Hypogastric Artery Embolization and Endografting

Controversies and techniques on the prevention and treatment of endoleaks.

BY ROBERT J. ROSEN, MD, AND RICHARD M. GREEN, MD

Since the advent of endovascular grafting for abdominal aortic aneurysm repair, there have been persistent questions about the importance of endoleaks and the need to prevent or treat them. Despite more than a decade of clinical experience, many of the original questions remain unanswered and are the subject of clinical debate. One of the most commonly encountered issues is the need for embolization of the hypogastric artery before endografting, when the distal landing zone is too short, or when the common iliac artery is too dilated to achieve a reliable seal.

The purpose of hypogastric embolization and occlusion is twofold: foremost, to provide a secure distal landing zone and avoid a type IB endoleak; second, to prevent retrograde filling of the sac to prevent a type II endoleak. One would hope that after 10 years of experience, there would be consensus on these issues, but that is not the case. For instance, there is legitimate disagreement about whether it is safe to occlude one or both hypogastric arteries, what the potential clinical sequelae are, what devices and techniques are easiest and safest to use, does it matter where the hypogastric artery is occluded, is complete occlusion necessary or even desirable, and should embolization be done at the time of endovascular aneurysm repair (EVAR) or staged? A review of the literature as well as our own experience provides some guidance but does not completely answer these questions.

The avoidance of any type I endoleak is accepted as critical, and extending the iliac limb beyond the hypogastric orifice into the external iliac artery is sometimes necessary (Figure 1). Whether the hypogastric artery must be occluded to avoid a type II endoleak is a matter of some debate.

Figure 1. This patient developed a type IB endoleak with sac expansion several years after EVAR. He was successfully treated with extension of the iliac limb into the external iliac artery without coil occlusion of the internal iliac artery (IIA).

This type of endoleak is a common postoperative finding seen in up to 30% of patients on imaging studies. The majority of type II endoleaks will resolve spontaneously on subsequent imaging studies and will not be associated with aneurysm expansion.

However, continued aneurysm expansion or failure to shrink is nearly always associated with endoleaks, so that at the very least, these patients will require close follow-up for an indefinite period of time—a major drawback of the endovascular approach in terms of time, expense, as well as a source of continued concern for the patient and physician alike. We accept the premise that it is better not to have an endoleak than to have one and take reasonable pre-EVAR measures to prevent them.

Early in the EVAR experience, several series examined the

value of preoperatively embolizing patent side branches (ie, inferior mesenteric, lumbar, and hypogastric arteries) to prevent type II endoleaks. The majority of investigators concluded that there was little benefit and some risk involved in prophylactically embolizing lumbars and inferior mesenterics before performing EVAR. There was already a long clinical experience with hypogastric ligation as well as embolization in the surgical, gynecologic, and interventional radiology literature, where it was used for aneurysms, retroperitoneal hemorrhage after pelvic trauma, and uterine hemorrhage. In these settings, the procedure was generally well-tolerated but associated with a certain incidence of buttock claudication and impotence. In a life-saving situation, this drawback was considered relatively minor.

When hypogastric embolization began to be widely performed as part of the EVAR procedure, it became apparent that in a significant number of patients (up to 55%), the ischemic side effects were persistent and, in some cases, severe.[1] In our practice, patients commonly complain of hip and buttock claudication immediately following the procedure; sometimes, this pain persists. It is unusual for an active person to return to baseline function after IIA embolization. Significant drops in the penile-brachial index have been documented.[2] The most troublesome cases are those with poor cross circulation from the contralateral IIA (Figure 2). One of the more troubling cases that we have seen is that of ischemic nerve damage after IIA embolization and EVAR with persistent pain.

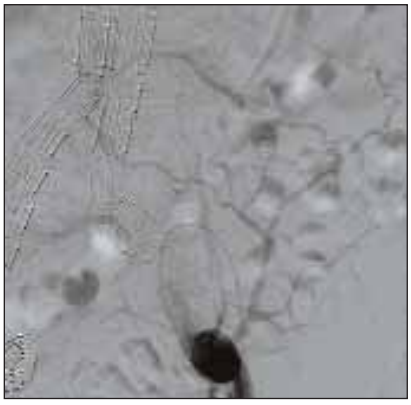

Figure 2. This patient complained of right hip claudication after EVAR. The right IIA was embolized preoperatively because of a large aneurysm extending down to the iliac bifurcation. Twelve months later, during the evaluation of an enlarging aortic sac and a type II endoleak, angiography revealed the iliolumbar source of the endoleak but also a striking lack of cross-pelvic circulation.

