

INTRODUCTION

Testicular tumors are tumors that develop in the testicles, part of the male reproductive system .it is highly curable neoplasm and a model for cancer management. The overall five year survival rate exceeds 95% (*De Giorgi et al., 2007*).

Testicular tumors in pediatric population are uncommon and account for 1% to 2% of all pediatric solid tumors, the annual incidence in boys younger than 15 years in United States is 1 per 100,000.

Benign lesions represent greater percentage of cases in children than in adults, a recent multicenter report found that 74% of primary testicular tumors in prepubertal children were benign (*Pohl et al., 2004*).

The incidence of childhood testicular tumors peaks at 2 years of age tapers after 4 years of age but then begins to rise again at puberty (*Haas and Schmidt, 1995*).

Etiological factors include: congenital causes (as cryptorchidism, gonadal dysgenesis) and acquired causes (trauma, hormones, atrophy.....etc).

Germ cell tumors (GCTs) account for nearly 95% of primary testicular tumors.

Germ cell tumors are composed of five basic cell types:

1. Seminoma
2. Embryonal cell carcinoma
3. Yolk sac tumor
4. Teratoma
5. Choriocarcinoma.

More than half of GCTs contain more than one cell type and therefore known as mixed GCTs. Teratoma is the most common testicular tumor in prepubertal children (*Pohl et al., 2004*).

The cardinal diagnostic finding in the patient with testicular tumor is a mass in the substance of the testis in the form of lump or swelling or hardness of the testis. 30-40% of cases were complaining of dull ache in the lower abdomen, in 10% of patients acute pain is the presenting symptom.

In approximately 10% of cases the presenting manifestations may be due to metastasis including neck swelling (supraclavicular lymph node metastasis), respiratory symptoms as cough or dyspnea,

gastrointestinal manifestations, lumbar pain, bone ache (*Konar et al., 2007*).

The study of biochemical marker substances particularly alpha fetoprotein and human chorionic gonadotrophin is clinically useful in diagnosis, staging and monitoring of treatment response in patients with germ cell tumors and may be useful as prognostic index (*Robinson et al., 2007*).

Radiologic investigations of pediatric tumors include: scrotal ultrasonography which is basically an extension of physical examination (any hypo echoic area within the tunica albugenia is markedly suspicious for testicular cancer), chest X-ray; anteroposterior and lateral chest X ray studies should be the initial radiographic procedures performed and CT scan: abdominal CT scans have been considered the most effective mean to identify retroperitoneal lymph node involvement. Magnetic resonance imaging (MRI) and Positron Emission tomography (*Stefanou et al., 2007*).

Treatment of prepubertal testis tumors is distinct from their adult counterparts, over the past 2 decades, studies have highlighted these differences and resulted in a distinct management approach to prepubertal patients.

Radical inguinal orchiectomy should be performed if yolk sac tumor is suspected when Alfa fetoprotein level is highly elevated, other treatment for other Germ cell tumors after exploration and frozen section include: testicular sparing surgery, Surveillance, platinum based chemotherapy according to type and stage of tumor (*Shah and Pohar, 2007*).

AIM OF THE WORK

The aim of this work is to introduce a state of the art review of the recent measures in detection and management of testicular Germ cell tumors in pediatric.

Chapter 1

ANATOMY AND DEVELOPMENT OF THE TESTIS

Testes and epididymes

The testes are the primary reproductive organs or gonads in the male. They are ovoid reproductive and endocrine organs responsible for sperm production and are suspended in the scrotum.

Average testicular dimensions are 4-5cm in length, 2.5cm in breadth and 3 cm in anteroposterior diameter; their weight varies from 10.5-14gram. The left testis usually lies lower than the right testis. Each testis lies obliquely within the scrotum, its upper pole tilted anterolaterally and the lower posteromedially. The anterior aspect is convex, the posterior nearly straight, with the spermatic cord attached to it. Anterior, medial and lateral surfaces and both poles are convex and smooth (*Standring et al., 2005*).

Testicular capsule:

The testicular capsule is composed of 3 layers:

- i. Visceral layer of tunica vaginalis

- ii. Tunica albuginea
- iii. Tunica vasculosa.

The visceral layer of tunica vaginalis is a thin serous layer formed of mesothelial cells, tunica albuginea is a fibrous membrane composed of collagen fibers and fibroblasts, it forms the main bulk of the capsule, it forms septations that separates the testis into lobules (*Davis et al., 1994*).

At the posterior border of the testis, tunica albugenia projects into the testicular interior as a thick, incomplete, fibrous septum, (mediastinum testis), which extends from the upper to the lower end of the testis. Testicular vessels run within the mediastinum testis (*Standring et al., 2005*)

Tunica vasculosa is a thin delicate areolar layer with networks of tiny blood vessels (*Davis et al., 1994*).

