysm at the first year after the open repair and right common and internal iliac artery aneurysm at the 6th year.

Kasirajan et al [7], on the contrary, reported no enlargements in a series of 9 isolated CIAs with a mean diameter of 2.1 cm (range, 2–2.5 cm) followed up for a mean of 57 months. When Dosluoglu et al [8] compared the CIA's expansion rate in patients with (n = 9; mean, 2.7 ± 0.8 cm in diameter) or without (n = 4; 2.6 ± 0.9 cm in diameter) previous AAA repair, they found that the size remained stable for the first 5 years after diagnosis. Balotta et al. [9] reported that most CIAs do not expand after tube graft insertion during AAA repair, and when they do, the degree of dilation is minimal.

Another important aspect of the common iliac artery aneurysms is the preservation of the internal iliac artery. One of the basic principles of vascular surgery is vessel preservation/reconstruction whenever possible. Even if IIA sacrifice has been generally reported to be safe, pelvic ischemic complications may actually occur and they can significantly impair patients' quality of life. A recent systematic review showed that buttock/thigh claudication develops in approximately one-third of patients undergoing IIA exclusion, and about 10% of men experience a new-onset erectile dysfunction [10]. The factors that influence the development of buttock/thigh claudication and erectile dysfunction are not completely understood, but the adequacy of pelvic collateral circulation likely plays an important role. Even though the exact definition of patients at high risk of pelvic ischemia is difficult, the likelihood and severity of postoperative ischemic manifestations are consistently higher after bilateral than unilateral occlusion [11, 12]. Thus, preservation of blood flow to at least one IIA is strongly recommended, if it does not compromise aneurysm exclusion, by clinical practice guidelines from vascular surgical societies in USA and Europe [13, 14]. The way the IIA is excluded also seems to play a major role in the development of pelvic ischemic complications: Coils are generally associated with poorer outcomes than plugs, and occlusion of the proximal IIA trunk is generally associated with reduced rates of pelvic ischemic complications as compared with occlusion of the distal IIA branches [15]. The timing of IIA embolization might be another determinant of pelvic ischemic complications. Bilateral embolization is usually performed in a two-stage fashion a few weeks apart to allow for collateral circulation development; similarly, unilateral embolization may also be staged or performed concomitantly with EVAR. However, despite claims that buttock/thigh claudication is more common after concomitant rather than staged procedures, there is no obvious benefit for sequential versus simultaneous IIA embolization [16].

Iliac branch devices (IBD) IBD represents the first dedicated endovascular option to preserve antegrade flow to the IIA, when anatomically feasible [17]. These devices offer reduced rates of mortality and morbidity as compared to open approaches, while maintaining excellent technical success and primary patency [18].

The bell-bottom technique has been used widely to facilitate achievement of a distal seal in a dilated CIA while preserving pelvic flow [19]. However, concerns about long term stability still remain, and high incidence of late type 1B endoleaks from loss of distal fixation and seal has been reported.

IIA bypass has excellent results in terms of patency and freedom from ischemic complications but is technically demanding and a more invasive operation that may reduce the benefit from EVAR [20].

The parallel-graft technique for IIA preservation is also feasible with acceptable short-term results, but the gutters created by the parallel grafts may cause endoleaks and the durability is the main concern [21]. Furthermore, the parallel stent grafts may compress each other, therefore potentially increasing the risk of thrombosis.

Use of physician-modified devices has also been described to maintain IIA perfusion [22]. However, they require time for modification and should be used cautiously by adequately trained physicians in patients without other reasonable options.

Use of aortouniiliac endografting with crossover femoro-femoral bypass is an alternative solution. This may include CIA embolization. However, these solutions seem less desirable, since they may cause contralateral IIA malperfusion and thrombotic or infective events, which would lead to serious complications following repair.

Simple IIA coverage without prior embolization has been shown by some authors as not increasing the risk of type 2 endoleaks or secondary interventions [23]. However, there is a lack of randomized controlled trials and the available evidence comes from small retrospective series which are difficult to compare.

In Bulgaria we don't have all the modern endovascular devices on the shelf. Furthermore, their use is not covered from the National Health Insurance. In order to preserve the IIA we used Advanta covered stents. Their patency rate for 2 years is 100%. In the literature there is no scientific data about the applicability of Advanta stent grafts in the settings of CII aneurysms. Lattermost this was our "bail-out" alternative.

5. Conclusion

Although most CIAs do not expand after tube graft insertion during AAA repair, some of them are affected from aneurysm progression. The endovascular option may be advantageous to this group of patients with history of previous abdominal operations or with serious cardiopulmonary risk factors as compared with the more invasive open surgical repair. The remaining open question is whether the use of commercially available stent grafts in treating these cases will be confirmed by long-term treatment results. Although long-term evidence is not yet available, the method appears to be beneficial in patients with hostile abdomen and in those at increased surgical risk.

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