Treatment of varicoceles: techniques and outcomes

Dane Johnson, M.D. and Jay Sandlow, M.D.

Department of Urology, Medical College of Wisconsin, Milwaukee, Wisconsin

Varicoceles, a dilation of veins within the pampiniform plexus, are present in ∼15% of the general male population. This paper reviews the indications for treatment of varicoceles, post-intervention outcomes following treatment, and the various techniques for treatment of varicoceles. The aim of this review is to describe and compare complications associated with each approach to varicocele treatment. (Fertil Steril® 2017;108:378–84. ©2017 by American Society for Reproductive Medicine.)

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Varicoceles, a dilation of veins within the pampiniform plexus, are present in ∼15% of the general male population. It is also one of the most frequent causes of male-factor infertility, with a prevalence of 30%–40% among men presenting for primary infertility evaluation and up to 85% in secondary infertility (1). In certain patients, varicoceles can cause testicular damage resulting in loss of testicular volume, spermatogenic dysfunction, disruption of hormone production, and sperm DNA damage (2–4). The mechanism of testicular dysfunction secondary to varicocele may be related to loss of the countercurrent temperature exchange between the pampiniform plexus and spermatic artery. Under normal physiologic circumstances, the testicle has been demonstrated to be 1–2°C cooler than the core body temperature (5). When varicoceles develop, venous stasis is often encountered, and the pooling of warm venous blood in these varicoceles is thought to lead to a loss of the countercurrent heat exchange (6). Studies using intrascrotal temperature probes support this hypothesis, finding that patients with varicoceles had intratesticular temperatures that were significantly higher than patients without varicoceles (7). This increased heat has been found to be detrimental to spermatogenesis and to result in germ cell loss and DNA damage (8). Additional studies have found that varicoceles may also induce a state of transient hypoxia, resulting in increased reactive oxygen species that may contribute to testicular dysfunction (9, 10). Fortunately, both mechanisms of injury are typically correctable by means of treatment of the varicocele.

INDICATIONS

According to best-practice statements from both the American Urological Association and the American Society for Reproductive Medicine, treatment of clinical varicoceles should be offered to the male partner of a couple attempting to conceive when the following are present: 1) a varicocele is palpable; 2) the couple has documented infertility; 3) the female has normal fertility or potentially correctable infertility; and 4) the male partner has one or more abnormal semen parameters or sperm function test results (11). In addition, varicocele treatment is indicated when the goal of treatment is aimed at preventing or reversing testicular atrophy in adolescent males, correcting pain from varicoceles, addressing elevated sperm DNA fragmentation (DNAF), or improving testicular function in hypogonadal men with varicoceles.

The incidence of clinical varicocele in adolescence is similar to that of the adult male population (12). Young men or adolescent boys with varicoceles should be evaluated for ipsilateral testicular hypotrophy and, if present, offered treatment. These patients are thought to be at risk for future testicular dysfunction and possible infertility (13). Studies have shown in young men that testicular volume discrepancy between the normal and the affected testis correlated with decreased sperm concentration and motility (14), and a cutoff of >10% size discrepancy has been proposed as a surgical criteria for asymptomatic adolescent varicocele (15). Furthermore, both nonhuman and human studies have shown that varicocele is associated with a progressive duration-dependent decline in testicular function (16) Adolescents with palpable varicoceles and objective

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Reprint requests: Jay Sandlow, M.D., Department of Urology, Medical College of Wisconsin, Milwaukee, WI 53226 (E-mail: jsandlow@mcw.edu).

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evidence of reduced ipsilateral testicular size or abnormal semen parameters should be offered varicocele repair.

Pain associated with varicoceles is relatively common and well recognized, with a prevalence of 2%–10% of men with varicoceles (17). This pain is often described as a dull throbbing pain that worsens with strain or physical exertion. When identified, pain from varicoceles is rarely successfully managed with conservative therapy alone, with spontaneous resolution rates of $<1\%$ described (18). Patients with pain consistent with symptomatic varicoceles should be offered treatment.

Sperm DNA is tightly bound to protamine to protect it from damage during transport through the testis and epididymis (19). However, when sperm is exposed to oxidative stress, DNAF may occur (20). Elevated sperm DNAF has been found to be associated with greater incidence of spontaneous abortion, recurrent pregnancy loss, and lower intrauterine insemination (IUI) and in vitro fertilization (IVF) pregnancy rates (21). Furthermore, varicoceles have been found to have a significant association with elevated DNAF, and treatment of varicoceles has been shown to improve this (22). Pregnancy after varicocelectomy has been associated with decreased sperm DNAF compared with those who do not achieve pregnancy (23). Finally, for couples with male-factor infertility and clinical varicocele, varicocelectomy improves IVF outcomes compared with couples treated with IVF alone (24). Based on these findings, varicocelectomy may be offered to couples with failed IUI, failed IVF, or otherwise unexplained infertility or recurrent pregnancy loss when the male partner has been found to have elevated sperm DNAF with or without abnormal semen parameters.

