INTRODUCTION

The reproductive functions of the male can be divided into three major subdivisions: First, spermatogenesis which means simply the formation of sperms; second, the regulation of male reproductive functions by the various hormones and the third, the performance of the male sexual act ***(Waalkes et al., 2012).***

A varicocele (VAR-ih-koe-seel) is an enlargement of the veins within the loose bag of skin that holds the testicles (scrotum). A varicocele is similar to a varicose vein that can occur in your leg. Varicoceles are a common cause of low sperm production and decreased sperm quality, which can cause infertility. However, not all varicoceles affect sperm production. Varicoceles can also cause testicles to fail to develop normally or shrink ***(Esteves and Chan, 2015).***

Varicoceles remains one of the most commonly diagnosed conditions leading to male infertility. Varicoceles typically develop in adolescence and likely result in worsened sperm production. Despite the decreased sperm quality overall, many men with varicoceles continue to have sufficient sperm quality to achieve a pregnancy later in life ***(Mirilas and Mentessidou, 2012)***

Clear indications to repair a varicocele in adolescence include progressive testicular atrophy, pain or abnormal semen analysis results. Although treatment of a varicocele generally improves sperm characteristics, it is not clear if an untreated varicocele leads to progressive worsening of sperm quality over time ***(Barone et al., 2011).***

AIM OF THE WORK

To discuss different modalities of management of varicocele.

ANATOMY OF TESTES

The testis (from the Greek word orchis) is the male gland important for both reproductive (exocrine) and endocrine functions. Initially, it begins as an undifferentiated gonad in the retroperitoneal area. Transcription of the SRY gene (testis-determining factor region) on the Y chromosome ultimately leads to sex differentiation. Without the SRY gene, the gonad would develop into an ovary ***(Baazeem et al., 2011).***

As the fetus develops, the functioning testis produces the male hormone testosterone to allow development of male genitalia. Over the last 3 months of gestation, the testis must course its way down from its original retroperitoneal position to its final destination in the scrotum. During its journey it must pass through the peritoneum, abdominal wall via the inguinal canal, and into the scrotal pouch ***(Iacono et al., 2014).***

