Varicocele Embolization for Infertility

What interventionists need to know about the rapidly evolving data on endovascular treatment for male factor infertility.

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A varicocele is a collection of varicose veins within the pampiniform (spermatic) plexus secondary to reflux in the internal spermatic vein (ISV). The condition affects 10% to 15% of the general population but is detected in as many as 40% of men undergoing an infertility workup.[1] Depending on the method used for diagnosis, varicoceles are reported as bilateral in 17% to 77% of men.[2] Traditionally, the diagnosis was made through clinical examination; however, as with other venous reflux disorders, ultrasound has become the mainstay of diagnosis.[3] The traditional indications for treatment include infertility in patients with appropriate semen abnormalities, chronic groin pain, testicular atrophy in adolescent varicoceles, and recurrent varicocele after previous repair. Other indications more recently described with variable strength of evidence include low serum testosterone (with or without erectile dysfunction),[4] benign prostatic hypertrophy,[5] enhancement of assisted fertility techniques,[6] and recurrent first trimester pregnancy loss.[7]

VARICOCELES AND INFERTILITY

Infertility affects 10% to 15% of men of reproductive age. In approximately 50%, a cause is not found.[8] The proof that varicocele repair improves fertility remains elusive; however, there is general acceptance that treatment does improve abnormalities of semen production.[9] The traditional measures to assess semen production are sperm motility, morphology, and total sperm count. However, sperm counts greatly vary from day to day in any individual patient, and these measures correlate poorly with infertility outcomes. It has long been known that spermatozoa of infertile men possess substantially more chromatin defects and DNA damage than sperm of fertile men. There are newer and less variable means of assessing these abnormalities, including seminal reactive oxygen species, DNA fragmentation index, and abnormal sperm chromatin condensation.[10] Multiple studies, including one randomized prospective study, show that surgical varicocelectomy is associated with improvement in sperm DNA integrity.[11] To date, there are no studies assessing these newer measures of semen generation after embolization.

For diagnosis, we look for abnormal reflux on color Doppler with the Valsalva maneuver, rather than the diameter and number of dilated veins, as venous diameter varies significantly with the patient's levels of hydration, anxiety, and inspiratory effort. We examine the patient in the standing position after 15 minutes of standing. We classify the examination as normal if there are no veins in the pampiniform plexus > 1.5 mm in diameter and a normal accentuation of flow with the Valsalva maneuver. A diagnosis of varicocele is confirmed if veins are > 2 mm in diameter and there is an abnormally brisk and prolonged accentuation of flow with the Valsalva maneuver (Figure 1). All other combinations of findings are placed in the category of "equivocal—requires spermatic venography to assess."

PREPROCEDURE PREPARATION

First, scrotal ultrasound should be performed on all patients, even in the case of a clinically obvious varicocele.

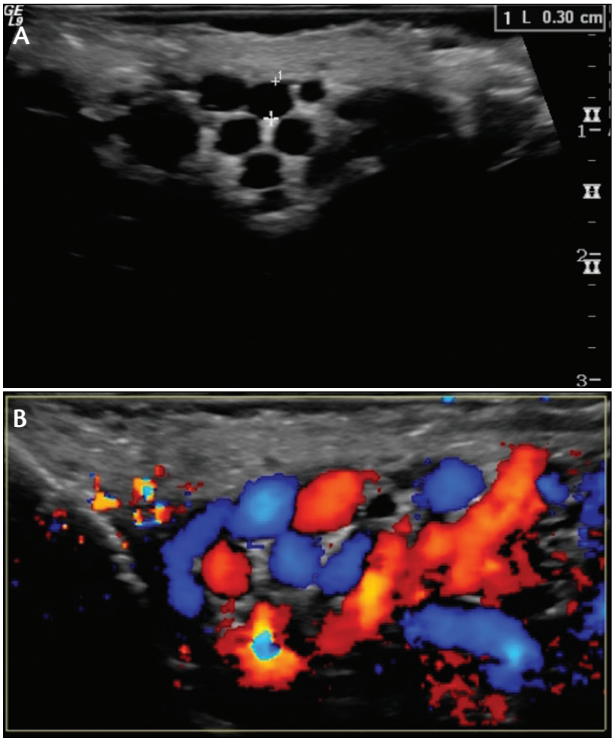

Figure 1. Scrotal ultrasound. Grayscale image of the pampiniform plexus demonstrating multiple dilated veins (A). Brisk accentuation of blood flow during the Valsalva maneuver is detected by color duplex imaging (B).

