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Visceral artery aneurysms - review

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Abstract

Introduction: Visceral artery aneurysms remain a rare condition. A rupture is the dangerous complication, which occurs in about 10-20% of the cases, they have a high mortality rate estimated up to 70%. Rupture percentage is higher in pregnancy, up to 50%, with considerable mortality rates of 75% for the pregnant and 95% for the foetus. The most common location of abdominal aneurysm is splenic artery with prevalence of 60% out of visceral aneurysms affecting this vessel. Since they are asymptomatic in 95% of cases, they are usually a random finding of examinations performed for other indications.

State of knowledge: Patients with a suspected visceral aneurysm are qualified for ultrasound as the first line examination, but currently computed tomography is the most favourable method.

Catheter-based angiography is considered to be the gold standard. It allows precise identification of the location of aneurysm and its morphology. For the treatment of visceral artery aneurysms numerous ways are available, however the endovascular method is recommended as the first choice in most cases.
Conclusions: Visceral artery aneurysms are a rare but potentially fatal pathology. The silent nature makes it difficult to diagnose. When recognised, aneurysms should be treated immediately, since rupture is associated with a considerable high mortality rate. Open and endovascular interventions are equally durable for elective repair of visceral artery aneurysms, but endovascular interventions are considered to be safe and effective, resulting in lower morbidity and mortality rate. There is a need for further large studies evaluating effectiveness and long-term outcome of endovascular treatment.

Key words: visceral artery aneurysm, embolizations, splenic artery aneurysm, pseudoaneurysm

Introduction - incidence and aetiology

Visceral artery aneurysms remain a rare, mostly random finding in radiology, with the documented prevalence estimated about 0,1-2% [1]. However, the number of undetected visceral artery aneurysms is probably much higher due to nonspecific clinical presentation in the better part of cases. Aneurysms are considered as a hazardous, potentially life-threatening pathology. The most devastating complication is a rupture - concerning about 10-20% of lesions, resulting in retroperitoneal, gastrointestinal bleeding, as well as bleeding into adjacent organs, depending on aneurysm location. In such cases the mortality rate is high, estimated at even 20–70%, depending on the location of the aneurysm [2, 3]. The most fatal consequences of visceral artery aneurysm rupture affect childbearing women. Rupture percentage is higher in pregnancy, up to 50%, with considerable mortality rates of 75% for the pregnant and 95% for the foetus [4].

After the abdominal aorta and iliac arteries, the most common location of abdominal aneurysm is splenic artery with about two-thirds of visceral aneurysms affecting this vessel. The slightly less common location is hepatic (20%) and superior mesenteric artery (5,5%). The rarest locations include the celiac artery, pancreatic branches, gastroduodenal artery and inferior mesenteric artery [5, 6, 7]. Visceral artery aneurysms are usually a random finding during examinations performed for other indications. This is due to the fact that they are asymptomatic in 95% of cases. In other cases occurring symptoms are nonspecific. The identification of visceral aneurysm has become higher in the past few years due to improvement of various imaging techniques and widely available ultrasound and cross-sectional body imaging [2]. Depending on its location the manifestation of a ruptured aneurysm varies and may involve intraperitoneal haemorrhage, gastrointestinal and portal system bleeding [6].

Specification of visceral artery aneurysms

Splenic artery aneurysms account for nearly 60% of reported visceral artery aneurysms. They usually take a saccular morphology and are typically located in the middle to distal part of the vessel. In contrast to other arterial aneurysms, splenic artery aneurysms are predominant in women - four times more frequent than in men - and are especially frequent found in multiparous women - hormonal changes during pregnancy are suspected to be associated with aneurysm formation [7, 8].

Hepatic artery aneurysms are less frequent among all visceral artery aneurysms, usually located in the proper and common hepatic artery. Their prevalence is higher among men than women. The leading cause of its formation is atherosclerosis, such as in other visceral artery aneurysms, but the iatrogenic traumas connected with percutaneous biliary procedures or liver transplantation are responsible for increasing incidence of hepatic artery aneurysms. Rupture is associated with pain, gastrointestinal bleeding and the occurence of

blood in the bile ducts [6, 7].

From a histopathological point of view, aneurysms can be divided into true aneurysms and pseudoaneurysms. True aneurysms expand locally and their walls maintain the entirety of the arterial wall. The main cause of true aneurysm is atherosclerosis. Connective tissue diseases and fibromuscular dysplasia are less common aetiologies. True aneurysms usually form fusiform broadening along the artery. Pseudoaneurysms show a defect in the arterial wall structure, which is usually linked with trauma, infection, iatrogenic causes and inflammation, especially pseudoaneurysms developed secondary to pancreatitis. In most cases they have a saccular shape with a narrow neck connected with the affected artery [7]. The difference between true aneurysms and pseudoaneurysms is important as the clinical course and complication rates differ significantly between them. In particular, the rate of rupture in pseudoaneurysm has been reported to be much higher than true aneurysms [3]. Saccular aneurysms where a bulge forms at one side of the artery, may be more prone to rupture than fusiform aneurysm of similar diameter due to increased wall stress [8].

