Endovascular Treatment of Ruptured Abdominal Aortic Aneurysms: Case Report

Rüptüre Abdominal Aort Anevrizmalarında Endovasküler Tedavi

Harun ARBATLI, MD,[a]
Oğuz YILMAZ, MD, [a]
Gökçe ŞİRİN, MD,[a]
Naci Erciyas YAĞAN, MD,[a]
Ergun DEMİRSOY, MD,[a]
Füruzan NUMAN, MD,[b]
Bingür SÖNMEZ, MD[a]

Clinics of [a]Cardiovascular Surgery,
[b]Invasive Radiology,
Istanbul Memorial Hospital, İSTANBUL

Yazışma Adresi/*Correspondence:*
Oğuz YILMAZ, MD
Istanbul Memorial Hospital,
Clinic of Cardiovascular Surgery,
İSTANBUL
doktoroguzyilmaz@yahoo.com

ABSTRACT When ruptured, abdominal aortic aneurysms (AAA) are highly fatal, even when promptly taken to medical centers. We aimed to evaluate the results of endovascular treatment of ruptured AAA in our hospital. We performed endovascular repair in 58 patients with AAA between May-2001 and April-2005. Three of these were admitted in the ruptured state. Endovascular treatment was performed in the aorto-uniiliac fashion with additional femoro-femoral cross-bypass in all. Two were discharged from the hospital and are in good state. The third patient however could not be weaned off the ventilator and was lost possibly due to undistinguished abdominal compartment syndrome and multiorgan failure on the 14th postoperative day. Endovascular stent-grafting is a good alternative for the treatment of ruptured AAAs. The abdominal compartment syndrome should be sought carefully in these cases. Endovascular repair is expected to be more frequently performed in ruptured AAA cases subsequent to randomized studies and optimal clinical experience.

Key Words: Aortic aneurysm, abdominal; aneurysm, ruptured; stents; compartment syndromes

ÖZET Abdominal aort anevrizmalarında rüptür geliştiğinde mortalite çok yüksektir. Burada kliniğimize rüptüre abdominal aort anevrizması ile başvuran hastalarda endovasküler tedavi ile ilk tecrübelerimizi değerlendirdik. Kliniğimizde Mayıs-2001 ile Nisan-2005 tarihleri arasında abdominal aort anevrizması ile başvuran 58 hastaya endovasküler girişim uygulanmıştır. Bu hastalardan üçünde anevrizma rüptüre olmuş idi. Her üçünde de endovasküler greft aorto-uniiliyak şekilde yerleştirilmiş ve ilave femoro-femoral bypass yapılmıştır. Hastaların ikisi sorunsuz şekilde hastaneden taburcu edilmiş ve halen sağlıklı şekilde takip edilmektedirler. Ancak üçüncü hasta solunum cihazından ayrılamamış, ve muhtemelen tam tanımlanamamış abdominal kompartman sendromu ve multiorgan yetmezliği nedeniyle işlem sonrası 14. gün kaybedilmiştir. Rüptüre abdominal aort anevrizmalarının acil tedavisinde endovasküler stent-greftleme işlemi uygun bir seçenektir. Bu tip vakalarda özellikle abdominal kompartman sendromunun gelişimi titizlikle araştırılmalıdır. Endovasküler tamir yöntemleri ile ilgili klinik tecrübenin artması ve randomize çalışmaların sonuçlanmasını takiben rüptüre abdominal anevrizmaların onarımında bu tekniklerin daha sıklıkla kullanılacağına inanıyoruz.