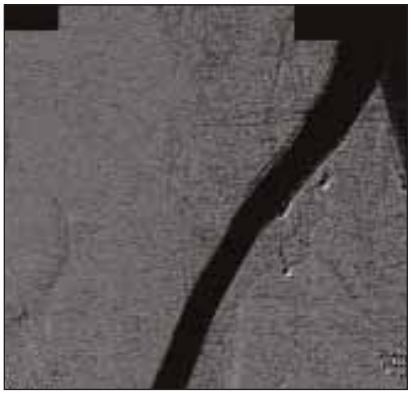

Figure 3. Proximal IIA occlusion with the Amplatzer Plug (AGA Medical Corporation, Golden Valley, MN). This device offers the advantage of achieving rapid occlusion with a single device, as well as permitting repositioning prior to release.

Specific anatomic situations seem to be associated with a higher incidence of ischemic problems: bilateral hypogastric embolization, unilateral embolization with stenosis on the contralateral side, and pre-existing or iatrogenic interruption of collateral pathways from the external iliac and common femoral circulation. Although the pelvis has one of the best collateral networks in the body, these patients have multiple pathways interrupted simultaneously (lumbar, inferior mesenteric artery, hypogastric artery, and, in some cases, common femoral branches), which may result in ischemic symptoms postoperatively. Although buttock claudication and impotence seem to be clearly attributable to interruption of these pathways, acute ischemic complications, such as colonic infarction or soft tissue necrosis, are much more likely due to distal embolization of atheromatous debris at the time of surgery.

Some investigators have questioned the need for hypogastric embolization, even when there is aneurysmal dilation of the common iliac artery necessitating extension of the endograft to the external iliac. Although it has been stated that at least 5 mm of nonaneurysmal common iliac and 15 mm of nonaneurysmal external arteries are required to obtain a seal across the patent hypogastric origin, others found that there was no correlation with development of a hypogastric-supplied type II endoleak, regardless of the size of the common iliac when the graft was extended into the external iliac artery.[3,4] We do not advocate this approach, and, in the rare case that coil occlusion is not possible or is unsuccessful, we recommend ligation of the offending hypogastric artery when an endoleak from the IIA is detected.

It has also been reported that covering the ostium of the hypogastric artery without prior coil embolization decreases the incidence of postoperative buttock claudication.[4] It has been suggested previously that more proximal coil occlusion of the hypogastric artery is much less likely to cause claudication than branch embolization, which is logical in that it preserves communication between the anterior and posterior divisions of the hypogastric collateral pathway.[1] If so, proximal occlusion of the IIA with a vascular plug may be the optimal method of control of backbleeding into the sac and maintenance of the pelvic circulation (Figure 3). Certain embolic devices, such as the recently introduced Amplatzer Plug, have the advantage of achieving rapid occlusion with a single device, as well as permitting repositioning before release. This may be a significant advan-