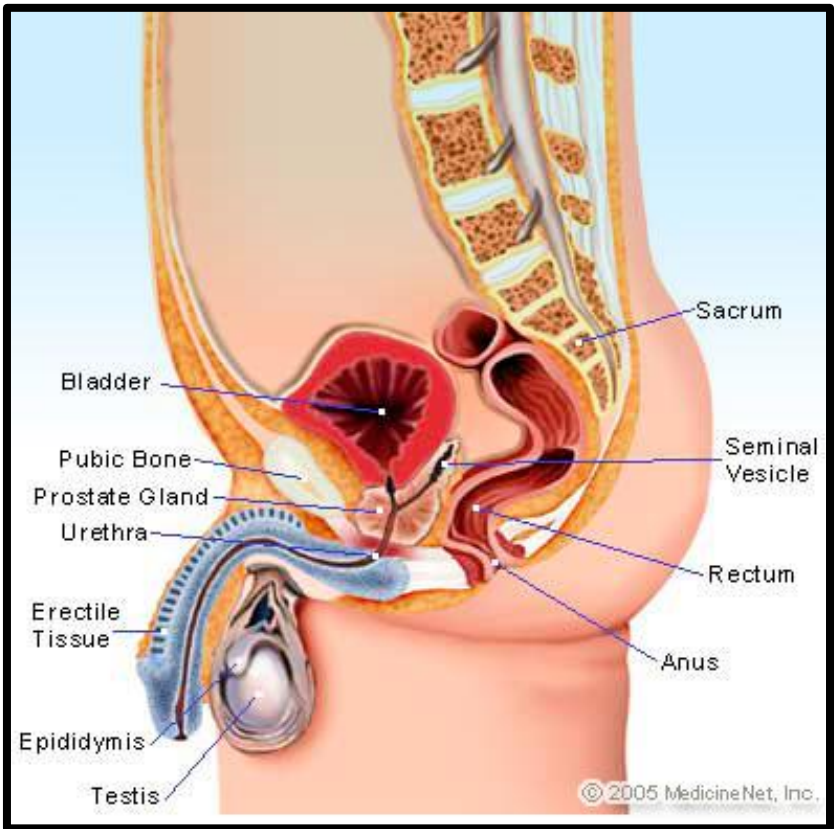

Fig. (1): Anatomy of the Male Pelvis ***(Iacono et al., 2014).***

Gross Anatomy

The testis is a paired, ovoid male reproductive organ that sits in the scrotum, separated from its mate by a scrotal septum. Described by some as being shaped and sized like a large olive or small plum, the average volume of the adult testis is approximately 25 mL. Typically, it measures 3.5-5 cm in length by 2.5-3 cm in both width by 3cm in depth (anteroposterior diameter) ***(Nork et al., 2014).***

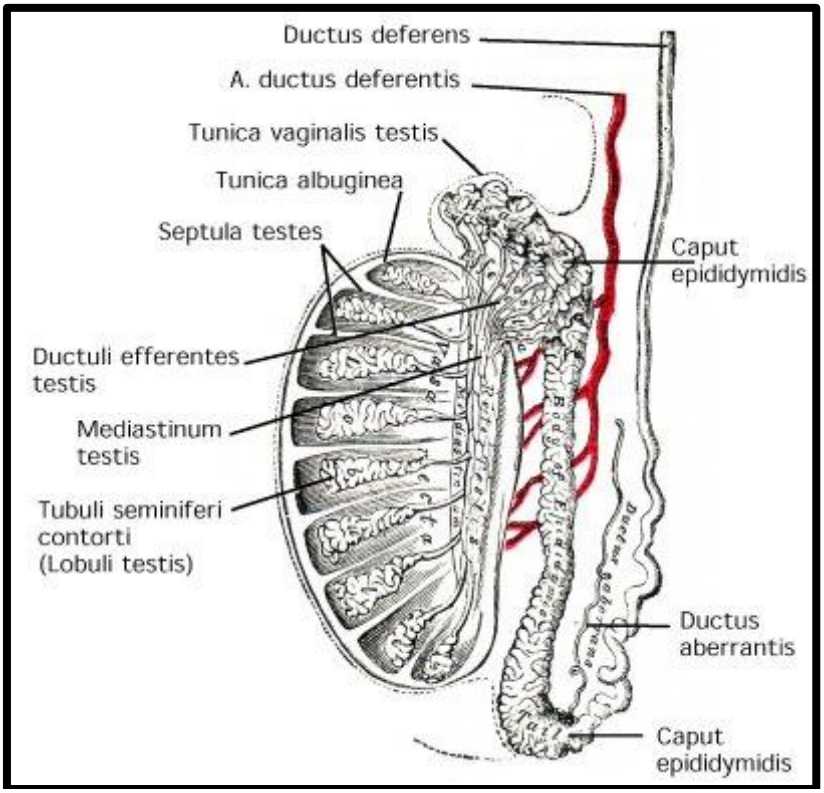

Fig. (2): Anatomy of the Male Testis ***(Nork et al., 2014)***

Smooth to palpation, the testis sits obliquely with its long axis mostly vertical with a slight anterior and lateral slant to the superior pole. Superiorly, it is suspended by the spermatic cord, with the left testis often sitting lower than the right testis. Inferiorly, the testis is anchored to the scrotum by the scrotal ligament, a remnant of the gubernaculums ***(Shiraishi et al., 2012)***

The tunica vaginalis testis (a remnant of the processus vaginalis) envelopes the testis in a double layer, except at the

superior and posterior borders where the spermatic cord and epididymis adhere to the testes. The visceral layer of the tunica vaginalis testis is closely applied to the testis, epididymis, and ductus deferens. On the posterolateral surface of the testis, this layer invests a slit-like recess between the body of the epididymis and the testis that is called the sinus of epididymis ***(Sabanegh et al., 2012)***