Each testis is composed of seminiferous tubules and interstitial tissue surrounded by a thick connective tissue capsule (tunica albuginea), Spermatozoa are produced by the seminiferous tubules. There are 400-600 highly coiled seminiferous tubules are modified at each end to become straight tubules,

which connect to a collecting chamber (the rete testis) in the mediastinum testis, projecting from the capsule into the posterior aspect of the gonad. Approximately 12-20 efferent ductules originate from the upper end of the rete testis penetrate the capsule and connect with the epididymis (*Drake et al., 2007*).

Epididymis

The epididymis is a single tubule 6-7m in length, it is divided into 3 parts: head (caput), a body (corpus) and a tail (cauda) (*Graham et al., 2010*).

Epididymis lies posteriorly and slightly lateral to the testis, with the vas deferens along its medial side, it consists of the single convoluted ductus epididymis formed by the union of the efferent ducts of the testis, which attach to the rete testis. From the tail, the vas deferens ascends medially to the deep inguinal ring, within the spermatic cord (*Standring et al., 2005*).

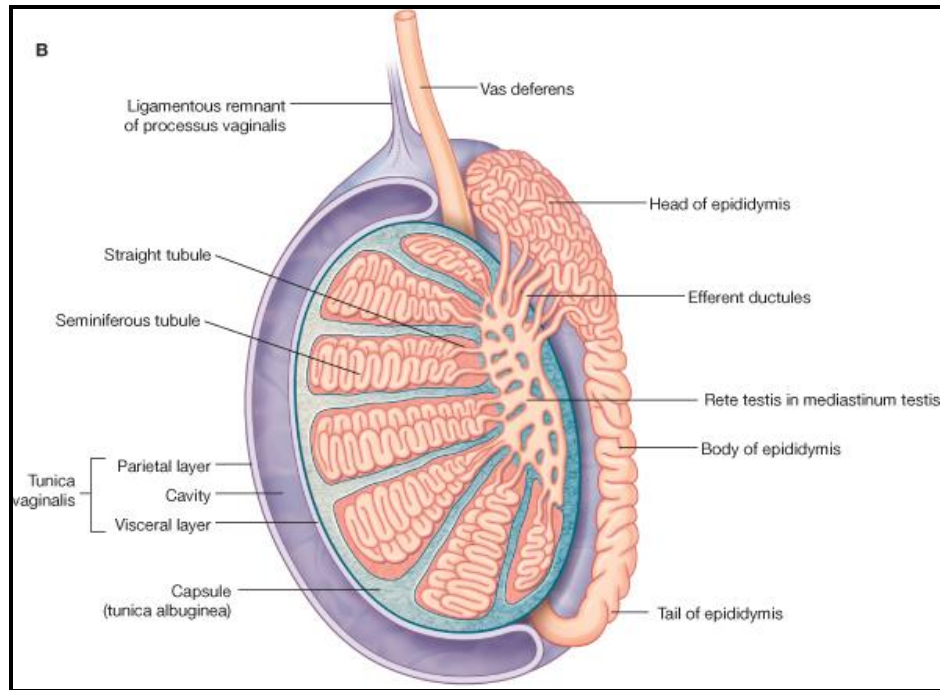


Fig. (1): Testis and surrounding structures.

Vascular supply: testicular arteries

The testicular arteries are two long, slender vessels, which arise anteriorly from the aorta a little inferior to the renal arteries. Each passes inferolaterally under the parietal peritoneum on psoas major (*Standring et al., 2005*).

The right testicular artery lies anterior to the inferior vena cava and posterior to the horizontal part of the duodenum, right colic and ileocolic arteries, root of the mesentery and terminal ileum, the left testicular artery lies posterior to the inferior mesenteric vein, left

colic artery and lower part of the descending colon (*Mostafa et al., 2008*).

Each artery crosses anterior to the genitofemoral nerve, ureter and the lower part of the external iliac artery and passes to the deep inguinal ring to enter the spermatic cord and travel via the inguinal canal to enter the scrotum (*Standring et al., 2005*).

In the spermatic cord each artery branched several times, sometimes just below the internal inguinal ring (*Lee et al., 1984*).

Testicular artery has one to three branches supplying the upper and lower poles of the testis (*Mostafa et al., 2008*).

The testis also receives blood from the cremasteric branch of the inferior epigastric artery and from the artery to the vas deferens) (*Graham et al., 2010*).

Interference with the testicular artery high in the abdomen therefore usually leaves the testis unharmed, whereas interruption in the region of the spermatic cord may interfere with all of these vessels and lead to infarction (*Standring et al., 2005*).

Testicular veins:

The testicular veins emerge posteriorly from the testis, drain the epididymis and unite to form the pampiniform plexus, which is a major component of the spermatic cord. In the inguinal canal the plexus is drained by three or four veins which run into the abdomen through the deep inguinal ring. Within the abdomen these veins united into two veins, which ascend on each side of the testicular artery, the right testicular vein opens into the inferior vena cava at an acute angle just inferior to the level of the renal veins, and the left testicular vein opens into the left renal vein at a right angle (*Standring et al., 2005*).