Universally accepted ultrasound criteria have not been established. Next, semen analysis is performed. Ideally, at least two samples should be collected for both pre- and posttreatment evaluations. Informed consent is then obtained with the female partner in attendance. Alternative therapies should be discussed, including no therapy or surgical therapy. Because the presence of a varicocele alone is not an indication for treatment, infertility treatment should only be performed for men with appropriate semen abnormalities. Surgical options include open surgical or laparoscopic ligation, which might be augmented by the use of microsurgery or antegrade spermatic vein sclerosis. Surgery usually involves a general anesthetic. Hydrocele formation, testicular infarction, wound infection, and scar formation are uncommon potential complications of surgery.

Surgical ligation and percutaneous embolization achieve similar clinical outcomes. Compared to surgery, the principal advantage of varicocele embolization is that the patient is almost always able to work the following day and can expect to resume his normal range of athletic activities in less than a week—both are much shorter times than surgery.[12] In our experience, patients miss a mean of 1.78 days (range, 0–10 days) from work and 4.5 days (range, 1–10 days) from full physical activity (including the day of the procedure) after varicocele embolization. In studies where patients have undergone both surgery and embolization, they have expressed a strong preference for embolization.[13] There are conflicting studies as to whether embolization or surgery is a more expensive therapy for varicocele, but when time off work is factored in, embolization may be much more cost-effective for the patient.

STEPS FOR SPERMATIC VENOGRAPHY AND VARICOCELE EMBOLIZATION

Step 1: Vascular Access

Access can be achieved via the internal jugular or femoral veins. Our preferred method is to puncture the right internal jugular vein under ultrasound guidance.

Step 2: Left Renal Vein Injection

During left renal vein injection, the origin of the left spermatic vein is noted (Figure 2).

Step 3: Left Spermatic Vein Catheterization

The catheter is manipulated into the left spermatic vein. A varicocele is present if the contrast refluxes into the pampiniform plexus. If the direction of flow is antegrade, this is considered to represent a negative spermatic venogram.

Step 4: Spermatic Vein Occlusion

If varicocele is confirmed, the spermatic vein is occluded, preferably immediately above the internal inguinal ring and along its full length to within 2 to 3 cm

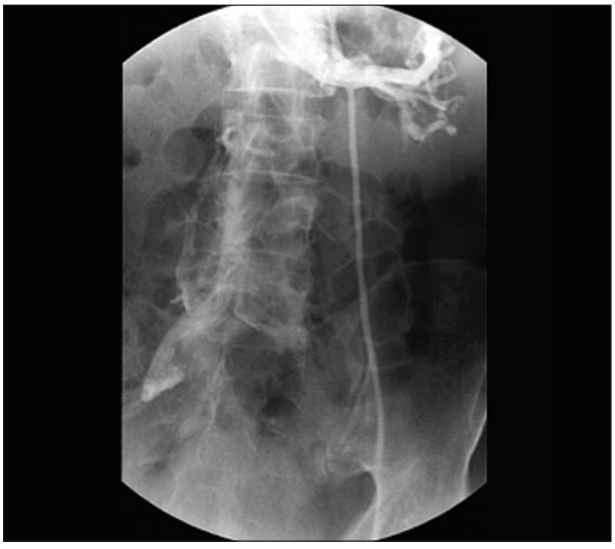

Figure 2. Left renal vein injection results in brisk retrograde flow into the left spermatic vein.