The parietal layer of tunica vaginalis is adjacent to the internal spermatic fascia, is more extensive, and extends superiorly into the distal part of the spermatic cord. Deep to the tunica vaginalis, the tunica albuginea is a tough, fibrous outer covering of the testis. On the posterior surface, it is reflected inwards to form an incomplete vertical septum called the mediastinum testis ***(Marcell, 2014)***

The mediastinum testis extends from the superior to near the inferior portion of the gland. It narrows in width as it travels inferiorly. Anteriorly and laterally, numerous imperfect septa are given off, which radiate to the gland surface and are attached to the tunica albuginea. These divide the interior of the testis into numerous, cone-shaped spaces that have a wide base at the gland's surface and narrow as they converge to the mediastinum. In these spaces, the numerous lobules of glandular structures (the

minute but long and highly coiled seminiferous tubules) are housed. The mediastinum supports the ducts and vessels as they pass to and from the glandular substance. The seminiferous tubules are lined with germ cells that produce sperm and nutrient fluid. These tubules empty their contents into a network of anastomosing ducts, which ultimately empties into the epididymis ***(Esteves and Chan, 2015).***

The epididymis is a comma shaped, elongated structure composed of a single, fine tubular structure estimated up to 6 meters (approximately 20 feet) in length. This tube is highly convoluted and tightly compressed (average size of approximately 5 cm) to the point of appearing solid. Located on the posterior border of the testis, it is composed of 3 parts, including the head (caput), body (corpora), and tail (cauda). The epididymal head overhangs the upper pole of the testis, receives the seminal fluid from the ducts of the testis (which pierce the upper portion of the mediastinum), then allows the passage of the sperm into the distal portion of the epididymis. Due to its length, the epididymal duct allows space for storage and maturation of sperm. Progressively tapering in width, the narrow tail continues as the ductus deferens ***(Iacono et al., 2014).***