Anahtar Kelimeler: Abdominal aort anevrizması; rüptüre anevrizma; stentler; kompartman sendromları

The mortality rate for ruptured abdominal aortic aneurysm (rAAA) is reported to be as high as 90% including deaths before admission to the hospital.[1] Classical treatment of rAAA includes laparotomy with control of hemorrhage and repair of the aneurysm by using fabric grafts. The surgeon often needs to clamp the supraceliac segment of the aorta or do

a thoracotomy to expose the thoracic aorta in order to control the hemorrhage. Endovascular aneurysm repair (EVAR) has recently been applied as an alternative surgical therapy for rAAA.[2-6] The present study details our initial experience of rAAA treated with endovascular repair in 3 patients.

CASE 1

A seventy one years old male was referred to our hospital with abdominal pain, fatigue and hypotension. His blood pressure was 90/65 mmHg and the hematocrit was 26%. Abdominal CT scan revealed contained rupture of the abdominal aortic aneurysm (Figure 1). A 27 mm long neck was present between the ostium of the right renal artery and the aneurysm. Endovascular repair was planned considering his severe chronic obstructive pulmonary disease (COPD) and coronary artery disease. He was transferred to the angiography suit, prepared and draped for open surgery in case of access failure. A left aorto-uniiliac stent-graft with an aortic extender and a contralateral iliac occluder were placed in order to exclude the aneurysm and a femoro-femoral cross-bypass was performed under local anesthesia (Figure 2). He was transported to the ICU in a good hemodynamic state and discharged from the hospital on the 5th postoperative day. He is in good state 41 months after the procedure.
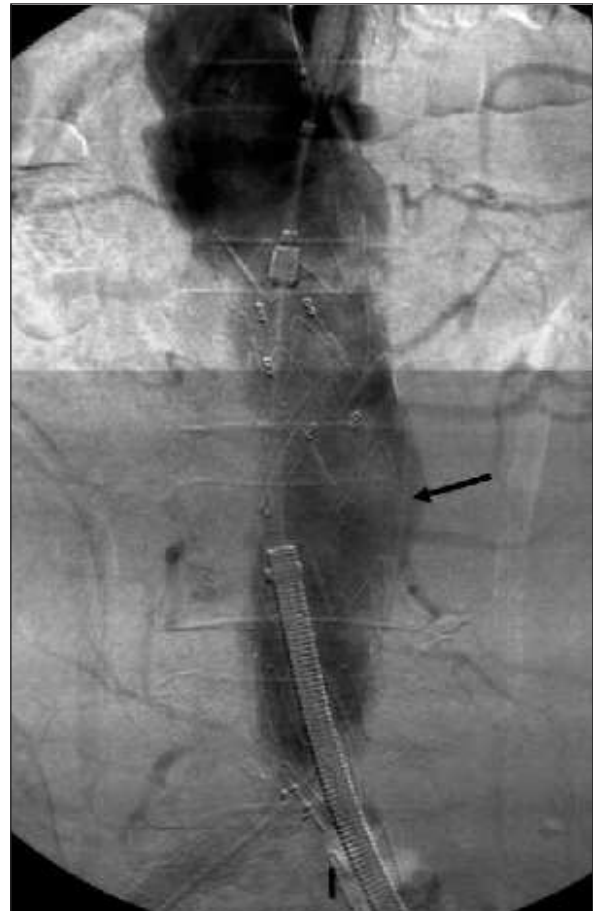

FIGURE 2: Thoracic stent graft was used as aortic extender in order to get a slightly larger diameter for the suprarenal fixation. Note the bare stent in the right common iliac artery implanted before for the occlusive disease and minor endoleak nearby the left border of the stent-graft (arrow).

FIGURE 1: Contained rupture of the abdominal aorta; note the fracture of the calcified plaque on the left-anterior wall of the abdominal aorta (arrow).

