

The Varicocele

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KEYWORDS

• Infertility • Microsurgery • Pampiniform plexus • Sperm • Testicle • Varicocele • Varicocelectomy

KEY POINTS

- Varicoceles are present in 35% to 40% of infertile men and represent a highly treatable form of male infertility.
- Varicoceles can result in disordered spermatogenesis, germ cell sloughing within the seminiferous tubules, testicular atrophy, and decreased testosterone secretion.
- Microsurgical varicocelectomy results in improved semen parameters and reproductive outcomes with low rates of recurrence and postoperative morbidity.
- Varicocelectomy is more cost-effective than both IUI and in vitro fertilization as a treatment option for affected infertile couples.

HISTORICAL PERSPECTIVE

The association of the varicocele with male infertility derives back to the first century AD when Celsius reported a link between dilated scrotal veins and testicular atrophy.¹ Besides supportive clothing, no known intervention was offered for symptomatic painful varicoceles until the nineteenth century when various methods were established to ligate these dilated veins. Among them was the Woods operation, which consisted of the passing of wire loops around the scrotal vessels and applying tension until they eventually cut themselves out.² Another popular modality involved the use of Andrew varicocele clamp, which removed the dilated vessels along with the scrotal skin covering these vessels.³ Several modifications were made on these “varicocelectomy” techniques, but the main indication for surgery was scrotal discomfort secondary to varicocele.

The benefits of varicocelectomy with regards to male reproduction were not recognized until the late nineteenth century. In 1885, Barwell⁴ reported on 100 men with varicoceles who underwent placement of wire loops around dilated scrotal veins and observed an improvement in testicular

size and consistency. Testicular function was augmented by Bennet⁵ in 1889, when he reported an improvement in semen quality in a patient who underwent bilateral varicocelectomy. In 1929, Macomber and Sanders⁶ further elucidated the reproductive benefit to varicocelectomy by reporting normal semen parameters and fertility after the procedure in an oligozoospermic subfertile patient. Despite these early reports, varicocelectomy did not gain popularity as a surgical treatment of male infertility until the work of Tulloch in 1955. In his series of 30 patients undergoing unilateral or bilateral varicocelectomy, he demonstrated an improvement in semen parameters in 26 patients, of which 10 had return to normal fertility with successful pregnancy.⁷ His conclusion that “where a varicocele is associated with subfertility, the varicocele should be cured” has become part of the backbone of reproductive medicine, and numerous studies have followed demonstrating an improvement in semen parameters and pregnancy rates in infertile men undergoing this procedure. These more contemporary series on varicoceles and treatment options, including outcomes data, are reviewed in further sections.

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The varicocele clamps and wire loops were discontinued in the early twentieth century as the ligation or excision of the pampiniform plexus transformed to varicolectomy through the inguinal or scrotal route. Because of the high failure rate and the risk of injury to end arteries through the scrotal approach, Ivanissevich advocated "high ligation of the internal spermatic vein" through either the high inguinal or retroperitoneal approach.² In 1960, he further documented his experience with 4470 operative cases, demonstrating both low complication and failure rates, and many surgeons continue to use some modification of this technique today.⁸ More advances in varicolectomy came through the use of microsurgery in the 1980s, when several published series demonstrated not only greater efficacy but also a reduction in morbidity through better preservation of the internal spermatic artery and lymphatic channels with higher magnification.⁹⁻¹¹

ANATOMY

A varicocele is defined as a dilatation or tortuosity of the veins of the pampiniform plexus. Clinically, they are found more commonly on the left side, although there is wide variation among the reported prevalence of bilateral varicoceles, which range from 30% to 80%.¹² An isolated right-sided varicocele is extremely rare and raises concern about an underlying retroperitoneal mass.

The reason for the prevalence of left varicoceles can be clarified by retroperitoneal anatomy. The left internal spermatic vein drains perpendicularly into the left renal vein, whereas the right internal spermatic vein drains obliquely into the vena cava. This basic finding has 2 ramifications that contribute to the left-sided predisposition. For one, the course of the left internal spermatic vein results in a length of approximately 8 to 10 cm longer than its right-sided counterpart. This added length, coupled with upright posture, results in increased hydrostatic pressure, which can overcome valvular mechanisms in certain men and lead to dilatation and tortuosity of spermatic veins. Second, the perpendicular insertion of the left internal spermatic vein into the left renal vein exposes the left spermatic vein to pressure elevations within the left renal vein. The oblique insertion of the right internal spermatic vein into the vena cava, on the contrary, shields the right internal spermatic vein from the increased pressures within the vena cava.¹³ The basis for increased hydrostatic pressure and varicocele formation is best elucidated by the work of Shafik and Bedeir,¹⁴ who studied venous tension patterns in spermatic cord veins in 32 patients with a left varicocele and

30 controls. They demonstrated that patients with left varicoceles have a venous tension that is considerably higher both during rest and during Valsalva maneuver compared with that in control subjects, with average increases of 19.7 mm Hg and 22 mm Hg, respectively.

The predisposition to varicocele formation is also related to abnormalities in valvular mechanisms among certain patients. In a well-quoted study, Ahlberg and colleagues¹⁵ performed anatomic examination of 30 normal men at autopsy and revealed the complete absence of valves in 40% of the left spermatic veins and 23% of the right spermatic veins. In a follow-up study, Ahlberg and colleagues¹⁶ performed selective phlebography in patients with varicoceles and control subjects in the erect position; they demonstrated retrograde left internal spermatic vein filling in 22 patients with varicoceles and right internal spermatic vein filling in 10 patients. They reported that some of these patients had no valves and others had incompetent valvular mechanics. Meanwhile, they did not observe any retrograde filling in 9 control patients and 6 patients who underwent previous varicolectomy. These studies articulate 2 important points: first, valvular malfunction or absence does exist in a certain segment of the population, and second, the absence of valves is more common in the left internal spermatic vein.

There may also be a genetic basis to the valvular dysfunction leading to varicocele development. Raman and colleagues¹⁷ evaluated 62 first-degree relatives of patients with varicoceles and found that 56.5% of them had a clinically palpable varicocele on physical examination, compared with a prevalence of 6.8% in 263 controls. Specifically, among the first-degree relatives with varicoceles, 74% were brothers, 41% were fathers, and 67% were sons. Although the genetic mechanisms predisposing to varicocele formation remain to be elucidated, these results suggest an inheritance pattern of this anatomic finding.

Most anatomic research has been conducted on the internal spermatic vein and varicocele formation; however, there are some data to suggest that dilated external spermatic (cremasteric) veins can also contribute to primary or recurrent varicoceles. In 1980, Coolsaet¹⁸ retrospectively reviewed 67 patients with left varicoceles who underwent preoperative venography and demonstrated that the cause of varicoceles stems from dysfunction within the internal spermatic vein, obstruction of the common iliac vein (resulting in dilated external spermatic veins), or both mechanisms. Murray and colleagues¹⁹ evaluated 44 varicocele recurrences and reported that 58% of

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