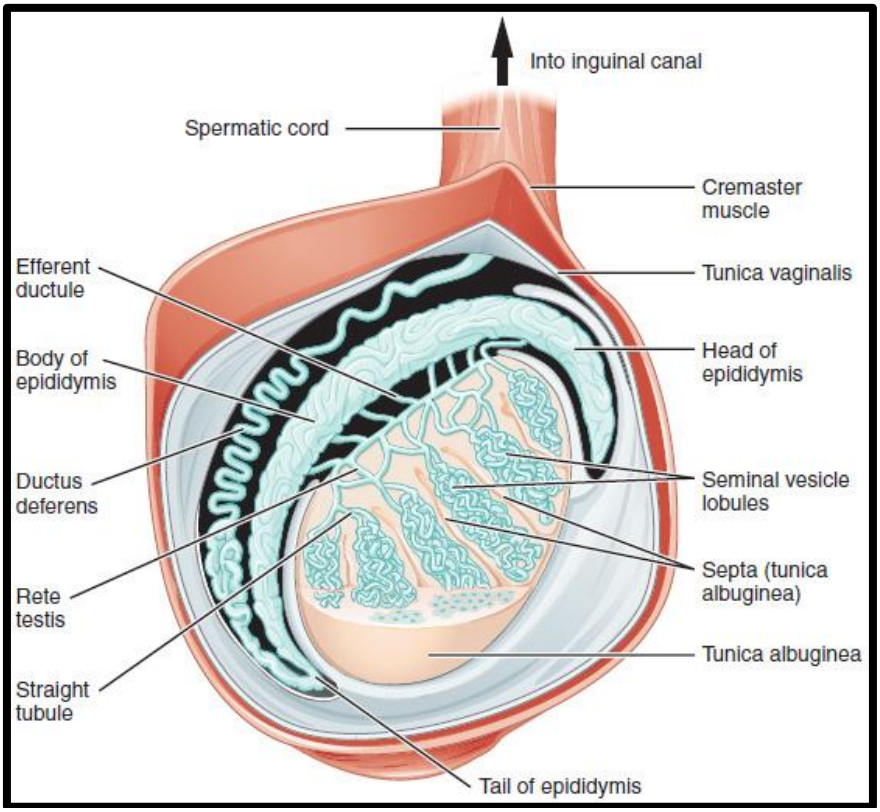

Fig. (3): Anatomy of the Testis and epididymis ***(Iacono et al., 2014)***

Microscopic Anatomy

The testis is composed of lobules of glandular tubules. These tubules are highly convoluted and held together by loose connective tissue with groups of "interstitial cells," which contain Leydig cells. The individual tubule consists of a basement membrane formed by laminated connective tissue with numerous elastic fibers with flattened cells between the layers and covered by an external layer of flattened epithelioid cells. Within the basement membrane are epithelial cells

arranged in several irregular layers but may be separated into germ cells at the periphery and varied cells of spermatogenesis up to mature sperm cells as they advance toward the lumen. Also a layer of Sertoli cells project inward from the basement to the lumen and provide support to the developing sperm cells ***(Nork et al., 2014)***

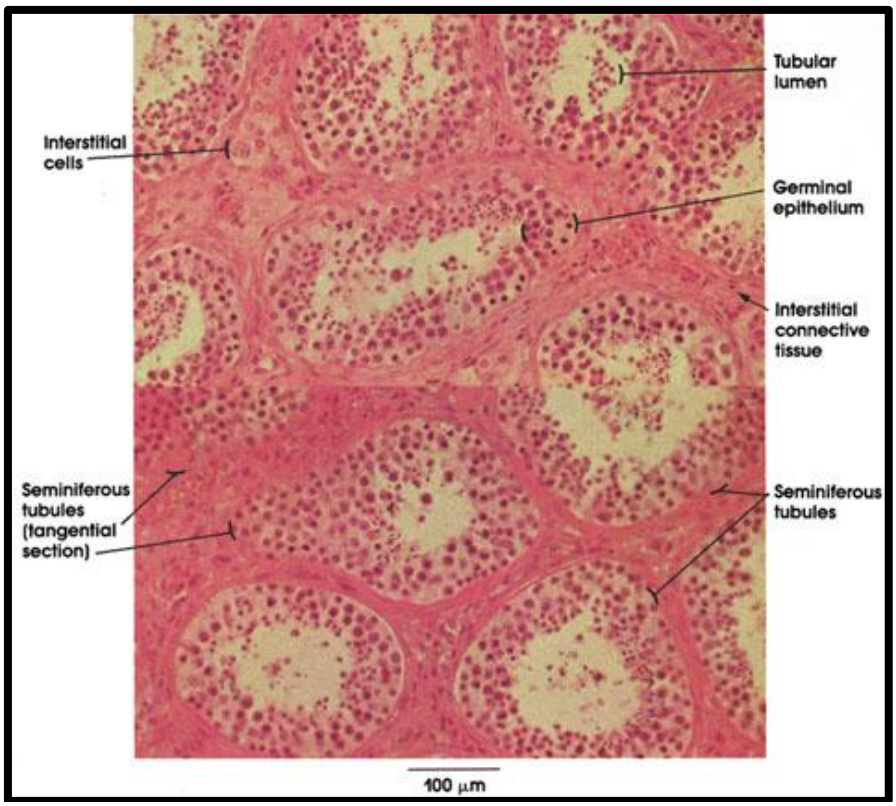

Fig. (4): Microscopic Anatomy of the Male Testis ***(Nork et al., 2014).***

Vessels and Nerves of the Testis, Epididymis, and Vas Deferens Arteries

1. ***Deep Arteries:*** supply the testis, epididymis, and vas deferens is accomplished by the following arteries:

a) *The internal spermatic artery* (gonadal or testicular artery), which is a branch of the aorta. Slightly below the level of the external ring, it gives off a branch to the coverings of the spermatic cord. The epididymis is supplied by a branch of the testicular artery, which is given off at the upper one-third of the testis and travels in the plane of the attachment of the epididymis on the posterior surface of the testis ***(Kolon, 2015)***

b) *The deferential artery* (artery of the vas deferens)-which emerges from the superior or the inferior vesical artery, a branch of the internal iliac artery (also known as the hypogastric artery).