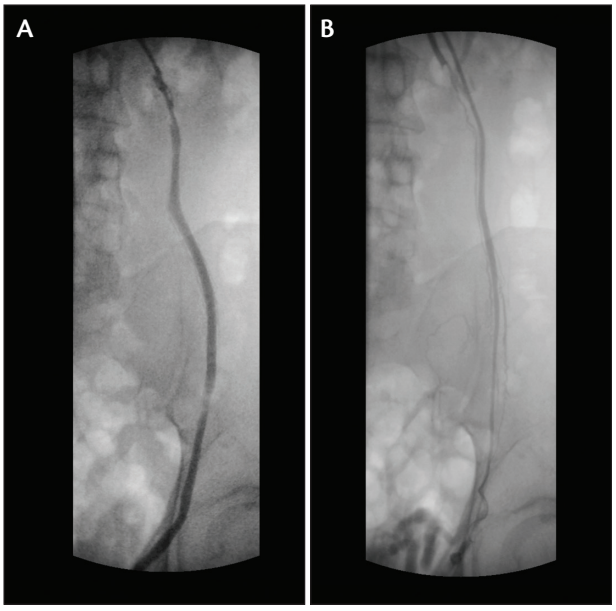

Figure 3. Parallel channels visible only after distal occlusion of main spermatic vein (images saved from fluoroscopy to reduce radiation dose). Spermatic vein preembolization appears as a solitary channel (A). After distal occlusion, new collaterals have become visible. Each of these collaterals may cause failure or recurrence if not occluded (B).

of its origin. The use of liquid embolics with or without metallic coils has become the most common method.[14] Embolization with coils alone without liquid should be avoided, even for "straightforward" cases due to a high rate of recurrence. It is important to look for collaterals throughout the procedure, which may only become visible after distal occlusion (Figure 3). These collaterals are the usual cause of technical failure or recurrence and therefore must be occluded. Options for occlusion methods are described as follows.

Sodium tetradecyl sulfate (STS) with or without coils. Before injecting the liquid, many interventionists, including the authors, will occlude the vein at the inguinal ring by applying external pressure with a compression device or the patient's hand (Figure 4). While the patient is performing a Valsalva maneuver, the STS is injected along the course of the vein from immediately above the coils at the inguinal ring to above the iliac crest (colic collateral) if a proximal coil is to be used. Otherwise, STS is injected to within 1 cm of the ISV origin, and 2.5 to 5 mL of solution is typically adequate.

For STS foam, a 2:1 mixture of 3% STS to sterile saline is aggressively mixed with an equal volume of air and is usually injected to displace the visualized contrast while the patient maintains a Valsalva

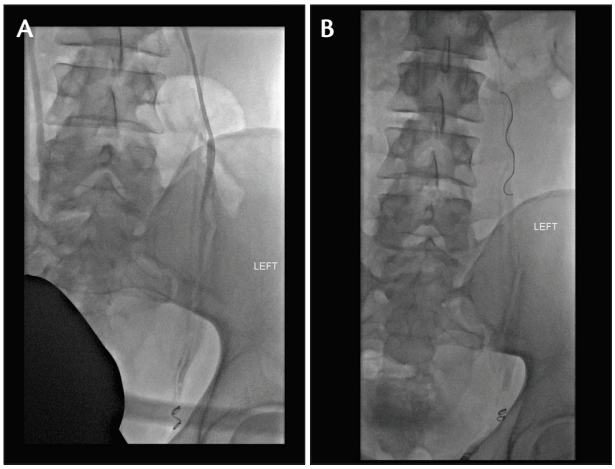

Figure 4. Tetradecyl sulphate opacified with contrast injected as the catheter is withdrawn fills the main vein and parallel channels (A). The distal vein is externally compressed. A 0.038-inch X 8-cm X 10-mm coil has been "laid out" instead of packing the upper vein with multiple coils (B). Note the static contrast-enhanced sclerosant in the spermatic vein and parallel channels.