CASE 2

Seventy five years old male was admitted to the hospital with sudden onset abdominal pain. He had been followed with the diagnosis of AAA and had refused either endovascular or open repair. His blood pressure was 80/55 mmHg. On admission he was immediately transferred to the angiography suit after the CT confirmation of rAAA (Figure 3). A left aorto-uniiliac stent-graft and a contralateral iliac occluder were placed and a femoro-femoral cross-bypass was performed under local anesthesia without any hemodynamic compromise (Figure 4). He was discharged on the 4th postoperative day. Thrombosis of the left iliac extension occurred 6 months later and an axillo-femoral bypass was carried out. He is still doing well 43 months after the primary procedure.
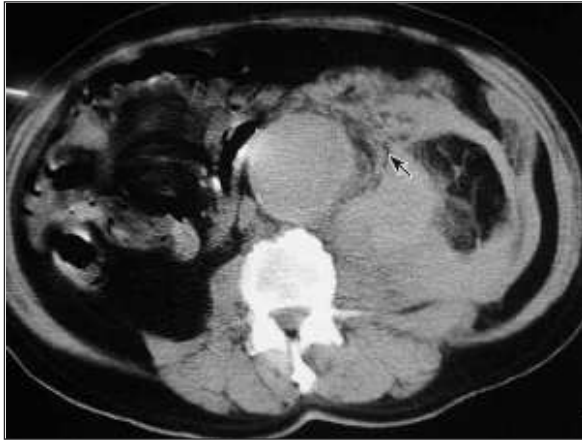
FIGURE 3: Ruptured AAA; note the expanding hematoma along the left border of the aneurysmatic abdominal aorta (arrow).

FIGURE 4: MR Angiography of the same patient 2 weeks after the procedure. Note the slight stenosis of the stent-graft corresponding to the aortic bifurcation (arrow), and good filling of the femoro-femoral cross-bypass reconstruction. This patient had necessitated an axillo-femoral bypass due to acute occlusion of the stent-graft limb six months after the procedure.

CASE 3

Sixty five years old male was referred from another hospital with the tomographic diagnosis of a rAAA. He presented with severe dyspnea, severe abdominal distension and fatigue. The systolic and diastolic blood pressures were 140 mmHg and 65 mmHg respectively, and the heart rate was 142 beats/minute. The hematocrit level was 26.3%. His abdominal CT revealed a large retroperitoneal hematoma due to a rAAA with the infra-renal aortic segment suitable for EVAR and a giant umbilical hernia (Figure 5). He also had severe spondilytis and severe restrictive and obstructive lung disease. Considering these comorbid factors the plan was to perform EVAR under general anesthesia. A left aorto-uniiliac stent-graft and a contralateral iliac occluder were implanted, and a femoro-femoral cross-bypass was performed (Figure 6,7). He was transferred to the ICU with good hemodynamic condition but abdominal distension persisted. The abdominal pressure measured indirectly from the urinary catheter was 18 mmHg. He was consulted by the general surgeons and followed conservatively thinking that the presence of a large umbilical hernia would prevent the development of an abdominal compartment syndrome. But he could not be weaned off ventilatory support in the following days. Proteus mirabilis was grown in tracheal cultures. Tracheostomy was performed after two unsuccessful extubation attempts and he was lost due to sepsis and multiorgan failure on the 14th postoperative day.

DISCUSSION

Ruptured AAA is one of the most drastic emergencies for the cardiovascular surgeon. The operative mortality for open repair of rAAA has been estimated to be 41% for the year 2000 in spite of improvements in resuscitation and critical care.[7,8]