c) *The cremasteric artery* (also known as external spermatic artery), which originates from the deep inferior epigastric artery, a branch of the external iliac artery ***(Kolon, 2015)***

The above arteries follow the spermatic cord, and hence can be considered "deep." The internal spermatic and deferential arteries are purely splanchnic, whereas the cremasteric is

somatic because it comes off of an abdominal muscle artery. There are anastomoses between deep arteries, as well as between deep and scrotal arteries ***(Kolon, 2015)***

Superficial Arteries: The scrotal arteries do not follow the spermatic cord and are considered here as "superficial." They can be divided into:

a) Anterior scrotal arteries, which arise from the external pudendal artery (branch of the femoral artery),

b) Posterior scrotal arteries, which originate from the internal pudendal artery (branch of the internal iliac artery). Anterior and posterior scrotal arteries anastomose ***(Waalkes et al., 2012)***

Mirilas and Mentessidou (2012) included these superficial arteries in the blood supply of the testis, epididymis, and vas because they contribute to the arterial network via anastomoses with the deep arteries.

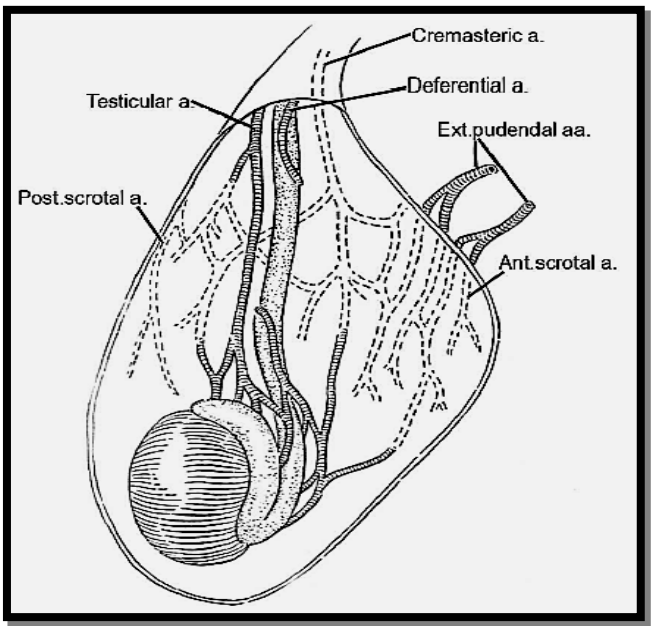

Fig. (5): Arterial supply of testis, epididymis, and vas deferens. Vessels coursing external to the internal spermatic fascia are shown by broken lines ***(Mirilas and Mentessidou, 2012).***

Veins

In the literature, the descriptions of the vein system of the testis-epididymis-vas have been controversial and confusing. Initially, two groups were described: an-anterior pampiniform plexus and a-posterior funicular plexus ("anterior" and "posterior" show location in reference to the vas); then, the deferential veins were added, positioned in the middle. However, others place the funicular plexus as the middle group and include in this group the deferential veins; the cremasteric veins were regarded as the posterior group ***(Trost and Nehra, 2011).***

In addition, in another classic anatomy textbook the pampiniform plexus is subdivided into an anterior, a posterior and, sometimes, a middle venous group comprising the deferential veins, whereas the funicular plexus is not mentioned at all. It is clear from above that the terms "pampiniform" and "funicular" are surrounded by impreciseness and considerable confusion ***(Mirilas and Mentessidou, 2012).***

