Varicoceles: Time for Change

A multicenter study with patient outcomes is long overdue.

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A varicocele is a congenital varicosity of the pampiniform plexus due to an absence of valves in the left internal spermatic vein. Approximately 10% to 15% of men have a left varicocele, which may cause pain, testicular atrophy, and be a cause of male infertility later in life.

HISTORICAL PERSPECTIVE

In Canada and Europe, varicoceles are treated almost exclusively by embolotherapy. Thirty-four years ago, Dr. Patrick Walsh proposed using endovascular techniques to occlude varicoceles and restore sperm motility in infertile males.[1] In 1981, we reported our results using a detachable balloon placed at the inguinal canal followed by a hypertonic dextrose sclerosant and a second detachable balloon 2 to 4 cm below the origin of the internal spermatic vein.[1] In Germany, Seyferth et al proposed endovascular occlusion, and subsequently, the endovascular approach was widely accepted throughout Europe and Canada.[2] Our initial results for male infertility with the criteria of a successful birth of children within 1 year of repair were published in 1987 and were equivalent to the results of surgery, with outcomes including restored motility and live births.[3]

Many other techniques for endovascular occlusion as well as surgical management have been developed since then, but they are usually reported as meta-analyses because attempting to randomize patients with infertility to no therapy, surgery, or endovascular occlusion was difficult even in the 1970s. We did learn a great deal, including the normal anatomy and the anatomical variations and causes for recurrences, which were all reported in the 1980s (Figure 1).[4-6]

Despite this early success, there are still approximately 100,000 surgeries performed each year in the United States either to restore sperm motility or to relieve pain in athletically active young boys and men. At last estimate, only approximately 2,000 to 3,000 endovascular occlusions are performed yearly in the United States, whereas the inverse is true in Europe and Canada.

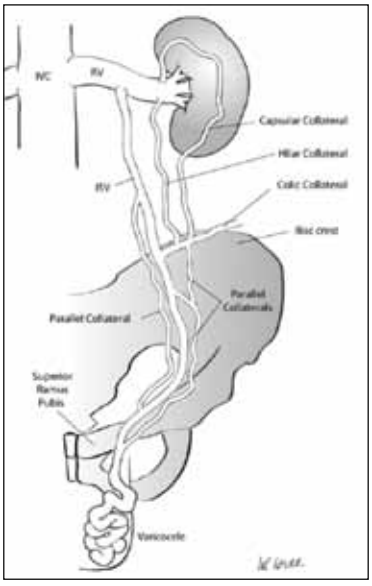

Figure 1. Normal and variant anatomy, left internal spermatic vein (ISV). Hilar and capsular collaterals can join the main ISV at any level. Reprinted with permission from Kandarpa K. Handbook of Interventional Radiology, 4th ed. Lippincott Williams & Wilkins; Philadelphia, PA; 2010.

DIAGNOSIS

Pediatrics

Most pediatricians who treat young boys will check the scrotum for undescended testicles because of the association of tumors with intrabdominal testicles.[7] If a varicocele is noted and if the patient is asymptomatic, they are usually followed until adolescence. During adolescence, if patients are symptomatic during sports, inguinal ligation or endovascular occlusion may be performed. Pediatric urologists usually repair large symptomatic varicoceles, which can cause testicular atrophy.[8] Regrowth of the left testicle has been documented after surgical or endovascular repair.[8]

Adults

Infertility has been associated with varicoceles for many years.[1] Historically, couples are considered relatively infertile if there has not been a conception within 1 year of unprotected intercourse. Approximately 25% of couples will have relative infertility at some time during

the course of their reproductive years. Approximately two-thirds of women will have some issue limiting their fertility, and one-third of men will have relative infertility, most commonly associated with a varicocele.[3] Spermiography may reveal decreased motility and, in some men, a slight decrease in sperm count. After repair of the varicocele, multiple studies have shown that approximately 40% of couples will be able to have a child without resorting to in vitro fertilization or other means.[3,9,10]

EVOLUTION OF TREATMENT APPROACHES

Microsurgical and laparoscopic surgical approaches were developed by urologists, and liquid agents such as hot contrast material and cyanoacrylates were used in the United States, but in small series without agreed-upon outcomes.[11-13]

Meanwhile, Canadian and European colleagues began using safe and inexpensive sclerosants, including polidocanol or sodium tetradecyl sulfate (STS), either as a liquid or foam, and reported favorable results in combination with coils.[14] Between 1990 and 2004, without detachable balloons, we occluded four positions in the internal spermatic vein (ISV) in which we had shown parallel or hilar collaterals were likely to enter the ISV and cause recurrences (Figure 2A).[4,6] Despite using more coils than our former technique with detachable balloons, we still had a significant recurrence rate in adolescents with large varicoceles. During this 14-year period, we were not actively pursuing new outpatient techniques for treating varicoceles because there was no readily available sclerosant in the United States.

