# Treating Varicoceles With Embolization

Traditionally confined to the realm of urologists, varicoceles can now be treated less invasively, less expensively, more safely, and just as successfully with endovascular techniques.

**BY STEVEN J. SMITH, MD, AND LUKE E. SEWALL, MD**

A 30-year-old man presented to his primary care physician with the complaint of a groin pull. He admitted to having worsening, intermittent, dull aching in his left testis for several years. His medical history and review of symptoms were otherwise noncontributory. He was sent for an ultrasound of the scrotum, which showed a normal testis, but a left varicocele. He was referred to a urologic surgeon who gave him the option of conservative management or varicocelectomy. The patient desired definitive therapy, but had a very active lifestyle and wanted to avoid the 2- to 4-week recovery period associated with surgery. He then referred himself to our interventional radiology clinic.

A physical examination revealed that he was a healthy 30-year-old man with a grade II-III left varicocele. He agreed to varicocele embolization and informed consent was obtained. The patient's scrotum was shielded with lead, and mild intravenous sedation was initiated. A 7-F vascular sheath was placed, and a 7-F Gonadal Curve guide catheter (Cordis Corporation, Warren, NJ) was passed from a right femoral approach into the left renal vein. A renal venogram with a Valsalva maneuver was positive for reflux into the left internal spermatic vein (ISV), indicating a left varicocele (Figure 1A).

The ISV was catheterized with a 5-F, 100-cm Glide catheter (Terumo Interventional Systems, Somerset, NJ) and selective venography showed a valveless ISV with retrograde flow into the scrotum (the scrotum itself was not directly visualized in order to limit the gonadal dose). In the inguinal region, the vein divided into two main channels, with tiny, faintly seen parallel branches noted (Figure 1B).

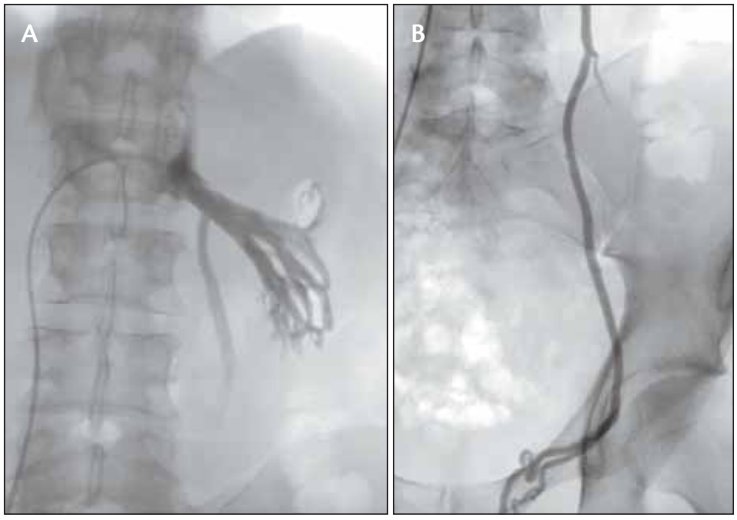


**Figure 1. A left renal venogram with Valsalva, showing reflux into the left ISV (A). A venogram of the caudal portion of the ISV shows division into two main channels in the inguinal region, plus tiny, faintly seen parallel veins (B).**

