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Kasuistika | Case report

Minimally invasive treatment of a life threatening ruptured thoracic aortic aneurysm

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SOUHRN

Popisujeme případ život ohrožující ruptury aneurysmatu hrudní aorty úspěšně řešené minimálně invazivním výkonem. Do naší nemocnice byl přijat 34letý muž v kritickém stavu, s akutní bolestí na hrudi po dobu 18 hodin, hemotemezí a s rychle klesajícími hodnotami hemoglobinu přes masivní transfuzi krve, s těžkou hypotenzí, anurií a se střevní obstrukcí. Ve věku 13 let podstoupil pacient operaci pro koarktaci oarty. CT skeny s použitím kontrastní látky prokázaly rupturu aneurysmatu hrudní aorty s těžkým levým hemothoraxem. Na základě pacientova celkového stavu, věku a anatomických poměrů léze bylo rozhodnuto o endovaskulární léčbě onemocnění sestupné hrudní aorty pomocí stentgraftů (thoracic endovascular aneurysm repair, TEVAR). Do hrudní aorty byly implantovány dva stentgrafty Valiant překrývající lézi primárního entry LSA. Vzhledem k reziduálnímu plnění aneurysmatického vaku levou podklíčkovou tepnou byl implantován vaskulární okludér; výsledkem byla úplná izolace aneurysmatu od krevního proudu s následným velmi krátkým a úspěšným obdobím zotavení. Poté byl pacient indikován k provedení video-asistované thorakoskopie (VATS) s cílem odstranit reziduální krevní sraženinu v levém pleurálním prostoru. Ruptura aortálního aneurysmatu je sice potenciálně fatální příhoda, pokud je však diagnostikována včas, lze ji úspěšně řešit endovaskulárně. V popsaném případě znamenalo naprosto nechirurgicky miniinvazivní řešení (TEVAR a uzávěr tepny ve snaze izolovat disekci a odstranění krevní sraženiny metodou VATS) účinný a život zachraňující výkon s rychlým zotavením bez dalších následků přes původně kritický stav při hospitalizaci.

Keywords:
Aortic aneurysm
Aortic aneurysm rupture
Endovascular treatment
TEVAR
VATS

ABSTRACT

We report a case of a life threatening thoracic aortic aneurysm rupture, treated successfully with minimally invasive approach. A 34-year-old man was admitted to our hospital in critical clinical condition, presenting with acute chest pain for 18 h, hematemesis and rapidly decreasing hemoglobin, despite massive transfusion done, severe hypotension, anuria and ileus. The patient had history of surgical aortic coarctation repair at age of 13. Contrast-enhanced CT images revealed a thoracic aortic aneurysm rupture with severe left-sided hemothorax. Based on the patient general condition, age and anatomy of the lesion thoracic endovascular aneurysm repair (TEVAR) was done. Two stent grafts Valiant were implanted in the thoracic aorta covering the entry tear engaging the LSA ostium. Because of residual filling of the aneurysmal sac through left subclavian artery, vascular occluder was implanted, causing complete isolation of the aneurysm from the blood flow. Very short and successful recovery period was observed. Due to residual coagulum in left pleural space the patient was directed for VATS evacuation. Aortic aneurysm rupture is a potentially fatal condition, but when diagnosed early, it can be successfully treated by endovascular methods. In this case a totally non-surgical minimally invasive approach (TEVAR and vascular plug to isolate the dissection and VATS assisted hemothorax evacuation) resulted efficiently and in a lifesaving manner with fast recovery without any sequelae despite the critical clinical presentation.

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Introduction

Thoracic aortic aneurysm is a disease, affecting approximately 10.4 per 100 000 persons per year [1]. The incidence is far greater in patients, operated for aortic coarctation in the past. Early and late postoperative aneurysm/pseudoaneurysm may occur near correction site according to operative technique used: 17% for subclavian flap angioplasty, 14% after patch angioplasty, 6% after interposition graft repair, and occasionally after end-to-end anastomosis [2]. The advanced age of surgical repair is independent risk factor for local aneurysm formation [3]. Several epidemiologic studies have shown that such aneurysms must be early diagnosed (regular follow-up imaging for all operated patients is mandatory) and treated, because of high rupture and death rate [4]. Thoracic aortic aneurysm rupture is a condition with extremely high mortality. The clinical approach to these patients dramatically changed in the last two decades, when the Thoracic EndoVascular Aortic Repair (TEVAR) became available. Several case reports, case series and meta-analyses reveal advantages of TEVAR versus open-surgery in cases of acute aortic rupture.

