Endovascular treatment for visceral aneurysms

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Introduction

Visceral arterial aneurysms (VAAs) are rare entity with a prevalence of 0.1%-2% [1-3]. VAAs carry a definite risk of rupture, which varies infrequency between 3% and 10%, depending on aneurysm size and location; when these aneurysms rupture, mortality occurs in 20% to 100% of patients [4,5]. VAA is typically classified into the true aneurysm and the pseudoaneurysm. The former is diagnosed unexpectedly since it is clinically silent, whereas the latter usually develops in association with surgery, trauma and infection. Both have a risk of rupture associated with high fatality so that the early treatment could be required. The rupture risk of pseudoaneurysm is greater at approximately 70 % and is not related to aneurysm size because of a lack of a structural wall with these lesions, therefore, all pseudoaneurysms should be treated [6,7].

The splenic artery aneurysms (SAAs) are the most common VAAs (33-66%), followed by the renal artery aneurysms (RAAs) (15-20%), the hepatic artery aneurysms (HAAs) (10-20%), superior mesenteric artery aneurysms (SMAAs) (5-7%), celiac artery aneurysms (4-20%), and pancreaticoduodenal artery aneurysms (PDAAs) and gastroduodenal artery aneurysms (GDAAs) (4-8%) [6, 8].

The SAAs are more common in women (3-4:1), and often associated with a high-flow state such as portal hypertension, liver cirrhosis and pregnancy. Rates of rupture in a SAA is approximately 2-5%, with a mortality rate of 29-36% [9,10]. The RAAs have an equal incidence in men and women. Several reports have been recommended that treatment advised when the size of RAAs are either larger than 2 cm, or when the patient is symptomatic [11,12].

Generally, interventional radiologic therapy for VAAs is typically indicated when there is no calcification or when the aneurysm is large (> 2 cm in diameter), growing, or symptomatic. However, recently Klausner et al reported that asymptomatic RAAs rarely rupture and have a very slow growth rate of 0.6-0.86mm/year [13]. As a result, they suggested that the current recommended treatment of asymptomatic RAAs measuring > 2 cm may be too aggressive. On the other hand, rupture of RAA less than 2 cm in size was also reported [14]. Other previous reports have also stated that intervention maybe indicated for SPAAs smaller than 2 cm in diameter when accompanied by cirrhosis [15], VAAs in women of child-bearing age, and that no correlation existed between RAAs, GDAAs, and PDAAs size and rupture. Thus, there is no clearly defined standard for indication of treatment including embolization, and decisions should be made on a case-by-case basis.

Treatments

Treatment options of VAAs include conservative management, surgery, and endovascular procedures, which depends upon the symptoms, patient's age, the size and location of the VAAs, and skill of the physicians. The primary aim of treatment is to prevent rupture by excluding flow to the aneurysms. Surgical managements, including ligation, resection of the VAAs and arterial reconstruction, has been used. However, endovascular treatments (EVTs) are replacing the surgical procedures because of its less invasiveness. Recently, transcatheter arterial embolization (TAE) including coil packing for VAAs has been widely used as a treatment alternative to surgical ligation [4,6,15-19]. General indications for TAE include symptomatic aneurysms, large (> 2 cm in diameter) or rapid growing, and those in women of child-bearing age.

Several techniques of EVTs are applied for exclusion of VAAs. Endovascular trapping (parent artery occlusion) with or without packing of the aneurysmal lumen is commonly used for the treatment of VAAs especially when collateralization will preserve the distal blood flow such as proximal SAAs. Detachable or pushable coils are generally used for occlusion of the parent artery (isolation), packing of the aneurysmal lumen, and combination of them [20]. The optimal embolization method is basically chosen by the type of aneurysmal shape; fusiform or saccular type (Figure 1). N-butyl-2-cyanoacrylate (NBCA)-Lipiodol mixture has been used solely or combined with coils for occlusion of the parent artery to reduce the number of coils required and to achieve complete occlusion [21]. However, it has a potential risk of migration of fragments of glue which can cause ischemic damage to the organs or non-target embolization.