The first "eureka moment" occurred in the mid 2000s with the approval of sodium tetradecyl (Sotradecol, AngioDynamics, Inc., Queensbury, NY), exclusively for treatment of varicose veins, and the establishment of many freestanding vein clinics. We approached Dr. Robert Weiss, our Chief of Urology, and together, we began a study of patients with painful adolescent varicoceles using transcatheter inguinal ligation of the ISV with one or two coils, tightly packed, followed by 1 to 3 mL of 2% STS foam (see *Essentials of Endovascular Technique Using a Contrast Displacement Method and STS* sidebar). A second set of coils was placed in the ISV adjacent to the upper third of the sacroiliac joint, and STS foam was injected (one or two injections) between the two sets of coils (Figure 2B). This study in a small number of patients was published in the *Journal of Vascular and Interventional Radiology*.[15] In this early work using 2% STS foam, we prevented the foam from entering the pampiniform plexus by compressing the left groin with a lead glove during injection of the foam. We omitted occluding the ISV higher with coils, preferring to leave the upper half of the ISV patent in order to treat recurrences.[15]

A second "eureka moment" also occurred in 2008 upon reading the results of treatment of adolescent varicoceles by surgical ligation with intraoperative sclerosis of the pampiniform plexus.[16] In this combined series,

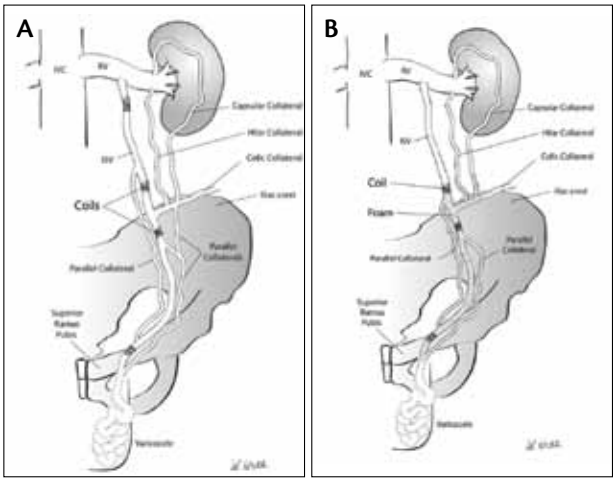

Figure 2. Between 1990 and 2004, the United States did not have an approved sclerosant, and we occluded the ISV in four locations using one or two packed coils at the most likely sites for recurrence (A). The first set of coils is placed at the internal inguinal ring, which increases resistance within the ISV, often demonstrating unopacified collaterals (B). At this point, using a safe and effective liquid or foam sclerosant in small alliquots will perfuse these collaterals and hopefully reduce recurrences. A second set of coils is placed in all patients in the ISV at the level of the mid or upper sacroiliac joint, and STS is administered. Reprinted with permission from Kandarpa K. Handbook of Interventional Radiology, 4th ed. Lippincott Williams & Wilkins; Philadelphia, PA; 2010.

ESSENTIALS OF ENDOVASCULAR TECHNIQUE USING A CONTRAST DISPLACEMENT METHOD AND STS

1. Endovascular occlusion of the ISV at the internal inguinal ring level with one or two coils placed just proximal to the superior ramus of the pubis while the patient is performing a Valsalva maneuver
2. Leaving the 5-F endhole catheter within the first set of coils, and displacing the static contrast material with 2 to 3 mL of 2% STS liquid or foam is performed at least twice
3. Placing another set of coils at a higher level in the ISV, usually over the mid portion of the mid sacroiliac joint and repeating contrast displacement with STS liquid or foam during a Valsalva maneuver
4. Leave the upper portion of ISV unoccluded, unlike the 1990–2004 approach

BUILDING A VARICOCELE PRACTICE

1. Must see patient in outpatient clinic
   a. Parents of adolescent want to know options
   b. Same is true for couples with infertility
2. If your IR practice is women's health (UFE, varicose veins, etc)
   a. Offering varicocele occlusion is a natural extension
   b. Should be part of your discussion with OB and pediatrics doctors and general community lectures
3. Work with your society, SIR, to fund multicenter study with outcomes
4. If it happened with UFE, it can happen with varicocele

pediatric urologists from the Mayo Clinic and Temple University demonstrated a reduction in their recurrence rates in patients with large painful varicoceles from approximately 15% to < 3%. Testicular regrowth occurred in 85% of their patients.[16]