Case presentation

A 34-year-old male patient was referred to our Emergency department in state of hypovolemic shock, approximately 18 h after sudden, new onset severe chest pain during physical activity, accompanied by hematemesis. The patient had a history of aortic coarctation repair at 13 years, with no subsequent follow-up. Risk factors were active smoking and uncontrolled hypertension (usual systolic blood pressure 150–160 mmHg), without known collagenopathy.

At admission patient was in a critical condition despite all resuscitation activities done during the transportation (including 7 units of fresh blood transfusion). He was in hypovolemic shock, unresponsive, with pale skin, blood pressure 90/50 mmHg, tachycardia 122 beats per minute, with no breathing in the left thoracic side. An electrocardiogram showed sinus tachycardia with no conduction

Table 1 – 2014 ESC Guidelines recommendations for (contained) rupture of the thoracic aortic aneurysm.

Recommendations	Class[a]	Level[b]
In patients with suspected rupture of the TAA, emergency CT angiography for diagnosis confirmation is recommended.	I	C
In patients with acute contained rupture of TAA urgent repair is recommended.	I	C
If the anatomy is favorable and the expertise available, endovascular repair (TEVAR) should be preferred over open surgery.	I	C

CT – computed tomography; TAA – thoracic aortic aneurysm; TEVAR – thoracic endovascular aortic repair.
[a] Class of recommendation
[b] Level of evidence

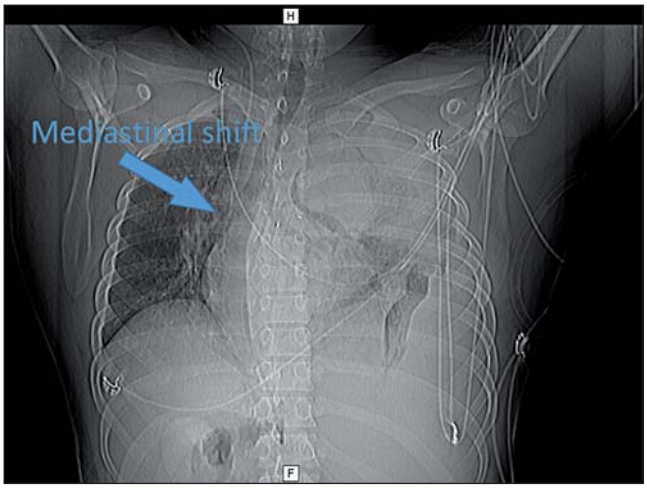

Fig. 1 – Diagnostic CT revealing massive pleural effusion.

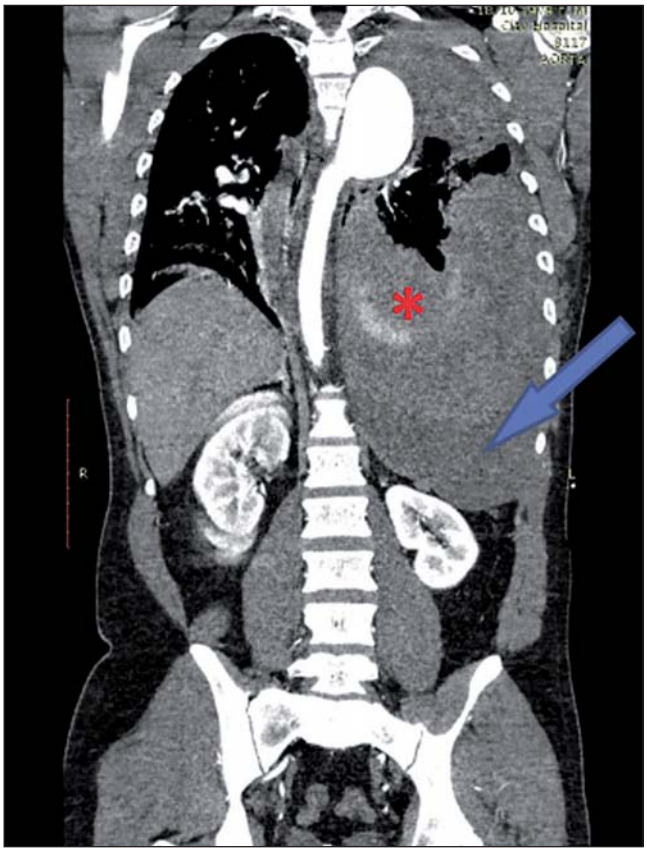

Fig. 2 – Initial CT aortography with active bleeding persisting.