Associated medical morbidities, significant blood loss, surgical insult of laparotomy, hypothermia and coagulopathy are the drawbacks for the open repair. EVAR for rAAA appears to decrease surgical stress, morbidity and postoperative mortality in recent series.[9]
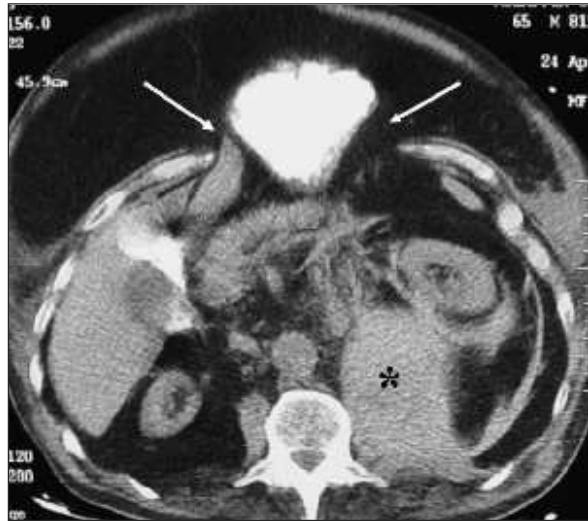
FIGURE 5: Ruptured AAA and giant hernia of the abdomen; note the edges of the rectus muscles of the abdomen, herniation of the stomach, small bowel, and the omentum (arrows), and retroperitoneal hematoma (asterix).
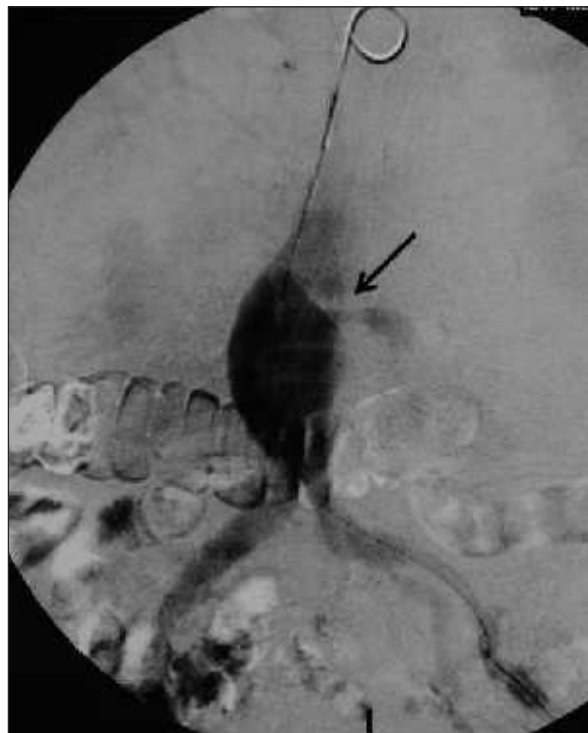

FIGURE 6: Perioperative digital subtraction angiography of the same patient. Note the leakage of the contrast material through the left border of the AAA (arrow).

Systemic inflammatory response and its resultant multiorgan dysfunction are frequently seen after open repair of ruptured AAAs. Preoperative and intraoperative hypotension, surgical trauma during

aortic exposure, hypothermia and coagulopathy caused by the large volume exchange, prolonged laparotomy and lower body ischemia due to aortic cross-clamping aggravate the physiologic stress. EVAR may ameliorate these events by reducing the blood loss, limiting the retroperitoneal tamponade, preventing the major surgical injury, avoiding aortic occlusion, and improving thermoregulation.

Despite the advantages of EVAR of rAAAs, there are also some potential disadvantages. The requirement of a CT scan to assess the anatomical suitability for EVAR has raised the concern of a delay in the management of patients with rAAA. On the other hand the material degeneration of the stent-grafts can lead to dislocation of the graft. This may cause graft thrombosis, aortic perforation, or secondary endoleaks. The rate of secondary intervention for failure of the stent-graft in the infrarenal aorta is as high as 15%.[10]

