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## Endovascular treatment of ruptured abdominal aortic aneurysms (rAAA) – own experience

### Wewnątrznaczyniowe leczenie pękniętych tętniaków aorty brzusznej – doświadczenia własne

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None  
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#### INTRODUCTION

Aneurysm (lat. *aneurysma*) is defined as a dilatation of the artery to a diameter at least 50% greater than normal vessel. In practice infrarenal abdominal aortic

#### S u m m a r y

**Introduction.** Abdominal aortic aneurysms (AAA) due to the asymptomatic development and high mortality when ruptured are called silent killers. Incidence of AAA increases with age and affects males more often. In the case of rupture only a very rapid intervention gives a chance to save life.

**Aim.** Evaluation of the effectiveness of the ruptured abdominal aortic aneurysm endovascular treatment.

**Material and methods.** Between 2009 to 2015 in the Department of Interventional Radiology and Neuroradiology 45 patients with ruptured abdominal aortic aneurysms underwent – endovascular aortic repair (EVAR). The study group included 36 men and 9 women aged 54-91 years (average – 83 years).

**Results.** The technical success of the procedure was noted in all cases, just one patient presented negligible endoleak type 1A in the final angiography. Perioperative mortality rate was 35.6%.

**Conclusions.** Endovascular treatment of ruptured abdominal aortic aneurysms as a minimally invasive procedure seems to increase patients' survival chances.

#### S t r e s z c z e n i e

**Wstęp.** Tętniaki aorty brzusznej ze względu na często bezobjawowy przebieg oraz wysoką śmiertelność w przypadku pęknięcia nazywane są cichymi zabójcami. Częstość ich występowania rośnie wraz z wiekiem i znacznie częściej dotyczą osób płci męskiej. W przypadku ich pęknięcia jedynie bardzo szybka interwencja daje szansę na uratowanie życia.

**Cel pracy.** Ocena skuteczności leczenia wewnątrznaczyniowego pękniętych tętniaków aorty brzusznej.

**Materiał i metody.** W latach 2009-2015 w Zakładzie Radiologii Zabiegowej i Neuroradiologii wykonano 45 zabiegów implantacji stentgraftów u pacjentów z pękniętym tętniakiem aorty brzusznej. W grupie badanej było 36 mężczyzn oraz 9 kobiet w wieku 54-91 lat (średnio – 83 lata).

**Wyniki.** Wszystkie zabiegi zakończyły się sukcesem technicznym – 100%, jedynie u jednego chorego utrzymywał się śladowy przeciek typu 1A w angiografii końcowej. Śmiertelność okołoperacyjna wyniosła 35,6%.

**Wnioski.** Leczenie wewnątrznaczyniowe pękniętych tętniaków aorty brzusznej jako zabieg małoinwazyjny wydaje się zwiększać szanse chorych na przeżycie.

aneurysm are diagnosed when the aortic diameter exceeds 3 cm (1, 2).

AAA is located between the diaphragm and aortic bifurcation, usually below the orifice of the renal

arteries. Aneurysms are usually asymptomatic until they rupture. Sometimes patients complain of unusual abdominal, lumbosacral or lower extremity pain and/or pulsation in the abdomen. Enlargement of an aneurysm may cause symptoms of the adjacent anatomical structures compression. The most common symptoms are hydronephrosis, proteinuria and/or hematuria all caused by the ureter compression, lower extremity deep venous thrombosis caused by the iliac vein or inferior vena cava compression, or more rarely nausea and emesis as a result of the duodenum or visceral vessels compression (3, 4).

Due to the clinical picture, aneurysms are divided into asymptomatic, symptomatic and ruptured. True and false aneurysms may be distinguished when considering the construction of the aneurysm, and morphology assessment differentiate them between saccular and fusiform.

AAA occur primarily in men – it is estimated that 3-9% of men and 1-2% of women are affected. The prevalence of aneurysm increases with age. According to long-term observations concerning the natural history of the AAA, the annual growth rate of the aneurysms with a diameter between 30 and 55 mm is 2-4 mm. The risk of the AAA rupture increases with the aneurysm diameter expansion (5, 6). It is assumed that the risk of the AAA rupture is 1-11% per year for aneurysms with a diameter of 50-59 mm, 10-22% per year for aneurysms with a diameter of 60-69 mm and 30-33% when the diameter exceeds 70 mm (7). In the case of aneurysm rupture mortality reaches 80% and up to 75% of these patients die before arriving to the hospital (8, 9).

Rupture of the aneurysm usually presents as an acute pain in the lumbar region frequently with a concomitant loss of consciousness. Rupture of the aneurysm proceeds as a two-stage process oftentimes. Blood extravasation into the retroperitoneal space is observed in the first stage. Due to its limited capacity the temporary auto-tamponade appears (inhibition of blood extravasation as a result of pressure equalization between the vessel lumen and a retroperitoneal space). The second stage is a spillage of the retroperitoneal hematoma into a notably more voluminous peritoneal cavity, which leads to an excessive blood loss and patient's death within few minutes (9).

Most of the AAAs are discovered accidentally, during examinations (abdominal US, CT, MRI) ordered for a different reason than AAA evaluation (10). US is the first-line imaging examination if AAA is suspected. If the diameter of the aneurysm is eligible for the operation (> 50 mm in men, > 45 mm in women) angio-CT examination is essential for an accurate morphology assessment, which allows the proper preparation for the treatment both open surgery repair (OSR) and EVAR. Angio-MR can be an alternative modality to the angio-CT examination (11).

## AIM

Evaluation of the effectiveness of the ruptured abdominal aortic aneurysm endovascular treatment.