abnormalities. Laboratory results revealed anemic syndrome with Hb – 95 g/l, Hct – 0.272 (despite massive blood transfusion during transportation).

The initial evaluation of patient included emergency chest Xray and CT aortography that revealed ruptured aortic aneurysm with massive pleural effusion (hemothorax) with significant left to right deviation of the esophagus, trachea and thoracic aorta. There was also mediastinal shift and displacement of the left diaphragm caudally with spleen and left kidney compression because of extremely big blood volume in the pleural space (Figs. 1 and 2). The CT reveals active bleeding persisting in left pleural

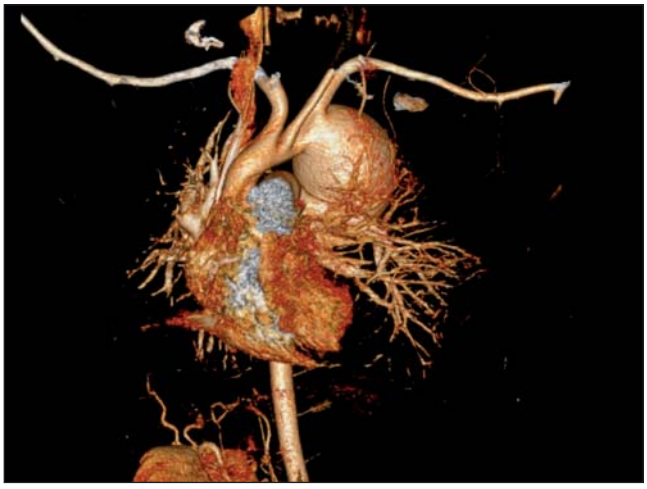

Fig. 3 – CT reconstruction of aortic aneurysm.

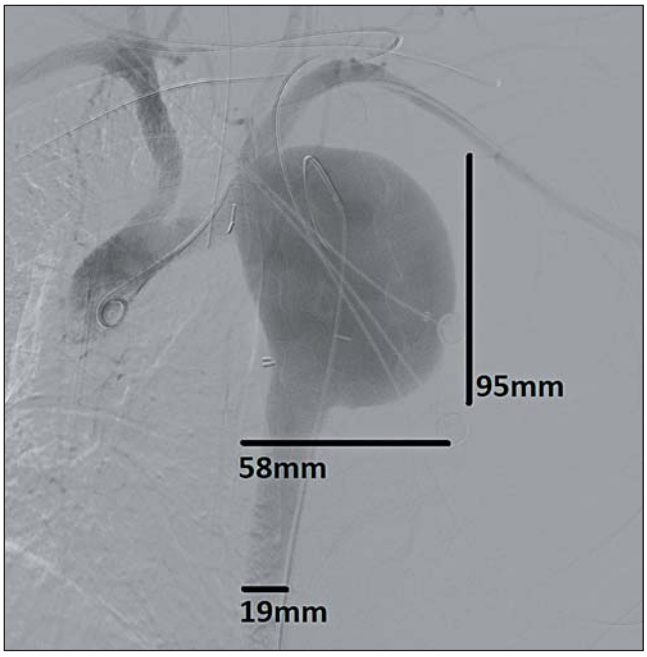

Fig. 4 – Preprocedure aortography.

Fig. 5 – Postprocedure control CT, revealing aneurysmal filling (marked with a red star).

space (marked with star in Fig. 2) and another find: left subclavian artery arising from the aneurysmal sac. Fig. 2 shows left diaphragm shift (from concave to convex) and displacement of left kidney from massive hemothorax. The measured size of the aneurysm was 95 mm × 58 mm involving the ostium of the left subclavian artery (LSA). A 3D reconstruction on the heart, aorta (including aneurysm) and main vessels was made for better visualization (Fig. 3).