A retrospective study by Lloyd et al. indicated that in the patients with rAAA who did not undergo surgery because of advanced age or associated comorbidities, the median interval between admission and death was 10 hours and 45 minutes.[11] This study points out that most of the patients with rAAA are sufficiently stable to undergo CT scan to confirm the suitability of EVAR. Scanning time and transport takes approximately 20 minutes in
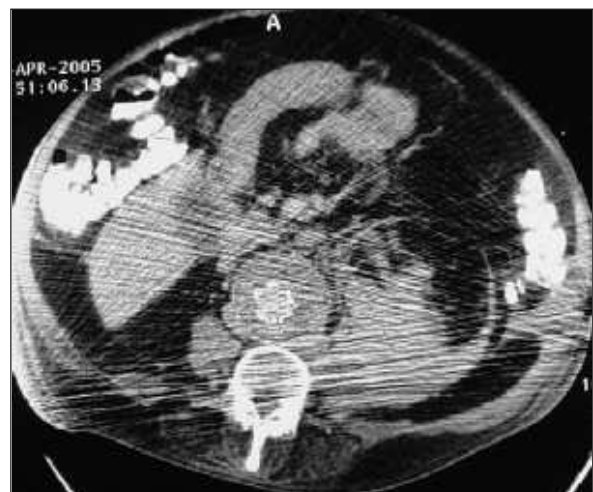

FIGURE 7: Abdominal CT evaluation of the same patient on the second postoperative day. (The image is artifacted). Note that there is no change in the extent of the hematoma and well placed stent-graft inside the aneurysm sac without any prominent endoleak.

our hospital. Nevertheless CT scan is an option, it is not the rule. The feasibility for EVAR may be assessed by an angiogram and IVUS in the operating room.[12] If hemodynamic instability occurs during the procedure, one can control the suprarenal aorta by advancing and inflating a compliant balloon over the access wire via the femoral or brachial arterial approach under fluoroscopy.[13] This way a sudden drop in blood pressure can be prevented on induction of general anesthesia.

Regarding the material failure that may cause migration, endoleaks and rupture; immediate endovascular bleeding control may be an appropriate goal in ruptured AAAs. EVAR at least may serve as a bridge to definitive open surgical repair or secondary EVAR performed under elective circumstances.

Brandt et al evaluated the feasibility of EVAR of rAAA in their study.[12] They were able to perform EVAR in 46% of the patients with rAAA, and concluded that potentially 54% of the patients could have been suitable for EVAR. Their absolute criteria for EVAR considering the infrarenal neck were at least 15 mm of length and a diameter of less than 30 mm. Thrombus less than 40%, and calcification less than 80% of the circumference and neck angulation less than 90° were the relative criteria. Although they could not demonstrate a statistically significant difference between the open repair group and the EVAR group; EVAR group tended to present less morbidity, mortality and hospital stay.

Two systematic reviews of recent medical literature, one of Harkin et al[15] including 891, and the other of Visser et al[16] including 148 patients with endovascular repair of the ruptured abdominal aortic aneurysms were reported in 2007. Whilst in the first study there was no benefit in mortality in the only one randomized controlled trial, evidence from non-randomized studies suggested a trend towards reductions in blood loss, duration of intensive care treatment, early complications, and mortality.[15] In the second review the 30-day mortality with EVAR was 22% compared to 38% in open surgery, but still this difference was not statistically significant.[16]

Our third patient who was lost due to multiorgan failure attracted our attention to abdominal compartment syndrome. Although there was no progression of the hematoma in the retroperitoneum, the intraabdominal pressure was 18 mmHg. He had a giant umbilical hernia creating extra space for abdominal organs, thus decreasing the intraabdominal pressure and this encouraged us to follow conservatively. Unfortunately the borderline respiratory distress caused by both severe obstructive and restrictive lung disease was aggravated by the abdominal distention and this was followed by ventilator induced pneumonia, multiorgan failure and death. It has been stated that respiratory dysfunction may occur at intraabdominal pressures as low as 15 mmHg, with progressive deterioration at higher pressures.[14]

CONCLUSION

Endovascular aneurysm repair seems to be safe and efficient in anatomically suitable patients compared to open repair in rAAAs. Scanning procedures do not prolong the intervention time significantly. The abdominal compartment syndrome should be looked for carefully. Our initial experience supports the feasibility of EVAR for rAAA.

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