Absolute Alcohol Embolization of Sporadic Angiomyolipoma

Colin P. Cantwell, M.D.,¹ Kevin E. Taubman, M.D.,¹ and Leslie B. Scorza, M.D.¹

ABSTRACT

Angiomyolipoma is a benign hamartoma. Seventy percent of angiomyolipomas occur sporadically in the general population and the remainder are associated with a syndrome. Of patients with tuberous sclerosis, 60 to 80% have an angiomyolipoma. Sporadic angiomyolipomas tend to be single and occur in an older age group. In tuberous sclerosis, the lesions are usually bilateral and multiple. Therapy is indicated when there are symptoms or when the lesion is greater than 4 cm. Criteria for further embolization include growth of the lesion by 2 cm at annual follow-up computed tomography and presentation with acute hemorrhage. We describe a case of a sporadic asymptomatic angiomyolipoma treated with absolute alcohol embolization.

KEYWORDS: Angiomyolipoma, embolization, alcohol, ablation, fibromuscular dysplasia, renal disorders

Objectives: On completion of this article, the reader should understand the indications for embolization of angiomyolipomas.

Accreditation: Tufts University School of Medicine (TUSM) is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

Credit: TUSM designates this educational activity for a maximum of 1 *AMA PRA Category 1 Credit*TM. Physicians should only claim credit commensurate with the extent of their participation in the activity.

CASE REPORT

A 45-year-old man presented for elective embolization of a 7-cm angiomyolipoma. The angiomyolipoma was incidentally diagnosed at the time of a computed tomography (CT) (Fig. 1) for appendicitis 2 weeks before embolization. There was no clinical or other radiological evidence of tuberous sclerosis.

The embolization was performed with moderate sedation with fentanyl citrate (Sublimaze, Akorn, Inc., Lake Forest, IL) and midazolam hydrochloride (Versed, Roche, Nutley, NJ) based on the practice guidelines of the American Society of Anesthesiologists. An abdominal aortogram was performed via a femoral

approach, with a 5F Contra catheter (Boston Scientific, Watertown, MA). Selective arteriography of the duplicated right renal arteries was performed with a glide C2 catheter (Boston Scientific). A 6F Balkin sheath (Cook, Bloomington, IN) was placed in the main right renal artery ostium. Using a 0.035-inch Glidewire (Boston Scientific) and a 5F Bernstein catheter (Boston Scientific), the supply to the angiomyolipoma was selectively catheterized.

Angiography revealed fibromuscular dysplasia of the right renal artery and a single renal branch supplying the angiomyolipoma (Fig. 2A and B). A 5F catheter with an 8.5-mm tip occlusion balloon (Boston Scientific)

¹Penn State Heart and Vascular Institute, Milton S. Hershey Medical Center, Hershey, Pennsylvania.

Address for correspondence and reprint requests: Leslie B. Scorza, M.D., Penn State Heart and Vascular Institute, Milton S. Hershey Medical Center, Mail code H066, 500 University Drive, Hershey, PA 17033-0850 (e-mail: lscorza@psu.edu).

Embolization 2008; Guest Editor, Thomas R. Burdick, M.D.

Semin Intervent Radiol 2008;25:319–322. Copyright © 2008 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA. Tel: +1 (212) 584-4662.

DOI 10.1055/s-0028-1085932. ISSN 0739-9529.

Figure 1 Contrast-enhanced axial computed tomography at the lower pole of the right kidney demonstrates a 7-cm angiomyolipoma (arrow).

was placed in the branch over a 0.018-inch Roadrunner guidewire (Cook). With the occlusion balloon inflated, contrast was injected to the parenchymal phase to determine the volume of absolute alcohol necessary for instillation (Fig. 3). Next, 1.6-mL of absolute alcohol was instilled in the lesion and left in situ for 1 minute with balloon occlusion. The alcohol was aspirated and a repeat selective angiogram was performed, which revealed exclusion of several proximal arterial branches from embolization by the occlusive balloon. The balloon was withdrawn and the procedure repeated with 0.6 mL of additional absolute alcohol. A repeat angiogram con-

firmed occlusion of the arterial flow to the angiomyolipoma (Fig. 4).

Angiography also revealed fibromuscular dysplasia of both the left and dominant upper pole right renal arteries. Simultaneous dual pressure measurement confirmed that this was not hemodynamically significant (< 10 mm Hg systolic differential between the aorta and distal renal artery). The patient had a normal creatinine and controlled hypertension on one medication, and the referring clinician did not wish to proceed.

No complications occurred. The patient was asymptomatic and was discharged on the following morning.

Figure 2 (A) An early arterial phase digital subtraction angiogram of the main renal artery demonstrates fibromuscular dysplasia of the main renal artery (arrow). (B) A late arterial phase from a further selective angiographic series of the main renal artery demonstrates the arterial supply of the angiomyolipoma (arrows).

Figure 3 Spot film of the balloon occlusion catheter inflated in the arterial supply of the angiomyolipoma with early arterial contrast filling for alcohol volume estimation.

DISCUSSION

Angiomyolipoma has been associated with phakomatoses, polycystic kidneys, and fibromuscular dysplasia. Four cases of fibromuscular dysplasia in association with sporadic angiomyolipoma have been cited in the literature.^{1,2} No genetic basis has been identified for this association.