As men age, serum testosterone levels can decrease (25). Unfortunately, men with varicoceles may be at risk for premature androgen insufficiency: Varicoceles are known to impair Leydig cell function, resulting in decreased testosterone production (26), and correction of varicocele can improve serum testosterone levels (27). Hypogonadal men with palpable varicoceles may be offered treatment, although this is still somewhat controversial.

APPROACHES TO VARICOCELE TREATMENT

Microsurgical Subinguinal Varicocelectomy

Microsurgical subinguinal varicocelectomy (MSV) uses a 3-cm transverse skin incision made over the pubic ramus just below the external ring, then carried down to and through the Scarpa fascia. The cord structures are grasped carefully with an atraumatic Babcock clamp and elevated into the wound. Sharp and blunt dissection are used to free the cord structures from surrounding tissues, allowing mobilization up through the skin incision. The cord is then secured at this level by an army-navy retractor. With the use of a surgical microscope for magnification, the external spermatic fascia is split and then divided. The vas and its perivasal vascular bundle are isolated and preserved. A micro-Doppler probe can then be used to identify the testicular artery. All lymphatic vessels are preserved when possible, as are any additional testicular arteries. All veins within the spermatic cord are ligated with either surgical clips or 4-0 ties. Once the cord has been reduced to the vas deferens, perivasal vessels, artery, and lymphatics, the spermatic cord is replaced into the wound. The wound is then closed with interrupted deep dermal suture and a running subcuticular suture (28).

Although meta-analyses have shown improved semen parameters and catch-up growth for all techniques of varicocele treatment, microsurgical subinguinal approach is the optimal technique for treating varicoceles, because it is consistently found to have the lowest rates of postoperative complications, including hydrocele formation and varicocele recurrence (29–32). According to a recent meta-analysis by Cayan et al. (33), MSV had significantly lower hydrocele formation rates (0.44%) compared with laparoscopic varicocelectomy (2.84%). They also found recurrence rates to be significantly lower when MSV was performed (1.05%) compared with laparoscopic (4.3%) and radiologic embolization (12.7%). Additional comparative studies evaluating outcomes have supported these findings (34).

Inguinal Varicocelectomy

Inguinal varicocelectomy uses a 3–4-cm incision over the lower inguinal canal, starting two to three finger breadths medial and caudal to the anterior iliac spine. The incision is carried down to and through the Scarpa fascia. Superficial inferior epigastric veins are ligated. The aponeurosis of the external oblique muscle is identified and incised parallel to the fascial fibers, with the incision continued inferiorly through the external inguinal ring. The ilioinguinal nerve is identified and freed from the underlying cord structures and then retracted laterally out of harm's way during the remainder of the procedure. The spermatic cord within the canal is isolated and elevated from the wound. The spermatic cord is then divided; vas, perivasal vessels, testicular artery, and lymphatics are all spared; and the veins are ligated. Running absorbable suture is then used to close the oblique fascia and subcutaneous space. The skin is closed with the use of a running subcuticular suture (28).

Microscopic inguinal varicocelectomy has also been shown to have a significant positive effect on semen parameters, with success rates similar to the microscopic subinguinal approach and significantly better than retroperitoneal or laparoscopic varicocelectomy (28). With similar outcomes between the two techniques, some have advocated the use of the microsurgical inguinal varicocelectomy as a technically easier procedure (35). Considering that the subinguinal approach encounters more spermatic arteries, inguinal varicocelectomy is thought to involve fewer internal spermatic vessels with larger diameters, resulting in shorter operative time (36). However, comparative studies between the two procedures looking at operative times have found no difference in operative time, suggesting that length of surgery is dependent more on surgeon experience (37). Furthermore, inguinal varicocelectomy does not always address the larger cremasteric veins, which can increase the risk for recurrences. Finally, inguinal varicocelectomy is associated with increased postoperative pain owing to the need to incise the aponeurosis of the external oblique fascia (38). For these reasons, we think that despite similar outcomes between the two approaches, subinguinal varicocelectomy remains the technique of choice.

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