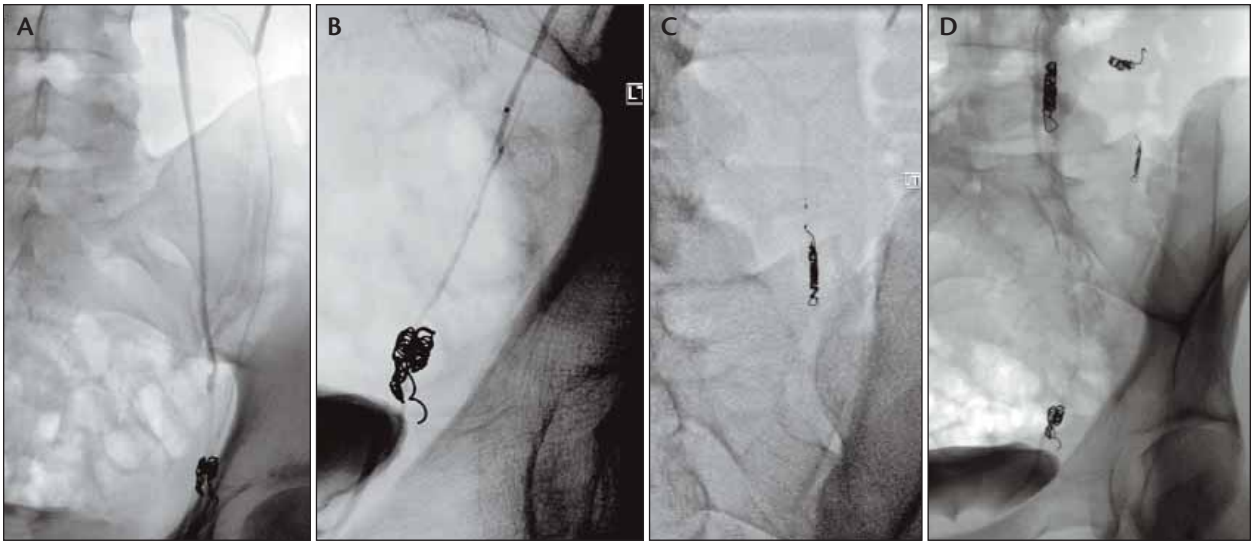


**Figure 2. A venogram after occluding the two main inguinal channels shows filling of a parallel network of veins connecting to a colic vein and to the renal hilum (A). A Renegade Hi-Flo microcatheter (Boston Scientific Corporation, Natick, MA) is passed into the collateral network after forcing it through a competent valve in the colic vein (B). An 0.018-inch MicroNester coil (Cook Medical) is deposited to block the parallel collateral (C). Final coil placement shows the ISV embolized at two points, the collateral channel embolized, and the colic vein embolized (D).**

The two main branches were occluded with use of 0.035-inch, 6-mm X 14-cm Nester embolization coils (Cook Medical, Bloomington, IN). After embolization, an occlusion venogram was obtained, which showed filling of a previously unseen separate parallel collateral venous system lateral to the ISV (Figure 2A) connecting with a left colic retroperitoneal vein and veins in the left renal hilum.

If not occluded, this collateral network would certainly enlarge and cause recurrence of the varicocele over time because it is also incompetent (valveless). The colic vein represents a portal-systemic venous anastomosis and cannot be reached from the colon direction. It connects to the ISV, but the flow direction is toward the ISV with a semicompetent venous valve at the junction in this patient.

With the use of a 130-cm Renegade Hi-Flo microcatheter and a Fathom 16 guidewire (Boston Scientific Corporation), an attempt was made to pass the valve and enter the colic vein system. The microcatheter was finally forced through the valve in a retrograde manner and then passed down into the collateral feeder (Figure 2B).

The feeder was then embolized with 1 mL of sodium tetradecyl sulfate 3% foam (Sotradecol, AngioDynamics, Inc., Queensbury, NY). The foam was created by mixing 2 mL of Sotradecol and 4 mL of room air. The vessel was then occluded using one 0.018-inch, 3-mm X 14-cm platinum MicroNester coil (Figure 2C). Care was taken not to allow any sclerosant to enter the colic vein. The colic vein was then embolized with one 0.035-inch, 6-mm X 14-cm Nester coil. The main ISV trunk was embolized with another nest of 0.035-inch Nester coils after injection of 3 mL of 3% Sotradecol foam inferiorly (Figure 2D).

Final venography showed no reflux to the varicocele. The catheters were removed, and the patient was observed for 4 hours and then sent home. The patient underwent follow-up evaluation 2 weeks later. The aching pain he had been experiencing was completely resolved. Upon physical examination, the varicocele was no longer palpable.

## DISCUSSION

Male varicocele, the formation of varicose veins in the scrotum, has been known since the first century. Tulloc described surgical correction in 1952, and varicocele embolization has been performed using various methods for approximately 30 years.[1-3] Most commonly occurring on the left (perhaps due to "nutcracker syndrome" pressure of the superior mesenteric artery on the left renal vein), varicocele is usually caused by failure of the valves in the ISV.[4] Various etiologies also include other incompetent veins, such as the external spermatic vein or the cremasteric vein. Although perhaps 10% of men in America may have a varicocele, it is often an asymptomatic condition requiring no treatment. However, varicoceles may cause pain, testicular atrophy,

**Figure 3. A left varicocele arising from left renal hilar collaterals. The ISV is not incompetent.**

**Figure 4. A multichannel ISV causing a varicocele.**

or be associated with male factor infertility, the three most common reasons for varicocele repair. Atrophy may be detected in adolescent boys with large varicoceles. Repair can usually reverse atrophy.[5,6]

