Visceral Artery Aneurysms: Six Tips From Approach to Treatment

Helpful tips on when and how to successfully treat visceral artery aneurysms.

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Pseudoaneurysms are distinguished from true aneurysms in that they do not include all three layers of the arterial wall. They typically develop as a result of inflammation, infection, and traumatic or iatrogenic injury.[1] In contrast, although visceral artery aneurysms (VAAs) are rare, their diagnosis has increased with broader application of cross-sectional imaging and the development of improved CT angiography (CTA).[2] General tips regarding when, how, and in whom to treat VAAs and pseudoaneurysms are provided in this article. We describe our top six tips, which are broken down into the pretreatment and treatment phases.

PRETREATMENT

Tip 1: Patient Selection Is Important

The most common sites of VAAs in decreasing order of prevalence are the splenic, hepatic, and superior mesenteric arteries.[1,2] Although the consensus is to treat all pseudoaneurysms regardless of size, circumstances under which VAAs should be treated are not as well established. We briefly review our institutional guidelines and the literature on which they are based. In the setting of symptomatic or rapidly enlarging VAAs, most authors agree that intervention is warranted, regardless of size.

Splenic artery aneurysms are the most common VAAs and, congruently, have the most available data to guide treatment algorithms. Several authors have found a significant increase in rupture risk, which confers high morbidity and mortality when the aneurysm is > 2 cm.[3,4] There is a clear association between pregnancy and higher splenic artery aneurysm rupture rates, leading most authors to suggest treating splenic artery aneurysms of any size in patients who are pregnant or intend to become pregnant.[3-5] A more controversial area in which some authors advocate treatment in aneurysms < 2 cm is portal hypertension; however, at our institution, we do not consider this an indication for intervention.[1]

Another fairly well-studied group is patients with renal artery aneurysms. The data in this area have led most authors to agree that aneurysms > 2 cm warrant repair.[6,7] In the setting of poorly controlled hypertension, there is controversy regarding the size threshold to offer treatment, with some favoring treatment of aneurysms as small as 1 cm and others drawing a line at 1.5 or 2 cm.[6,7] Given the heightened risk of rupture during pregnancy, most authors concur that pregnant patients or those anticipating pregnancy should have their aneurysms treated regardless of size.

Hepatic artery aneurysms have also been studied to a certain degree[8]; however, these aneurysms and the remaining VAAs are not well represented in the literature given their relative infrequency. The general guidelines for other VAAs are in part guided by experience with splenic and renal arteries. The majority of authors recommend treating aneurysms > 2 cm, with the exception of those in patients who are or plan to become pregnant, regardless of size. One specific problem is aneurysms of the pancreaticoduodenal artery. They are often related to celiac trunk stenosis or occlusion and develop on an artery that has high flow due to collateralization from the superior mesenteric artery to the hepatosplenic arterial territory. This type of aneurysm carries a very high risk of rupture and should be treated regardless of size.[9]

Tip 2: Obtain Imaging

Obtaining a CTA with three-dimensional reconstructions prior to the procedure is extremely helpful. It allows for treatment planning and spares valuable time, contrast, and radiation dose during catheter angiography. In our practice, it is rare for the patient to proceed to treatment without CTA or magnetic resonance angiography to characterize the aneurysm and corresponding vasculature for additional abnormalities, such as variant anatomy and vessel patency. Even in more acute clinical scenarios or where the aneurysmal source is likely known, we believe that an initial evaluation with CTA is beneficial, unless the patient is too unstable to delay treatment. Referring physicians commonly do not recognize the importance of proper cross-sectional imaging prior to intervention, emphasizing the need for good interdisciplinary communication.

INTRAPROCEDURAL KEYS

Tip 3: Stabilize Access

In our practice, access is almost always via the common femoral artery; however, given the promising data arising from the cardiology literature, as well as other areas of interventional radiology, radial access is a valid alternative approach, and utilization will likely increase, given its benefits.[10] After achieving access, the next step is to cannulate the visceral branch of interest and perform diagnostic angiography. We have found it extremely valuable to select the appropriate devices to obtain maximum stability prior to crossing the lesion and device deployment. One of the easiest ways to increase stability is to place a sheath or guide catheter into the visceral artery origin, which must be performed carefully to avoid dissection or vasospasm. When a larger sheath is used, it provides the added benefit of allowing arterial injection during device positioning and throughout the remainder of the procedure. Depending on the patient's anatomy, different 4- or 5-F catheters will provide varying amounts of stability, and experience is needed to accurately choose the optimal tools. For instance, in a fairly straight visceral artery, a Cobra catheter may be advanced a significant distance into the artery to make it very stable, whereas a Simmons catheter may provide greater stability in other anatomic configurations. When the system is maximally stabilized, the devices may track more readily through what is frequently a serpiginous course. It also enables the interventionist to deliver the chosen device with less concern for malpositioning.