For the endovascular sac packing, the most important technique is the order and the selection of many various detachable coils. Recanalization or coil compaction may occur in approximately 30% of cases after packing, therefore, high packing density of the aneurysmal lumen at least 24% is required for stable occlusion [15]. For tight packing, the order and size selection of various type of detachable coils are very important. When planning the tight packing before the procedure, not only coil type but also catheter selection should be also cautiously considered in advance to obtain a good support. The compatibility between the coil and the microcatheter is essential to smooth delivery of coils without any trouble including stack or push back of the coils.

The VAAs usually have a large neck, and often involve a few branches at the neck or body. Therefore, we should apply the adjunctive techniques including multiple catheters technique, and balloon or stent assisted technique are required for safe and sufficiently tight packing of the aneurysmal lumen with preserving the parent artery and branches (Figure 2). Stent graft is an alternative technique of excluding VAAs with preserving the parent artery [22-24]. Therefore, a wide-neck aneurysm is no longer a contraindication for endovascular coil packing using combination of adjunctive

techniques. However, long-term and scheduled imaging follow-up including contrast-enhanced MR angiography is mandatory [25], because recurrent aneurysm can occur after EVTs.

In this session, we present a pictorial review of various kinds of devices, adjunctive techniques, and tips of procedures, especially focusing on the endovascular coil packing of VAAs.

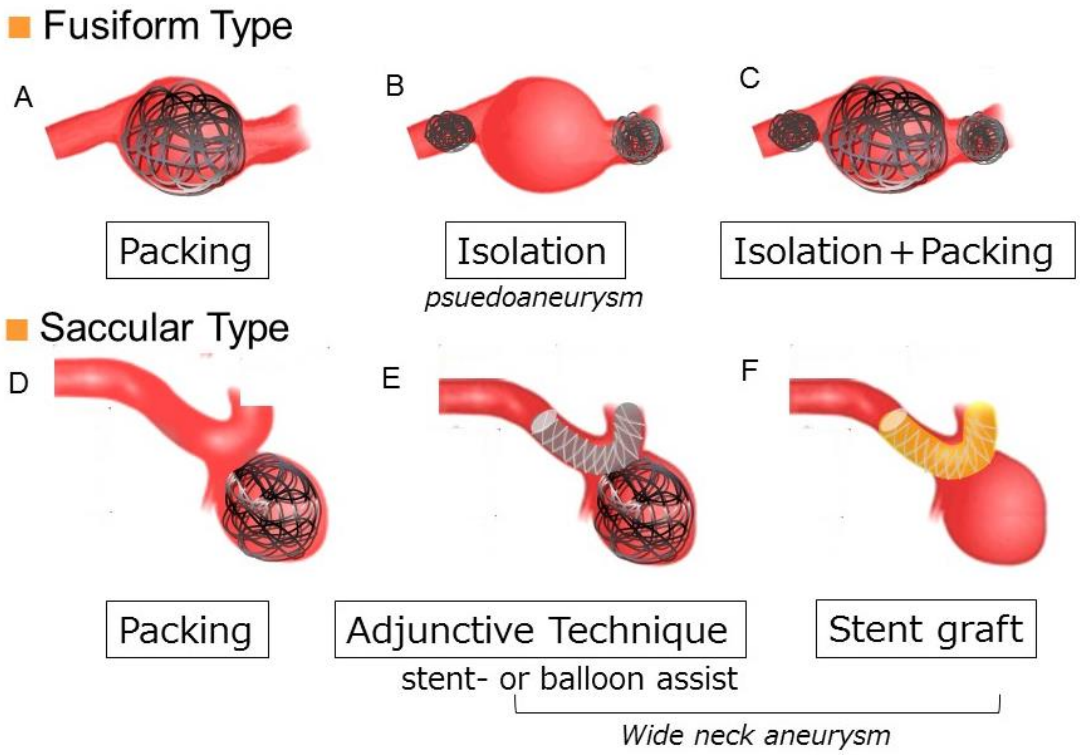


Figure 1: Basics of embolization of aneurysm

A) For fusiform type, endovascular trapping (parent artery occlusion) with packing of the aneurysmal lumen is tightly performed especially when collateralization will preserve the distal blood flow.