We immediately began a study using pre- and postoperative ultrasound, which was presented at the Society of Interventional Radiology (SIR) annual scientific meeting in 2010 in abstract form.[17] In 54 young patients, using the same technique we described in 2008, Dr. Arici demonstrated that after occluding the ISV at the internal inguinal ring and achieving stasis, we could displace the contrast material with 2% STS foam or liquid into the pampiniform plexus. Our results were similar, with minimal discomfort the day after the outpatient procedure, which could primarily be controlled with over-the-counter ibuprofen (Figure 2B).[17,18]

More importantly, all patients underwent preprocedural limited ultrasound and postprocedural ultrasound examination 4 to 6 months later. We achieved a 98% technical success rate. Ultrasound follow-up in 47 of the 54 patients identified thrombosed veins, and color Doppler demonstrated lack of reflux in the majority of these patients.[17,18] Radiation concerns were, to a major degree, obviated by using fluoro capture images for our permanent record.[17,18] Postembolization syndrome occurred in 18% of patients in this series and was easily controlled with ibuprofen and/or ketorolac in standard doses. Patients returned to school or work within 1 to 2 days and to active sports within 3 to 4 days.

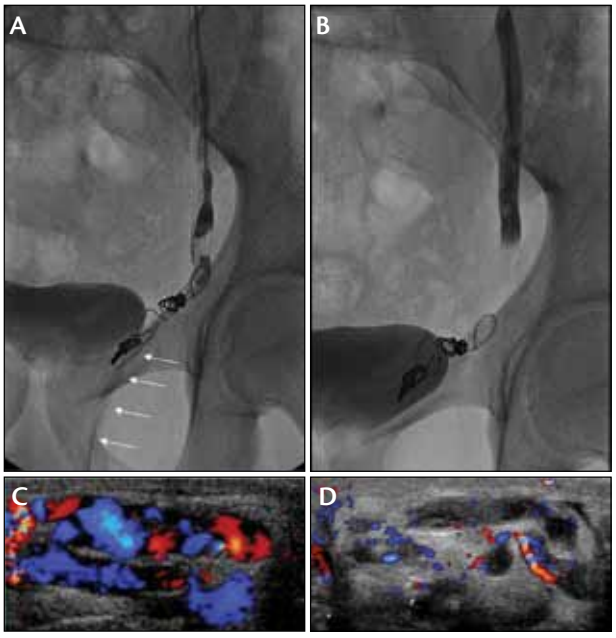

Figure 3. After occlusion at the inguinal canal, parallel collaterals are demonstrated (A, arrows), and they are obliterated after two injections of 3 mL of 2% STS foam (B). A second set of coils and foam were placed in the ISV at the level of the sacroiliac joint (not shown). In the ultrasound examination, a large varicocele with free reflux during a Valsalva maneuver before occlusion is demonstrated (C). At 3 months after treatment, reflux is obliterated, and one can see organized thrombus within the varicocele (D).

The catheter techniques used are standard.[15] Coil placement at the level of the internal inguinal ring increases resistance in the proximal ISV and allows better dispersion of STS liquid or foam into the pampiniform plexus, as well as into obscure collaterals that might cause recurrence (Figure 3A and B). The patients are usually placed under light sedation. The Valsalva maneuver is very useful because most of our patients are young and displacing the static contrast material with STS allows maximal contact with the pampiniform plexus, as well as the potential collaterals (Figure 3C and D).

WHAT IS NEEDED IN THE FUTURE

There are many successful models now in interventional radiology, and I can think of no better model than the approach that was utilized by SIR to prove the efficacy of uterine fibroid embolization (UFE) (see *Building a Varicocele Practice* sidebar).[19,20] After pilot studies of UFE, SIR developed guidelines for the management of fibroids based on outcomes using pre- and post-UFE magnetic resonance imaging examinations and a quality-of-life measure (SF-36).

Similarly, SIR should develop guidelines based on our approach, or a modified approach, with ultrasound examination before treatment and at 2 to 3 months after treatment in patients with symptomatic varicoceles. As previously mentioned, it was very difficult to perform randomized studies in patients with infertility when the procedure was first developed. Proving the efficacy of our approach, or a modified approach, in a large number of patients with symptomatic varicoceles is very feasible. If our results are proven, the technique would be applicable to a larger population of men with varicoceles and relative infertility. ■

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