Tip 4: Use a Microcatheter

After stable access to the parent visceral artery is achieved, a wire must be passed beyond the VAA. This may be possible with a 0.035-inch wire and 4- or 5-F catheter; however, we recommend advancing the 4- or 5-F catheter as distally as can safely be done in order to stabilize the system further, but without crossing the

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aneurysm sac or orifice. Instead, it is recommended that a microcatheter and microwire be used to cross the aneurysm, as this allows increased control and gentle probing. Given the numerous microcoils available and the development of MVP plugs (Medtronic), which are available from 1.5- to 5-mm sizes and fit through 0.021- and 0.027-inch microcatheters, respectively, microsystems do not significantly reduce treatment options in our opinion. In the case of stent graft deployment, it is common for these systems to require tracking over a 0.014- or 0.018-inch microwire.

Tip 5: Preserve the Parent Artery If Possible

In many cases, sacrificing the parent artery may lead to ischemic complications.[11,12] The fear of significant complications, along with the general desire to maintain as close to physiologic flow as possible, leads us to attempt to save the parent artery when technically feasible. This can be accomplished using a few different techniques.

Stent grafts. With the development of covered stents, several authors have demonstrated the safe and effective use of stent grafts in the exclusion of VAAs.[13,14] The difficulty often lies in tracking the stent through the often tortuous parent artery and across the aneurysm. It is generally recommended that the stent graft be placed with a landing zone of 10 mm on each side of the aneurysmal neck to ensure an adequate seal.[1] Frequently used devices include the Atrium iCast (Maquet Medical Systems) and Viabahn (Gore & Associates), depending on the anatomy and size of the vessel. The Viabahn device provides relatively good trackability, but requires a 6- or 7-F sheath. It is also important to remember that Viabahn stents go over a 0.014- or 0.018-inch guidewire. Atrium and other balloon-expandable stents typically do not track as well, but do provide the benefit of precise placement and smaller sheath sizes. These are particularly useful when the VAA is near the ostium of an artery and exact placement is required.

Packing the aneurysmal sac. This technique requires cannulation of the aneurysmal sac and should not be attempted in the case of pseudoaneurysms, as the lack of sac wall integrity raises the concern for rupture. It also requires a narrow neck to prevent coil migration. If the aneurysm neck is wide, stent- or balloon-assisted coiling may be utilized. A noncovered stent or balloon can be placed across the neck, and the coils can be placed through the interstices to prevent their migration. This technique is particularly useful to treat VAAs at branch points and allow preservation of flow without sacrificing a branch.

When coiling the aneurysmal sac, a scaffolding coil is typically placed, which has the same diameter as the sac itself. This is followed by either smaller scaffolding coils or packing coils. It is important to achieve a dense coil pack to prevent recanalization.[15] Given the danger of coil migration into the parent artery and subsequent thrombosis, detachable coils are typically used in this setting, as control of the coil is imperative.

Finally, balloon-assisted liquid embolization of the aneurysm sac has been described in the literature.[16] In this setting, a balloon protects the parent artery while Onyx (Medtronic) is used to fill the aneurysm sac. It is important to make sure that the balloon is inflated long enough to prevent extravasation of the liquid embolic into the parent vessel.

Tip 6: If You Sacrifice the Parent Artery, Make Sure to Shut Down the Artery

If it is determined that the parent artery could or must be sacrificed, embolization of the parent artery proximal and distal to the ostium of the aneurysm is of the upmost importance. The purpose of coiling distal to the aneurysm is to prevent retrograde filling of the aneurysm. This requires getting a catheter or microcatheter distal to the sac, which can be technically difficult. Once access distal to the aneurysm is established, a vascular plug or coil is typically placed to stop flow just distal to the aneurysm. Vascular plugs provide the advantage of flow occlusion after placement of a single device. Currently, there are MVP plugs, which, depending on size, can be delivered through catheters ranging in size from a 0.021-inch microcatheter to a 5-F catheter, and Amplatzer plugs (St. Jude Medical, Inc.), which fit through 4- or 5-F catheters available on the market. Both devices are detachable.

If coils are used, we will typically place a detachable coil first to control coil position. Following this, pushable coils, which are far less expensive, provide a nice balance between control and cost savings. It is vital to achieve a dense packing of coils in both the proximal and distal locations to achieve stasis.[16]

CONCLUSION

Although rare, the treatment of VAAs and pseudoaneurysms is a fundamental service provided by the interventional team. We have found that the tips provided in this article can help to ensure both a successful and efficient procedure. ■

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