During the short clinical discussion our heart team considered that the open surgery correction of aneurysm rupture in this clinical state was associated with huge intraoperative mortality. Based on the general condition, age, localization of the rupture site and following the up-to-date guidelines for type B aortic dissection management emergency TEVAR repair was chosen by the multidisciplinary heart team.

A multidisciplinary team was gathered including: two invasive cardiologists (with rich experience in TEVAR procedures), anesthesiologist, vascular surgeon, radiologist, and nurse team. The whole procedure was performed with local anesthesia and sedation. Two standard vascular approaches were used, including 6F left radial approach (to facilitate angiographic visualization and LSA ostium landmarking) and 24F femoral surgical approach, used for the introduction of the stent grafts.

An invasive aortography using 5F "pigtail" catheter placed in the ascending aorta was made, completely confirming the initial finding – huge thoracic aorta aneurysm engaging the left subclavian artery ostium with larger but contained rupture toward the left thoracic space (Fig. 3). Two overlapping stent grafts Medtronic Valiant 28/197 mm and Medtronic Valiant 30/197 mm were chosen to completely cover and isolate the aneurysm from the bloodstream. The two devices were implanted overlapping each other, starting 2 cm before the left subclavian artery (landing zone), covering all the aneurysmal length and ending in intact (healthy) part of descending aorta (Fig. 4).

When a control CT aortography was made after the stent grafts implantation, a residual retrograde filling was seen through a massive collateral vascular network and retrograde flow from the LSA (type II endoleak, Fig. 5). Red star in Fig. 5 demonstrates the filling of aneurysmal sac. In this case we saw a very interesting phenomenon – the main part of retrograde filling came from the left internal mammary artery and not from the vertebral artery as usual. It is most probably due to the large collateral network elaborated before the aortic coarctation correction allowing arterial supply of the lower part of the body in the time before the surgical correction of the coarctation. The most significant collateral pathway included left subclavian artery (before the coarctation), internal thoracic artery, intercostal arteries and thoracic aorta (coarctation). A retrograde blood flow in these vessels becomes a reason for filling aneurysmal sac even after a complete coverage of the proximal window of the aneurysm by the implanted stent-grafts. We have chosen to implant a vascular occluder device at the LSA ostium proximal to the left vertebral and internal thoracic artery ostium using the same left radial approach to stop this residual retrograde filling and allowing optimal collateral

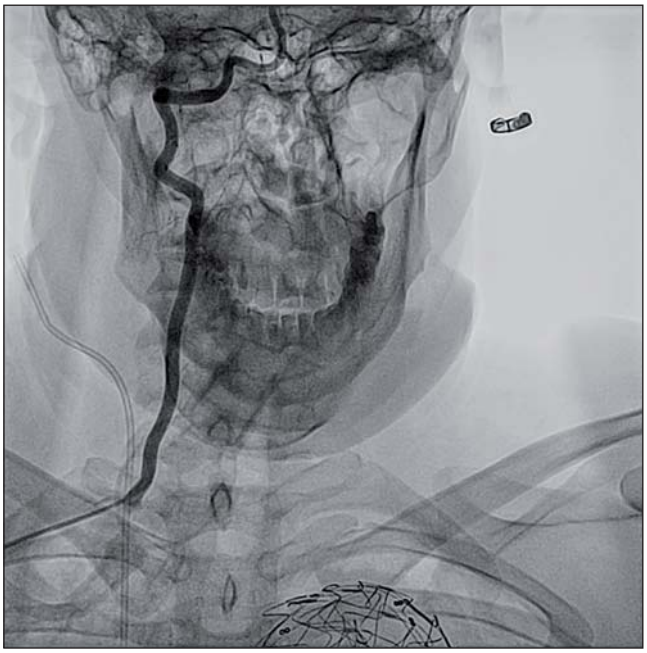

Fig. 6 – Control right vertebrography.