Varicocele repair in infertility is controversial and has conflicting citations.[7] One meta-analysis cites an odds ratio for pregnancy in treated patients at 2.87 over nontreated controls; another reports an odds ratio of only 1:1 (varicocele repair worthless).[8,9] It is accepted, however, that varicocele is more common in infertile couples than couples with no fertility problems and that repair improves semen analysis and testosterone levels.[10-12]

Our patient reported a dull, aching pain, which is the most common type caused by varicocele. Because reflux of blood pressure into the pampiniform plexus from an incompetent ISV is the usual cause, therapy focuses on blocking that vein and diverting flow into other competent veins in the pelvis. Surgical repair involves ligation of the ISV, either in its retroperitoneal course (high ligation) at the inguinal level or via a subinguinal microsurgical technique. Advantages of transcatheter repair include no need for general anesthesia, incisions, or sutures, and a more rapid resumption of normal activities.

There are other reasons for patients to choose embolization. In a study from the Cleveland Clinic, Dewire et al allowed patients to choose embolization or surgical repair of their varicoceles.[13] The two groups had equal outcomes, but complete recovery was on average 2 days for embolization versus 2 to 3 weeks for surgery. No embolization patient stayed overnight. All infections occurred in the surgery group and one surgical patient lost a testis. Embolization was also less expensive. In a study of patients who had undergone both varicocele surgery and embolization, Fenely et al found that all preferred embolization.[14] Many studies have shown surgery and embolization to have equivalent outcomes.[15-17] Bilateral varicoceles can be successfully treated by embolization in one session using one venipuncture, whereas surgery requires two separate incisions.

Some earlier studies of varicocele embolization reported a relatively high technical failure rate.[14,18] These findings have been used by some to argue that the much more invasive subinguinal microsurgery is the procedure of choice.[19] The cause of the earlier technical failures appears to have been the inability of previously available equipment to occlude aberrant or anomalous collateral veins causing varicoceles. With a better understanding of aberrant anatomy and experience (Figure 3), technical failures and recurrences for transcatheter occlusion are low.[15,20,21]

Sclerosing agents have been used for years to treat varicoceles, either alone or as an adjunct to coil embolization.[20-23] It is well known that tiny side branches of the ISV may be missed at surgery or may fail to be coil-embolized and enlarge over time to cause recurrence. Varicoceles may also be caused by multichannel ISVs (Figure 4).

The careful use of a liquid or foam sclerosing agent with embolization may allow occlusion of these small multiple channels and a higher success rate.[20,24,25] Foam sclerotherapy must be used carefully by experienced operators in open abdominal veins because destruction of the veins injected is rapid and severe complications of foam sclerotherapy have been described.[25-27]

## CONCLUSION

A comprehensive knowledge of variant anatomy, embolization and sclerotherapy can be used to successfully treat almost any varicocele with normal or aberrant collateral supply. Embolization of varicoceles is as effective as surgery, is safer, and has other advantages over surgery. Although this patient was not offered the option of embolization by his urologist and "self-referred" to interventional radiology, we hope that in the future, more patients will be presented with the option of nonsurgical treatment. ■

*Steven J. Smith, MD, is Clinical Associate Professor at Northwestern's Feinberg School of Medicine, Chicago, and Practicing Partner in Vascular and Interventional Radiology, an affiliate of Adventist Midwest Health System, Chicago, Illinois. He has disclosed that his practice has received a grant from Cook Medical. Dr. Smith may be reached at (630) 856-7460; smithmd2@comcast.net.*

*Luke E. Sewall, MD, is Founder and Managing Partner of Vascular and Interventional Radiology, and a practicing interventional radiologist in the affiliated Adventist Midwest Health System Hospitals, Chicago, Illinois. He has disclosed that he holds no financial interest in any product or manufacturer mentioned herein. Dr. Sewall may be reached at (630) 856-7460; invasvmd@comcast.net.*