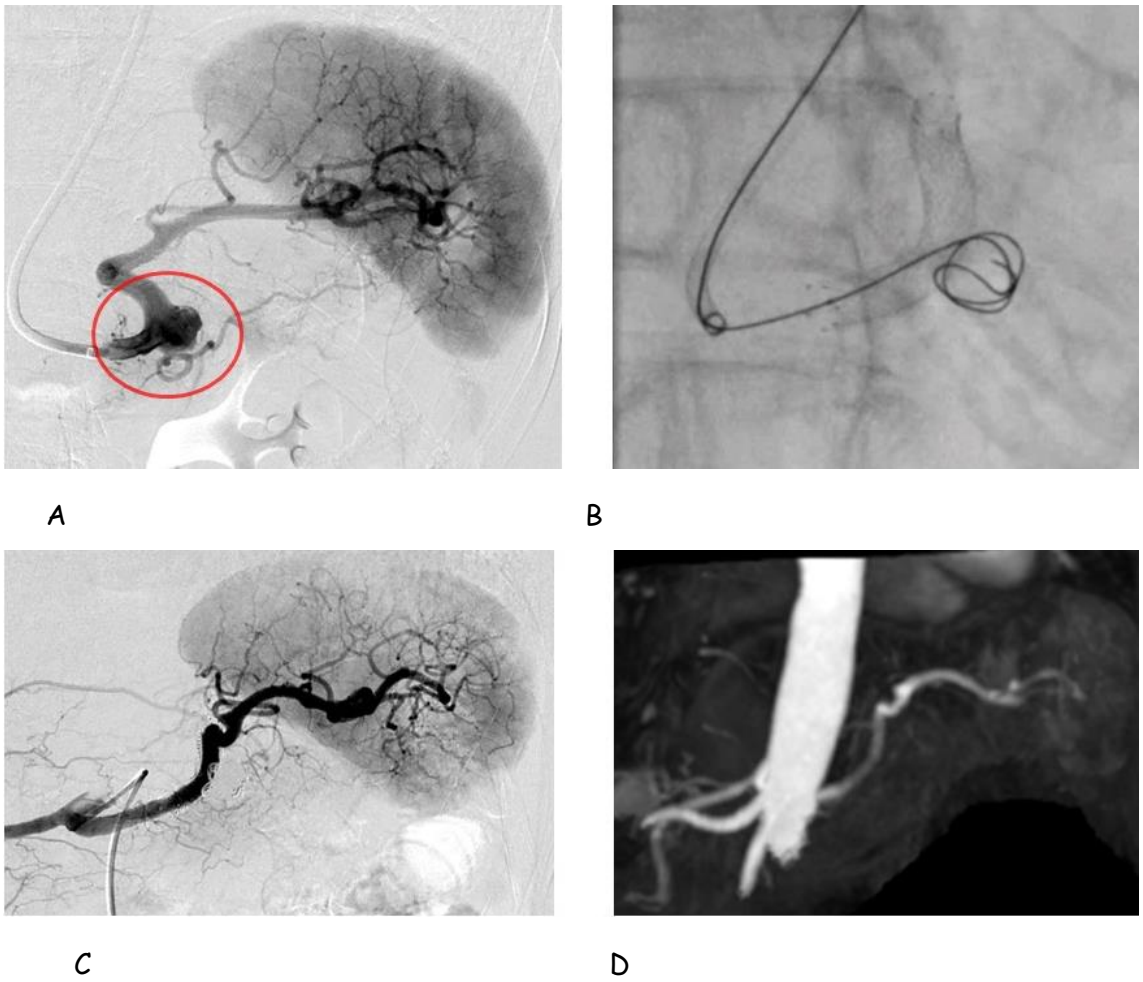
B) Distal and proximal portion of the parent artery are occluded. Especially for pseudoaneurysm, isolation is commonly performed with coils regardless of type of the aneurysmal shape.

C) Combination of isolation and coil packing. Aneurysmal lumen is a little loosely packed with coils when small vessel is branched from the aneurysm.

D) For saccular type, commonly tight packing with coils is performed.

E) In wide neck aneurysm, adjunctive technique including stent- or balloon assisted coil packing is useful.

F) Only stent graft is placed for exclusion of the aneurysm.



A B C D

Figure 2: Stent assist technique for wide neck VAA

A) Splenic arteriography reveals wide neck SAA involving a great pancreatic artery.

B) Stent assist technique is performed with coiling through the mesh.

C) After the procedure, SAA is sufficiently excluded with preserving the parent artery.

D) Follow-up MR angiography 3 years after the EVT shows stable complete occlusion and no recanalization of SAA with preservation of the parent artery flow.

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