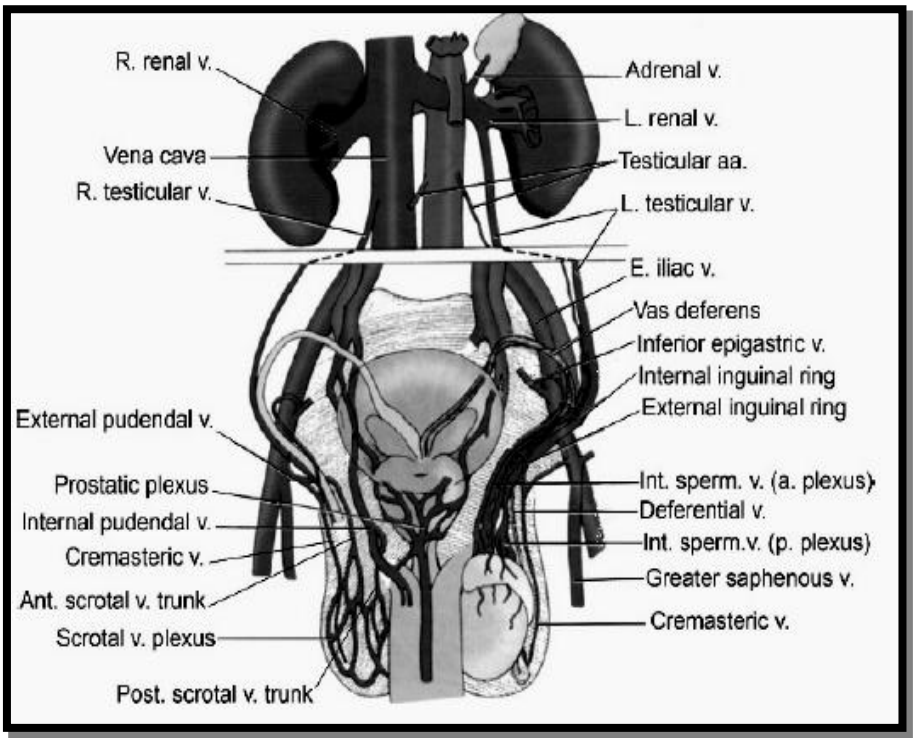

Fig. (6): Venous return of testis, epididymis, and vas deferens. Ant. scrotal v. trunk indicates anterior scrotal venous trunk; E. iliac v., external iliac vein; Int. sperm. v. (a. plexus), internal spermatic veins (anterior plexus); Int. sperm. v. (p. plexus), internal spermatic veins (posterior plexus); Post. scrotal v. trunk, posterior scrotal venous trunk ***(Mirilas and Mentessidou, 2012).***

As a general rule, veins will follow the arteries. Therefore, in conjunction with the arteries' description above, there would be 3 deep venous routes-along the internal spermatic artery, artery of the vas, and cremasteric artery-and a superficial venous return accomplished by the scrotal veins ***(Mirilas and Mentessidou, 2012).***

First

Deep Veins:

1. *Internal spermatic veins:* The internal spermatic veins drain the testis and epididymis. Recent anatomic work verified 2 vertical plexuses (anterior and posterior) at the upper and middle third of the testis. Although there is agreement on a total of about 10 to 12 veins close to the testis and epididymis, at a higher level of the spermatic cord their number varies significantly in descriptions: from 1 to 3, to 6 to 10. The microsurgical intraoperative findings of vein numbers per cord above and below the external ring are more reliable. Proximal to the internal inguinal ring, the number is reduced to 2 veins running anterior and posterior to the testicular artery, converging to a terminal trunk in the retroperitoneal space ***(Li et al., 2012)***

2. *Veins of the vas deferens:* These are small and travel adherent to the vas deferens. These veins terminate in the prostatic and vesical plexuses, which finally join the internal