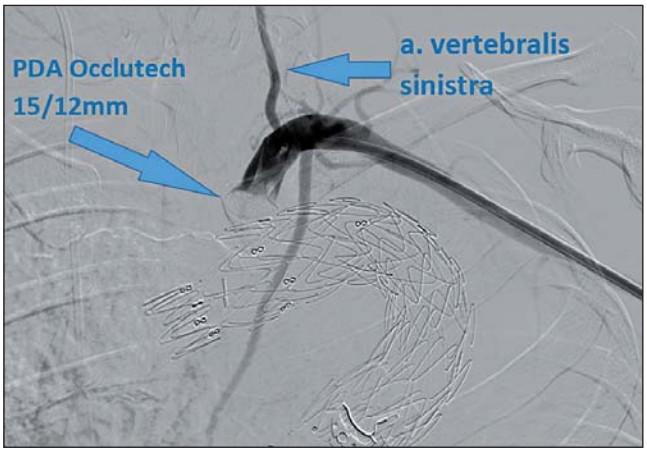

Fig. 7 – Left subclavian artery with implanted occluder device.

Fig. 8 – Final CT reconstruction with no aneurysmal filling and without end organ ischemia.

filling of the left arm. An initial selective right vertebral arteriography was made proving normal cerebral arterial supply in the vertebro-basilar territory from the right vertebral artery (Fig. 6).

A 15/12 mm PDA Occlutech occluder device was successfully implanted at the ostium of LSA. Diagnostic angio showing total interruption of retrograde flow by the implanted vascular plug (Fig. 7). After complete isolation of the aneurysmal sac and a left thoracic drain was introduced and 2.5 liters of old blood were slowly drained.

After the procedure a surgical closure of femoral approach was made and the patient was transferred to the ICU for observation. Very short recovery period was observed, without subsequent recurrence of symptoms. After 3 days in ICU the patient was transferred to the standard care ward. On the third postprocedure day new CT aortography with 3D reconstruction was made, demonstrating precise stent graft and vascular occlude position with full aneurysmal sac isolation, without end organ ischemia and no residual leakage to the left pleural space with left lung expansion (Fig. 8). The patient was discharged at 8th postprocedure day. Because of residual partial left sided hemothorax, despite the placed drainage, he was transferred to the thoracic surgery department for further evacuation of pleural coagulum. A minimally invasive video-assisted thoracoscopic surgery (VATS) was performed with complete evacuation of the residual coagulum and full left lung expansion at discharge was proven (Fig. 9).

Uneventful clinical follow-up was observed. One and three months after combined minimally invasive treatment a control CT aortography was made, showing full isolation of the aneurysm with no leakage, no pleural effusion and expanded lung parenchyma. Uneventful clinical follow-up was registered.

Discussion

Our experience with TEVAR includes 47 cases during the last 3 years. Out of them 4 (8.5%) were done in patients with ruptured aortic aneurysms or dissections. We chose to report this clinical case, because we consider it as unique – with practically terminal condition of the patient at admission, extremely risky for open surgery treat-

Fig. 9 – Control CT after VATS operation with no pleural effusion and left lung expansion.

ment. Endovascular repair was probably the only survival option for his life. Because of high mortality, there are few published case reports with successful endovascular treatment of aortic aneurysm rupture treated in a similar way. Some of them are only bridge to open surgery. We did not find a case report presenting combination of TEVAR with single-stage implantation of the occluder device (because of type II endoleak) and minimally invasive approach (VATS) to massive pleural effusion. Aim of this publication is to show totally endovascular and minimally invasive approach in a patient with ruptured aortic false aneurysm resulting in a left sided pleural effusion and hemorrhagic shock.

It is important to emphasize in the last ESC guidelines for aortic diseases, in patients with suspected rupture of TAA endovascular repair (TEVAR) should be preferred over open repair (recommendation class Ic) (Table 1) [5].

Conclusions

Aortic aneurysm rupture is a dramatic condition with extremely high mortality as a natural clinical evolution. Emergent open surgical or endovascular treatment is mandatory. In the late several publications endovascular treatment is considered as a method of choice because of lower mortality and morbidity rate. In just few published cases totally endovascular or minimally invasive approach was applied. Most probably these results are the reason in the last guidelines endovascular repair was included with class IC indication for aortic dissection [6]

Conflict of interest
No conflict of interest.

Funding body
None.

Ethical statement
I declare, on behalf of all authors, that the research was conducted according to Declaration of Helsinki.

Informed consent
I declare, on behalf of all authors, that informed consent was obtained from all patients participating in this study.

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