## MATERIAL AND METHODS

Between 2009 and 2015, 45 patients with rAAA hospitalized in the Department of Vascular Surgery underwent stentgraft implantation in the Department of Interventional Radiology and Neuroradiology, Medical University in Lublin. The study group included 36 men and 9 women aged 54-91 years (average – 83 years). Hemodynamically stable patients underwent angio-CT before the procedure. Most of the stentgraft implantations were performed under general anesthesia (88.8% – 40/45), spinal anesthesia was used in 4 procedures, while in 1 procedure local anesthesia with intravenous sedation was performed. Aorto-bi-iliac stentgrafts were implanted in 39 patients. Aorto-uni-iliac stentgraft system was used in the case of arterial iliac axis total occlusion which precluded the typical accomplishment of the procedure. Procedures with the Zenith Uni-iliac stentgraft deployment were completed with the femoro-femoral bypass performance.

Zenith (Cook Medical) aorto-bi-iliac stentgrafts were implanted in 23 patients, in 16 patients Excluder/Excluder C3 (Gore) stentgrafts were used. Before the treatment, each patient underwent angio-CT examination as a basis for the proper prosthesis selection in the angiographic workplace straightaway (fig. 1). After the endovascular treatment in 3 patients the surgical removal of the abdominal cavity hematoma was performed.



Fig. 1. Angio-CT – 3D reconstruction of the rAAA

## RESULTS

The technical success of the procedure was noted in all cases (fig. 2, 3). A negligible type 1A endoleak was observed in 1 patient despite ballooning at the proximal sealing zone.

Overall operative mortality rate was 35.6% (16 out of 45 patients). Intraoperative mortality rate was 6.7% (3 out of 45 patients) and during the first 30 days after the procedure or later during the hospitalization mortality rate was 28.9% (13 out of 45 patients).

Patients were assessed with Doppler ultrasound examination during the follow-up at 1, 6 and 12 months after the procedure and thereafter annually. If results were ambiguous angio-CT was performed.

## DISCUSSION

Mortality in patients with rAAA is extremely high, according to literature ranging from 9 up to 83% (12-17). Considering the wide range of data concerning overall operative mortality in patients with rAAA Bown et al. in 2002 performed a meta-analysis of 171 studies published in English language literature from 1955 to 2000 (161 retrospective and 10 prospective studies), including 21 523 emergency patients operated on for rAAA. Overall operative mortality was 48% (95% CI: 46-50%), while intraoperative mortality was 15% (95% CI: 13-17%) and postoperative mortality was 40% (95% CI: 37-43%). The estimated mortality was 55% in 1960, 48% in 1980 and 41% in 2000 indicating mortality reduction of approximately 3.5% per decade (18).

EVAR in the elective management of AAA comparing to OSR demonstrates lower 30-day mortality rate whereas the disparity is decreasing with time (19-23).

Published studies show the superiority of the endovascular treatment and better long-term results also in patients with rAAA. Novo Martinez et al. evaluated 82 patients with rAAA. In the group which underwent endovascular treatment operative mortality was 42%, while in the group treated with open surgery 63.49%. Duration of hospitalization was also significantly reduced in EVAR group (24).

Researchers from the Vascular Center in Bonn obtained in their study similar mortality rate after endovascular treatment of patients with rAAA to that achieved in our center – 30 day mortality rate was 28.9%, while the overall mortality during hospitalization was 40.8% (25). In a study conducted in China, comparing the two treatment methods (EVAR and OSR) in a group of 59 patients with rAAA overall operative mortality was 36.5% (27.8 vs. 47.8% – EVAR vs. OSR). On the contrary, reintervention rate in 30-days after the procedure as well as during the whole follow-up was higher in patients undergoing EVAR (36.1 vs. 8.7%). An increased number of reinterventions in patients undergoing EVAR is associated with the occurrence of endoleaks after implantation of stent grafts. However, most reinterventions are performed under local anesthesia which is more beneficial for the patients with numerous comorbidities. In the con-



Fig. 2. Initial intraoperative angiography



Fig. 3. Control angiography after the treatment of rAAA

clusions the authors indicate EVAR as the method of choice for the patients with rAAA (26).

In a study of the Dutch center in Eindhoven showing 15 years of experience in the rAAA and elective AAA treatment (Broos et al.) a very low mortality rate

in emergency patients was obtained. Only 18.9% of patients with rAAA died within 30 days after the procedure, and mortality rate in patients who underwent elective treatment was 2.2%. During the 5 years after elective EVAR 65.1% of patients survived whereas after emergency treatment the ratio was 48.1% (27).

Interesting results were demonstrated in the study conducted in New Zealand including 285 patients with rAAA. Overall mortality rate was 34% and the authors did not find statistically significant difference between patients treated with EVAR and OSR. A difference in the length of hospitalization and the number of postoperative complications were found, both in favor of patients after endovascular treatment (28).

The above mentioned studies show a significant disparities in the results obtained in different centers. Nevertheless there is a persistent tendency to indicate endovascular treatment as a primary treatment option.

Endovascular treatment of rAAA, as a minimally invasive procedure seems to increase patients' survival chances. A small incisions in the groin compared with major abdominal surgery in usually elderly patients, frequently hemodynamically unstable due to excessive blood loss and numerous comorbidities make EVAR the method of choice for rAAA. Nonetheless each patient should be approached individually when choosing a treatment method.

## CONCLUSIONS

Endovascular treatment of rAAA, as a minimally invasive procedure seems to increase patients' survival chances. An essential requirement for the endovascular treatment of the patients with rAAA is a 24-hour availability of the qualified personnel as well as the wide range of the stentgraft types and sizes ready to use.

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