Angiomyolipoma is a benign hamartoma. Seventy percent of angiomyolipomas occur sporadically in the

general population, and the remainder are associated with a syndrome. Of patients with tuberous sclerosis, 60 to 80% have an angiomyolipoma. Sporadic angiomyolipomas tend to be single and occur in an older age group (age 40–50 years vs. 15–30 years for tuberous sclerosis patients). In tuberous sclerosis, the lesions are usually bilateral and multiple.³

Symptoms include flank pain, hematuria, anemia, renal mass, and presentation with hemorrhagic shock. When < 4 cm, only 23% are symptomatic. When > 4 cm, 80 to 90% are symptomatic. More than 50 to 60% will hemorrhage and on average have one bleeding episode every 3.4 years.³

Therapy has focused on renal preservation and is indicated when there are symptoms or when the lesion is > 4 cm. Surgical therapy with nephron-sparing techniques has been applied. Arterial embolization of angiomyolipomas has been performed with gelatin, polyvinyl alcohol, coils, ethanol, and combinations of these techniques. Embolization with iodized oil and absolute ethanol in a 3:7 or 1:3 mix have been reported.^{3,4} A single successful case of cryotherapy has been reported.⁵

The success of absolute ethanol and iodized oil embolization in one series with a median 51.5-month follow-up was 57.1% in patients with tuberous sclerosis and 100% in those with sporadic angiomyolipoma. Recurrence occurred at a median of 78.7 months.³ The propensity to recurrence in tuberous sclerosis has not been explained. Criteria for further embolization include growth of the lesion by 2 cm at annual follow-up CT or presentation with acute hemorrhage.

The cellular toxicity of pure ethanol rather than thrombosis-induced hypoxia seems to be the main factor in developing very early and permanent damage to the glomerular tufts during embolization. In contrast, the ethanol and Ethiodol mixture does not cause such early parenchymal changes. In the animal studies, no parenchymal changes were observed 3 hours after embolization, whereas injection of ethanol alone resulted in complete glomerular necrosis 1 hour after injection. The addition of Ethiodol reduces the direct cellular toxicity of the ethanol in the animal model of the normal kidney.

All the clinical series have reported use of iodized oil and absolute ethanol mixes of 1:3 or 3:7 used for embolism. These series cite the reasons for dilution of the ethanol with contrast is to monitor embolization and to avoid nontarget embolization.

Animal experiments in pig and rabbit kidneys with absolute ethanol and iodized oil-absolute ethanol 1:1 mixes have demonstrated a different mechanism of effect and the necessity in normal kidney for proximal occlusion of the renal artery when an iodized oil-ethanol mix is used. Ethanol through chemical toxicity leads to immediate capillary level ablation. Iodized oil in addition

Figure 4 Digital subtraction angiography of the renal artery after alcohol ablation demonstrates cessation of flow in the feeding artery (arrow). The beaded irregularity of right renal artery is secondary to fibromuscular dysplasia (arrowhead).

to the ethanol does not lead to immediate flow cessation and reduces the mechanism of capillary damage, leading to the need for some degree of proximal occlusion of inflow. This finding has not been validated in clinical therapy of angiomyolipoma.^{6,7}

A technique we have used after the ethanol volume has been determined is to deflate the occlusive balloon, reestablishing flow. Once the alcohol is prepared, the occlusive balloon is reinflated, contrast is instilled to establish that the seal is adequate, and then the alcohol is instilled for 1 minute. As injection occurs, contrast in the parenchyma may be seen to wash out. At the end of 1 minute, the alcohol is withdrawn and the balloon is deflated for follow-up angiography.

SUMMARY

We report a case of angiomyolipoma successfully treated with absolute alcohol ablation and associated with fibromuscular dysplasia of the renal artery, a constellation rarely reported in the literature.

REFERENCES

1. Montero Garcia A, Sanz Guajardo A, Segura Sanchez A, Martínez Piñero JA, Sánchez Sicilia L. Renal angiomyolipoma associated with fibromuscular dysplasia. An uncommon cause of retroperitoneal hemorrhage. *Rev Clin Esp* 1970; 117(2):181-186
2. Barrilero AE. Renal angiomyolipoma: a study of 13 cases. *J Urol* 1977;117:547-552
3. Kothary N, Soulen MC, Clark TWI, et al. Renal angiomyolipoma: long-term results after arterial embolization. *J Vasc Interv Radiol* 2005;16:45-50
4. Lee W, Kim TS, Chung JW, et al. Renal angiomyolipoma: embolotherapy with a mixture of alcohol and iodized oil. *J Vasc Interv Radiol* 1998;9:255-261
5. Silverman SG, Tuncali K, vanSonnenberg E, et al. Renal tumors: MR imaging-guided percutaneous cryotherapy-initial experience in 23 patients. *Radiology* 2005;236:716-724
6. Kónya A, Wright KC. Capillary embolization using Ethiodol-ethanol for complete renal ablation in swine. *Invest Radiol* 2002;37:512-520
7. Kónya A, Van Pelt CS, Wright KC. Ethiodized oil-ethanol capillary embolization in rabbit kidneys: temporal histopathologic findings. *Radiology* 2004;232:147-153