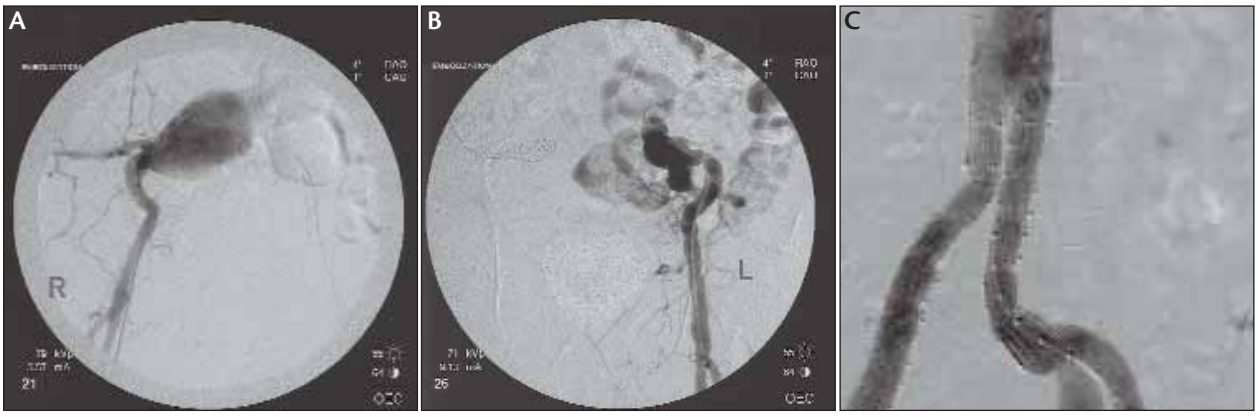

Figure 4. One of the more difficult decisions regarding the distal landing zones is when to coil occlude and deploy in the external iliac artery and when to bell-bottom the distal attachment. Figure 4A shows a large right common iliac artery aneurysm, and this patient underwent coiling. We did not believe that covering the orifice of the IIA would, in the absence of IIA occlusion, prevent backflow into the sac. Figure 4B shows the coils in place and the enlargement of the distal left common iliac artery. We chose to bell-bottom the distal attachment of the endograft and deploy it in the distal common iliac artery. At 12 months, there is no sign of endoleak from either IIA (C).

tage in terms of time as well as achieving optimal proximal occlusion of the main hypogastric trunk. Embolic materials that should never be used in the hypogastric circulation include ethanol, sclerosants, thrombin, and small particulate agents; all of these are associated with a high risk of acute ischemic complications including colonic ulceration, skin sloughing, and permanent nerve injury.[5]

Various flared modular iliac limbs have extended the range of iliac diameters in which a seal can be achieved while preserving the hypogastric artery (Figure 4A-C). This strategy remains our practice, but we have seen endoleaks as a result of continued diameter growth at the distal landing zone. This does require secondary IIA occlusion and extension of the endograft into the external iliac artery. We usually add a bypass distal to the occluded IIA in this setting. Hypogastric bypass is technically challenging, particularly in the setting of a large iliac artery aneurysm or an obese patient, but the results are encouraging in terms of the avoidance of ischemic symptoms (Figure 5).[6]

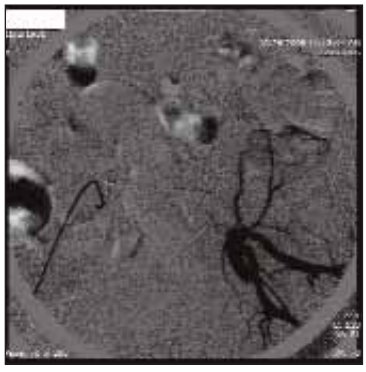

Figure 5. Operative arteriogram showing patent bypass from the left external to the left internal iliac artery. The patient underwent preoperative right IIA embolization. The bypass was performed immediately before EVAR.

Other described approaches involve hybrid surgical-endovascular procedures in which the body of the graft is placed by the usual endovascular approach while the distal limb of the graft is hand-sewn to the aneurysmal common iliac using a retroperitoneal exposure, thus preserving hypogastric flow on that side.[7]

Our experience with bilateral IIA embolization is limited; we perform bilateral IIA embolization with great trepidation despite favorable published series.[8] Our preference when both IIAs require embolization is to create a hypogastric artery bypass distal to the coils before EVAR deployment. Several other approaches have been employed to preserve pelvic collateral flow when both hypogastric arteries would need to be occluded to accomplish endovascular repair of an aneurysm. One suggested approach is staged embolization, in which each hypogastric artery is embolized at a separate procedure over a period of weeks to months, followed by the EVAR procedure itself.[9] Other investigators stress the importance of the preservation of the deep femoral artery collateral vessels and recommend profundoplasty at the time of EVAR.[2] Because the incidence of ischemic complications remains unpredictable, it is unclear whether isolated case reports of a successful outcome provide evidence that the theoretical advantage of giving collaterals time to develop is valid. It also leaves the patient at risk with an untreated aneurysm for a considerable period of time. Recent progress in the development of branched and fenestrated endografts may increase our ability to preserve hypogastric flow, although the tremendous variability in hypogastric anatomy, as well as the common occurrence of aneurysmal dilation of the hypogastric artery itself, will present considerable challenges.