The testicular veins which form several highly anastomotic channels that surround the testicular artery (pampiniform plexus) allow countercurrent heat exchange, which cools the blood in the testicular artery (*Anderson et al., 2007*).

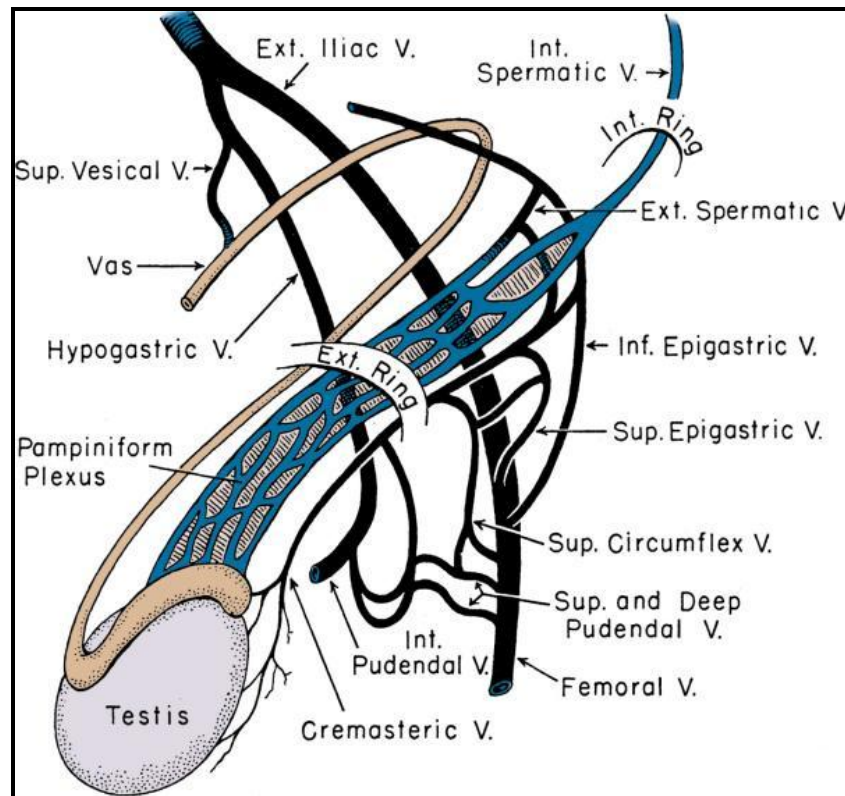


Fig. (2): Venous drainage of the testis and epididymis. Note connections between the pampiniform plexus and the saphenous, internal iliac and external iliac veins (*Anderson et al., 2007*).

Lymphatic drainage of the testis

Testicular vessels start in a superficial plexus under the tunica vaginalis, and a deep plexus in the substance of the testis and epididymis. Four to eight collecting trunks ascend in the spermatic cord and accompany the testicular vessels on psoas major, ending in the lateral aortic and pre- aortic nodes (*Standring et al., 2005*).

Nerve supply of the testis:

Visceral innervation to the testis and epididymis travels by two routes. A portion arises in the renal and aortic plexuses and travels with the gonadal vessels. Additional gonadal afferent and efferent nerves course from the pelvic plexus in association with the vas deferens (*Rauchenwald et al., 1995*).

Intractable orchialgia may respond to anesthesia of the pelvic plexus (*Zorn et al., 1994*).

Inter-inguinal, some afferent and efferent nerves cross over to the contralateral pelvic plexus (*Taguchi et al., 1999*).

This neural cross-communication may explain how pathologic processes in one testis (e.g., tumor or varicocele) may affect the function of the contralateral testis. The genital branch of the genitofemoral nerve supplies sensation to the parietal and visceral tunica vaginalis and the overlying scrotum (*Anderson et al., 2007*).

Descent of the testis:

The mechanism of testicular descent has been variously ascribed to shortening and active contraction

of the gubernaculum, increased intra-abdominal pressure (*Standring et al., 2005*).

The gubernaculum appears at the seventh week of embryologic development as a condensation of mesenchymal tissue within the subserous fascia on either side of the vertebral column that extends from the gonad to the fascia between the developing external and internal oblique muscles. This distal attachment has been shown experimentally to be important in normal development of the processus vaginalis (*Clarnette et al., 1996*).

Gubernaculum continues to grow until the seventh month, by which time its caudal part has filled the future inguinal canal and has begun to expand the developing scrotum. In this it also precedes the processus vaginalis. It stops growing in the last two months of gestation, and this, coupled with an accelerating rate of growth in the testis and epididymis, may be a factor in testicular descent (*Standring et al., 2005*).

