THE ROLE OF VARICOCELE IN MALE FERTILITY

Male infertility has been found to be a major factor in a couple’s inability to conceive in 50% of childless marriages. There are many causes of male infertility including: deficient sperm production, blockage of ducts through which sperm are transported from the testicles, hormonal abnormalities, failure of sperm to mature properly and antisperm antibodies. **Varicocele** is felt to play a major role in male infertility by mechanisms that will be explained below.

In order to understand what a varicocele is, one must be aware of some basic anatomy and physiology. The **testicles** are the paired male genital organs that contain not only sperm but also cells that produce and nourish the sperm. These organs are located in a sac called the scrotum. The **epididymis** is a small, tubular structure attached to the testicle. It is a reservoir where the sperm mature and are stored. The **vas deferens** connects the epididymis to the urethra and is the tube through which sperm travel during ejaculation. The vas deferens is not situated by itself but is a part of a larger tissue bundle called the **spermatic cord**. The spermatic cord contains many blood vessels as well as the vas deferens, nerves and lymphatic channels. The veins of the spermatic cord are known as the **pampiniform plexus**. These veins drain blood from the testis, epididymis and vas deferens, eventually becoming the spermatic veins that drain into the main circulation at the level of the kidneys. The pampiniform plexus of veins may become tortuous and dilated, much like a varicose vein in the leg.

The varicocele is a well-recognized cause of decreased testicular function and is present in about 40% of infertile males. In order to understand the significance of this abnormality in the infertile patient, a brief review of the historical background, current concepts of its anatomy and function, and methods and results of surgical repair must be considered.

**History**
Varicoceles have been recognized as a clinical problem since the 16th century. It was not until the late 19th century that the relationship between infertility and varicocele was first proposed by the British surgeon, Barfield. Through the early 1900s, reports by other surgeons continued to describe the association of infertility with a varicocele.
It was not until the 1950s, however, that the concept gained support as a clinical entity among American surgeons. Research then continued with studies characterizing semen of men with varicoceles as having varying degrees of impaired sperm quality.

From these studies, a pattern of low sperm count, poor motility and a predominance of abnormal sperm forms was documented. This became known as the "stress pattern" of semen. Although not specific for varicocele, it consistently suggests early evidence of testicular damage. Although varicoceles appear in about 15% of the normal fertile male population, their presence is significantly higher in the subfertile population. In fact, scrotal varicoceles have been found to be the most common identifiable and surgically correctable factor contributing to poor testicular function and decreased semen quality.

**Anatomy of the Varicocele and Mechanism of Effect**

Varicoceles are more common on the left than the right for multiple anatomic reasons. They may vary in size and can be classified into three groups: (1) large – easily identified by inspection alone; (2) moderate – identified by palpation without bearing down; and (3) small – identification only by bearing down which increases intra-abdominal pressure, further impeding drainage and thus increasing the size of the varicocele. It is important to remember, however, that the size of the varicocele is not related to the degree of changes in the sperm.

Several theories have been proposed to explain the deleterious effect of the varicocele on sperm quality. These include possible effects of oxygen deprivation, increased testicular temperature or metabolic toxins. Despite considerable research, none of these theories have been unquestionably proven, although an increased heat effect caused by impaired circulation appears to be the most reproducible defect. The fact that creation of a varicocele in the experimental animal can lead to poor sperm function with elevated intratesticular temperature gives support to this concept.

Regardless of the mechanism of action, varicocele is a significant factor in decreased testicular function and reduced semen quality in large percentage of men seen for infertility.

**Diagnosis**

Because of its potential role in causing significant testicular damage, it is important to identify the varicocele on physical examination. Reasons for surgical correction include the presence of significant testicular pain, impairment of testicular function as evidenced by decreased semen quality, and loss of testicular size (atrophy). The mere presence of a varicocele does not mean that surgical correction is necessary. Usually, the varicocele is asymptomatic in the patient seen primarily for evaluation of male fertility. However, the patient may sometimes complain of pain or heaviness in the scrotum.
Careful physical examination remains the primary method of varicocele detection. It is important to examine the patient in the standing position, having him perform the Valsalva maneuver (i.e. take a deep breath and bear down) to magnify a small varicocele. When small varicoceles are difficult to diagnose, more objective means can be used such as ultrasonography and venography. The ultrasound technique is painless and evaluates dilation of the peritesticular veins using sound waves. Venography requires a small incision in the groin, insertion of a needle into the groin vein and injection of “dye” (contrast solution) which will flow into the spermatic vein. This technique is performed on an outpatient basis and allows direct visualization of the varicocele by x-ray.

**Surgery and its Results**

Once a varicocele is diagnosed, reasons for surgical correction include: testicular discomfort or pain unrelieved by routine, symptomatic treatment, testicular atrophy (loss of size), or the possible contribution to unexplained male infertility.

There are two commonly used surgical approaches for the correction of a scrotal varicocele: (1) the transinguinal (groin) approach and (2) the retroperineal (abdominal) approach. Under routine conditions, the transinguinal approach is the operation of choice. The retroperitoneal approach is used in patients who have already had an attempted varicocele or hernia repair where considerable scarring may be encountered.

Although the mechanisms whereby varicoceles cause impairment in sperm production and semen quality remain theoretical, the statistical association between varicocele and male infertility is unquestionable. Furthermore, improvement in semen quality after varicocele correction has been repeatedly demonstrated. The resultant improvement in semen quality occurs in about 67% of patients, with the most improvement seen in sperm motility rather than in sperm count. The pregnancy rate is as high as 40%, with the pregnancy occurring an average of six to nine months following surgery.

The scrotal varicocele remains the most common correctable factor when treating decreased semen quality. Therefore, when present in the infertile male with abnormalities of semen quality, surgical correction should be strongly considered. The side effects following varicocele repair are remarkably low, and successful surgery will often increase the incidence of eventual pregnancy in the infertile couple.