TECHNIQUES

In terms of the technical aspects of performing hypogastric embolization, before EVAR, most operators

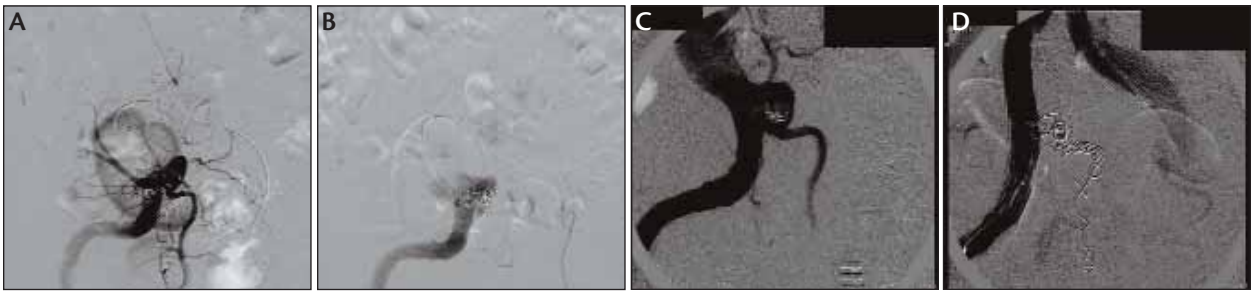

Figure 6. Occasionally, one finds that coil embolization has not resulted in complete occlusion on delayed studies and that antegrade flow persists in the IIA. Figure 6A shows a patient with previous coil embolization who at the time of EVAR was found to have persistent flow in the IIA (B). Several coils were added to ensure occlusion. The endograft was then deployed (C, D).

use a contralateral femoral approach. It is advisable to use a coaxial system with a long sheath or guiding catheter positioned within or just proximal to the hypogastric origin. This coaxial approach allows the subsequent use of various selective catheters to achieve optimal position for embolizing without the need for repeatedly crossing the aortic bifurcation, which, in the aneurysmal aorta, may be difficult and present a risk of distal atheroembolization. A coaxial system is also protective against nontarget embolization and preserves access if an embolic device becomes lodged in the catheter.

Numerous types of coils are available; the best for this application are generally those with complex shapes (eg, helical rather than cylindrical) and fibers to make occlusion more rapid. Platinum coils are much more easily seen fluoroscopically than stainless steel, a factor that may be critical with large patients or suboptimal C-arm fluoroscopy in the operating room. Coils can be placed by pushing them through the catheter with an injection of saline or by advancing them through the catheter with a pusher wire. Care must be taken when coils are extruded from the catheter, as the exiting coil will tend to push the catheter tip back, presenting a risk of losing the coil into the external iliac artery with distal embolization. When the hypogastric artery itself is aneurysmal, embolization may be performed by packing the aneurysm with coils or by selectively occluding the normal caliber outflow branches to cause thrombosis of the sac, which generally requires the use of coaxial microcatheters and microcoils.

The need to achieve complete occlusion at the time of embolization has been debated in the literature. Definitive prevention of endoleaks would seem to require complete occlusion of the hypogastric artery, which one cannot assume would occur just because coils have been deposited—persistent flow through the coils is not uncommonly seen during angiography performed weeks or months later. If at the time of EVAR we encounter a patent but embolized IIA, we attempt to add more coils. If we cannot, we cover the orifice of the IIA with the endograft and follow the patient for the presence of a type II endoleak (Figure 6). This persistent forward flow may actually be desirable both in terms of preventing ischemic complications and reducing the likelihood of reversal of flow with endoleak formation.[3]

CONCLUSION

Hypogastric artery embolization has become an accepted adjunctive technique in performing EVAR. Coils are currently the most commonly used device, but newer devices may increase the safety and effectiveness of the procedure. A significant number of patients will develop ischemic complications, most commonly buttock claudication, which is usually transient but may be permanent and disabling. Attempts should be made to preserve at least one hypogastric artery to reduce the incidence of this problem. ■

Robert J. Rosen, MD, is from the Lenox Hill Heart and Vascular Institute of New York, in New York City. He has disclosed that he holds no financial interest in any product or manufacturer mentioned herein. Dr. Rosen may be reached at (212) 434-2606; rrosen@lenoxhill.net.

Richard M. Green, MD, is from the Department of Surgery, Lenox Hill Hospital, in New York City. He has disclosed that he holds no financial interest in any product or manufacturer mentioned herein. Dr. Green may be reached at (212) 434-3420; rgreen@lenoxhill.net.

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