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Ruptured visceral artery aneurysms

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Abstract Visceral artery aneurysms are rare but their estimated mortality due to rupture ranges between 25 and 70%. Treatment of visceral artery aneurysm rupture is usually managed by interventional radiology. Specific embolization techniques depend on the location, affected organ, locoregional arterial anatomy, and interventional radiologist skill. The success rate following treatment by interventional radiology is greater than 90%. The main complication is recanalization of the aneurysm, showing the importance of post-therapeutic monitoring, which should preferably be performed using MR imaging.

Visceral artery aneurysms (VAA) are rare [1], multiple in up to 20% of patients and usually asymptomatic until rupture. Mortality rate due to rupture varies from 25 to 70% [2]. VAA rupture requires multidisciplinary management including emergency-intensive care specialists, surgeons and diagnostic and interventional radiologists. The prevalence varies depending on the anatomical location (Table 1) [3].

An aneurysm is an arterial dilatation (1.5 times the size of the original vessel) with loss of parallelism of the vascular walls. True aneurysms must be differentiated from pseudoaneurysms, because the risk of complications is different and requires specific management.

A true visceral artery aneurysm (TVAA) is defined by an arterial dilatation that involves the three layers of the vascular wall (intima — media — adventia). It may be sacciform or fusiform. The causes of TVAA vary but are mainly atherosclerosis, fibrodysplasia or connective tissue disorders. A treatment of true aneurysms is indicated in the following cases:

- clinical symptoms (pain, embolism, rupture);

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Table 1 Prevalence of visceral aneurysms in relation to their location [3].

Location of the aneurysm	Prevalence (%)
Splenic artery	60
Hepatic artery	20
Superior mesenteric artery	5—7
Celiac artery	3—4
Gastric and gastroepiploic arteries	4
Jejunal and ilieocolic arteries	3
Pancreaticoduodenal arteries	1—2
Gastroduodenal artery	1—2
Inferior mesenteric artery	< 1
Renal arteries	1—10

- more than 2 cm in size or twice the size of the artery by consensus;
- rapid increase in the diameter of the aneurysm;
- specific location (duodenopancreatic arcades);
- pregnant women or women of childbearing age [4];
- project for liver transplantation or portal hypertension for splenic artery aneurysms.

A visceral artery pseudoaneurysm (VAPA) is a contained encapsulated hematoma that communicates with the arterial lumen. There is a high risk of rupture whatever its size and treatment is systematic. The cause of pseudoaneurysms may be post-traumatic, infectious, inflammatory or iatrogenic (puncture, biopsy).

On imaging, aneurysms are traditionally associated with other signs of atherosclerotic disease, usually wall calcification, while pseudoaneurysms usually correspond to a round contrast-enhanced arterial lesion in contact with an artery within a specific context.

Different studies have compared surgical treatment to treatment by interventional radiology (TVAA and VAPA, ruptured or not), without showing any significant difference in morbidity and mortality, overall survival, or post-procedural recurrence [5—7]. In cases of ruptured visceral aneurysms, surgical mortality is 23.9% vs. 2.7% during radiological endovascular management [8—10].

First line management of ruptured visceral aneurysms is therefore based on endovascular treatment by interventional radiologists.

Diagnosis of a ruptured visceral artery aneurysm

Except for known visceral artery aneurysms, the diagnosis is usually made in the presence of hemorrhagic shock that may or may not be preceded by more specific clinical symptoms including abdominal pain, hemobilia, gastrointestinal hemorrhage, hemoperitoneum, or hemoretroperitoneum.

The diagnosis is based on contrast-enhanced abdominal and pelvic Multiple Detector Computed Tomography (MDCT) angiography (1.5 mL/kg) of iodinated contrast material with a sufficient concentration of iodine (370 to 400 mg of iodine per 100 mL) and a flow rate of 3 to 5 mL/s, with automated contrast medium administration. The protocol includes a non-enhanced helical acquisition of the abdomen and pelvis, an arterial phase helical acquisition of the abdomen and pelvis (automated acquisition at a threshold of 120 HU in the aorta) to search for active bleeding, and a venous phase helical acquisition (between 60 and 90 seconds) [11,12] associated with a late phase helical acquisition if necessary (3 to 5 minutes after contrast medium administration). In an emergency situation, magnetic resonance imaging (MRI) is not recommended (problems of access, length of the exam) [13].

MDCT angiography of the abdomen and pelvis is essential because it can confirm the diagnosis of a ruptured visceral aneurysm, as well as be used to plan the endovascular procedure. The information that can be obtained from MDCT includes [14]:

- determining the procedural approach (femoral or humeral): analysis of vessel tortuosity (aortoiliac axis, angle of the visceral arteries in relation to the axis of the aorta), celiac trunk stenosis (arcuate ligament, atheroma);
- description of the aneurysm: size and shape of the aneurysm, diameter of the involved artery below and above the aneurysm, size of the neck (if sacciform), length of the aneurysm (in case of stent placement);
- number of afferent and efferent branches;
- determination of locoregional anatomy: analysis of collateral vessels that could flow into the aneurysm, anatomical variants and presence of aneurysms in other locations.

Volume rendering (VR) and maximal intensity projection (MIP) reconstructions are helpful to obtain optimal analysis of the aneurysm [12].

Treatment

The basic concept behind the treatment of a ruptured visceral aneurysm is to exclude it from the general circulation by endovascular management [15]. The surgeon should be informed of the presence of a ruptured VA. This procedure is performed in coordination with the anesthesia-intensive care team (patient monitoring, blood and platelet transfusion, fresh frozen plasma if necessary). If the patient is not hemodynamically stable, surgery should be considered. This procedure can be performed under local or general anesthesia depending on the patient's condition, the anesthesiologist's opinion or the interventional radiologist's usual practices.

Technique

The best approach is femoral or in certain cases humeral if anatomical difficulties have been identified (arcuate ligament/celiac trunk stenosis). The stability of the navigation equipment (long introducer sheath/guide catheter, catheter, microcatheter) is necessary to perform embolization under optimal safety conditions. The use of a long introducer sheath or a guide catheter associated with an anatomically adapted probe and a microcatheter is recommended (triaxial catheter system). The choice of the embolic agents essentially depends on the aneurysm being treated and the operator's experience.