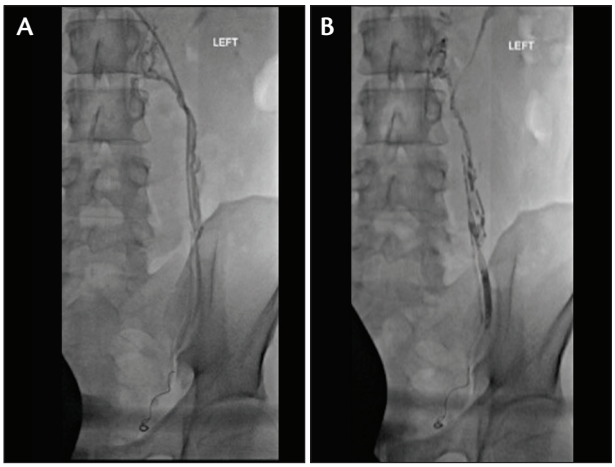

Figure 5. Left varicocele embolization with glue. Venogram after coils have been placed in lower vein during the Valsalva maneuver with external compression (A). Multiple collateral channels are shown, which were not apparent on the initial venogram. Filling of collateral channels with glue/lipiodol injected under similar conditions as the catheter was withdrawn (B).

maneuver. Some interventionists use STS foam alone without coils.[15] In this instance, the vein is occluded at the inguinal ring by applying external pressure as previously described.

Glue. Cyanoacrylate (or "glue"), particularly in countries where it is inexpensive, is increasingly used for varicocele occlusion with equal efficacy to coil/sclerosant emboliza-

tion.[16] Glue to lipiodol ratios (ranging from 1:1 to 1:6), type of cyanoacrylate, and balloon occlusion versus injection from standard catheter are matters of individual choice. Optimally, glue will fill the vein and collaterals from immediately deep to the inguinal ring to 1 to 2 cm from the ISV origin (Figure 5). Some practitioners place coils in the distal ISV before injecting glue. Coils in the proximal ISV are not necessary. Avoiding injection of glue into the scrotum is essential, either by previously placed distal coils or external compression. Overinjection of glue will result in extension into the renal vein or embolization into the pulmonary artery.

Step 5: Right Spermatic Venography

The same steps performed for the left spermatic vein are repeated for the right spermatic vein, except that the right spermatic vein usually arises directly from the inferior vena cava. If reflux is demonstrated, embolization is performed in the same manner as on the left. The right spermatic vein arises from the inferior vena cava at an acute angle, which can make catheterization from the femoral route especially difficult.

POSTPROCEDURE CARE

The patient is kept in bed for 1 hour postprocedure. The patient is advised to take anti-inflammatory agents as needed and to avoid any activity involving the Valsalva maneuver, such as lifting, vigorous, or "hitting type" sports for 3 full days beginning the day after the procedure. Most patients report a minor dull ache in the back or groin lasting < 2 to 5 days. Fewer than 5% of patients will develop more severe pain lasting up to 14 days, requiring oral analgesics and anti-inflammatory agents and avoidance of vigorous exercise.

RESULTS

Technical success rates of embolization for previously untreated varicoceles and for postsurgical recurrence range from 93% to 100%. Thirty percent to 35% of infertile couples will have a normal pregnancy if there are no female infertility factors. In the literature, pregnancy rates from 11% to 60% have been reported.[9,17]

CONCLUSION

Long-standing and legitimate concerns of a lack of proof that varicocele treatment improves pregnancy rates in infertile couples have not been definitively put to rest; however, using more robust methods of assessing semen function, more recent data have markedly improved. In addition, evidence now suggests a significant role for varicocele therapy as part of assisted fertility procedures, such as in vitro fertilization. A major stumbling block to achieving even better data is a lack of standardized diagnostic criteria for varicocele and persistent adherence by clinical specialties to using clinical exam only for diagnosis. Varicocele embolization is safe and technically effective and achieves comparable results to surgery while offering the advantages of shorter recovery time, avoidance of general anesthetic, and patient preference. ■

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