1. Tulloch WS. Consideration of sterility factors in the light of subsequent pregnancies. Subfertility in males. Edinburgh Med J. 1952;59:29.
2. Lima SS, Castro MP, Costo FF. A new method for the treatment of varicocele. Andrologia. 1978;10:103–106.
3. White RI Jr, Ursic TA, Kaufman SL, et al. Therapeutic embolization with detachable balloons. Physical factors influencing permanent occlusion. Radiology. 1978;126:521–523.
4. Zerhouni EA, Siegelman SS, Walsh PA, et al. Elevated pressure in the left renal vein in patients with varicocele: preliminary observations. J Urol. 1980;123:512–513.
5. Reyes BL, Trerotola SO, Venbrux AC, et al. Percutaneous embolotherapy of adolescent varicocele: results and long-term follow-up. J Vasc Interv Radiol. 1994;5:131–134.
6. Kass EJ, Reitelman C. Adolescent varicocele. Urol Clin North Am. 1995;22:151–158.
7. Richardson I, Grotas AB, Nagler HM. Outcomes of varicocelectomy treatment: an updated critical analysis. Urol Clin North Am. 2008;35:191–209.
8. Marmar JL, Agarwal A, Prabakaran S. Reassessing the value of varicocelectomy as a treatment for male subfertility with a new meta-analysis. Fertil and Steril. 2007;88:639–648.
9. Evers JH, Collins J, Clarke J. Surgery or embolization for varicoceles in subfertile men. Cochrane Database Syst Rev. 2009;(1):CD000479.
10. Pryor JL, Howards SS. Varicocele. Urol Clin North Am. 1987;14:499–513.
11. Laven JS, Haans LC, Mali WP, et al. Effects on varicocele treatment in adolescents: a randomized study. Fertil and Steril. 1992;58:756–762.
12. Gat Y, Gornish M, Belenky A, et al. Elevation of serum testosterone and free testosterone after embolization of the internal spermatic vein for the treatment of varicocele in infertile men. Hum Reprod. 2004;19:2303–2306.
13. Dewire DM, Thomas AJ Jr, Flak RM, et al. Clinical outcome and cost comparison of percutaneous embolization and surgical ligation of varicocele. J Androl. 1994;15(suppl):38–42.
14. Feneley MR, Pal MK, Nockler IB, et al. Retrograde embolization and causes of failure in the primary treatment of varicocele. Br J Urol. 1997;80:642–646.
15. Nabi G, Asterlings, Greene DR, et al. Percutaneous embolization of varicoceles: outcomes and correlation of semen improvement with pregnancy. Urology. 2004;63:359–363.
16. Shlansky-Goldberg RD, VanArsdalen KN, Rutter CM, et al. Percutaneous varicocele embolization versus surgical ligation for the treatment of infertility: changes in seminal parameters and pregnancy outcomes. J Vasc Interv Radiol. 1997;8:759–767.
17. Nieschlag E, Behre M, Schlingheider A, et al. Surgical ligation vs angiographic embolization of the vena spermatica: a prospective randomized study for the treatment of varicocele-related infertility. Andrologia. 1993;25:233–237.
18. Marsman JWP. Clinical versus subclinical varicocele: venographic findings and improvement of fertility after embolization. Radiology. 1985;155:63–638.
19. Khera M, Lipshultz LI. Evolving approach to the varicocele. Urol Clin North Am. 2008;35:183–189.
20. Reiner E, Pollak JS, White RI, et al. Initial experience with 3% sodium tetradecyl sulfate foam and fibered coils for management of adolescent varicocele. J Vasc Interv Radiol. 2008;19:207–210.
21. Gandini R, Konda D, Reale CA, et al. Male varicocele: transcatheter foam sclerotherapy with sodium tetradecyl sulfate-outcome in 244 patients. Radiology. 2008;246:612–618.
22. Richter EJ, Zietler E, Seyfarth W. Phlebography and sclerotherapy of the spermatic veins. Semin Interv Radiol. 1984;1:175.
23. Hunter DW, King MJ, Aeppli DM, et al. Spermatic vein occlusion with hot contrast material: angiographic results. J Vasc Interv Radiol. 1991;2:507–515.
24. Pocek M, Guazzaroni MR, Simonetti G. Four years' follow-up results of three different percutaneous treatments for male varicocele. Phlebology. 1999;14:48–53.
25. Orsini C, Brotto M. Immediate pathologic effects on the vein wall of foam sclerotherapy. Dermatol Surg. 2007;33:1250–1254.
26. Bush RG, Derrick M, Manjoney D. Major neurological events following foam sclerotherapy. Phlebology. 2008;23:189–192.
27. Forlee MV, Grouden M, Moore DJ, et al. Stroke after varicose vein foam injection sclerotherapy. J Vasc Surg. 2006;43:162–164.