Visceral artery aneurysms - diagnosis

Patients with a suspected visceral aneurysm are qualified for ultrasound as the first line examination, however most of these abnormalities are detected incidentally during an diagnostic pathway conducted for other indications. The disadvantage is the subjective character of data interpretation - results are highly dependent on the technical skill of the performing sonographer. Ultrasound is an easily available and non-invasive tool which does not require special preparation of patients and provides to detect visceral artery aneurysms with similar accuracy to detecting aortic aneurysms [9]. Dilated artery, thickened wall as well as the presence of pathological changes in arterial wall - atherosclerotic plaque or thrombus - are available with ultrasound imaging. Ultrasonography also provides morphological assessment of aneurysms and hemodynamic evaluation of blood flow [6].

Currently the most favourable method is computed tomography - an invaluable tool for specifying the location, shape and size of a lesion. It provides the assessment of the character of the aneurysm wall, and determines the relationship of the abnormality to other vessels and anatomical structures. Magnetic resonance imaging can be performed in patients with renal failure or allergy to a contrast medium used in computed tomography. Moreover, compared to tomography, the additional benefits include avoidance of nephrotoxic contrast agents use and exclusion of ionising radiation exposure. However, devices used in previous endovascular procedures, such as stents or coils can form artefacts which may hinder assessment of examination or even make it impossible for interpretation [6, 10].

Catheter-based angiography, the highest resolution method, is considered to be the gold standard in the localisation and visualisation of visceral aneurysms. Invasive nature is a drawback of this technique. Catheter-based angiography allows to precisely identify the location of aneurysm, visualise the source of possible bleeding, the pattern of blood flow, collateral circulation as well as concomitant aneurysms [10].

Methods of treatment

For the treatment of visceral artery aneurysms numerous ways are available, including open surgery, laparoscopy, as well as endovascular techniques - with embolization and stenting being the most popular [10]. Trends in operative management were changing over the years. Recent rapid development of techniques and devices used for embolization and stenting contributed to availability of most visceral artery aneurysms for treatment with minimally invasive transcatheter techniques. Nowadays the endovascular method is recommended as the first choice in the best part of cases. The number of overall repairs of visceral artery aneurysms increased substantially during the first decade of XXI, which was mainly driven by an increase in endovascular repairs. Open repairs are becoming less common in absolute number and proportion [11].

The indication for treatment should derive from existing symptoms. In cases of asymptomatic patients, the decision should be determined depending on the risk of rupture that

corresponds with the diameter of the lesion. The most frequently mentioned and generally accepted criterion to treat aneurysms is a diameter of minimum 20 mm, regardless of the diameter of the parent vessel [12]. According to the guidelines, treatment of aneurysm with smaller diameter is recommended if the lesion exceeds three times the diameter of the respective normal artery. [13]. Those indications are different for pregnant or childbearing age women due to the hazardous risk of complications and death - this group of patients may require consideration for earlier intervention [14].

Open surgical repair can be performed with ligation, excision with patching, repair etc. Endovascular techniques are minimally invasive, requiring shorter recovery time. They are characterised by lower incidence of complications and associated by lower risk of morbidity and death. They include embolization, coiling, and use of covered stents. In recent years they have become more and more available in medical practice [15]. Coil embolisation is the most frequently used endovascular technique in visceral artery aneurysm management, representing a safe and cost-effective alternative with low risk of ischemic complications. Coils provide mechanical obstruction and secondary thrombosis with concomitant inflammatory reaction, resulting in exclusion of aneurysm from blood flow. To minimise the risk of material migration, coils should be not smaller than 20% of vessel lumen. The aneurysm with a wide neck requires a stent-assisted strategy of embolisation. The use of stents prevents coil migration from the aneurysm lumen, which may indicate an occlusion of a concomitant vessel and cause an infarction of healthy organs. To enhance the embolic effect in large vessels, coils can be associated with other liquid embolic agents, like glue and Squid [16]. Nowadays embolisation particles, such as polyvinyl alcohol or embospheres, are rarely used for visceral artery aneurysms due to the increased risk of distal ischemia [17].

The comparison meta-analysis, with over 1300 included patients of open and endovascular treatment shows that both methods are safe and effective in true splenic artery aneurysm management. Among 511 revised cases of open surgery technical success was achieved in 97.8% and in 95.2% of 385 endovascular interventions. Conversion to open surgery was necessary in 1.8% of the endovascular cases to successfully exclude the aneurysm. The 30-day mortality was compared in both intervention groups and results support the endovascular method. In the group with open surgery mortality rate was significantly higher reaching 5,1%, compared with 0,6% in the patients treated with endovascular approach ($P < .001$). However, endovascular treatment was associated with a larger number of minor complications, such as wound infection or postembolization syndrome. The incidence of major long-term complications was low and comparable, with a percentage of 1.1% for conventional surgery and 0.8% for endovascular treatment. The mean hospital length of stay was 9.8 days for open surgery patients and was considerably longer compared with the endovascular group, in which mean hospital stay was estimated at 2.0 days [18].

Summary

Visceral artery aneurysms are a rare but potentially fatal pathology. The silent nature makes it difficult to diagnose in an early stage, when the risk of rupture and severe bleeding is low. When recognised, aneurysms should be treated immediately, since rupture is associated with a considerable high mortality rate. With the more frequent use of cross-sectional imaging examinations and concomitant technical development, there is an increase in the incidental detection of visceral artery aneurysms and this indicates a need for clear guidelines. Open and endovascular interventions are equally durable for elective repair of visceral artery aneurysms, but endovascular interventions are considered to be safe and effective, resulting in lower morbidity and mortality rate. The choice of endovascular methods increase in medical practice for this pathology management. There is a need for further large studies evaluating effectiveness and long-term outcome of endovascular treatment.

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