MALDESCENDED TESTIS

ESSAY

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BY

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" I always feel indebted to God who helps me "

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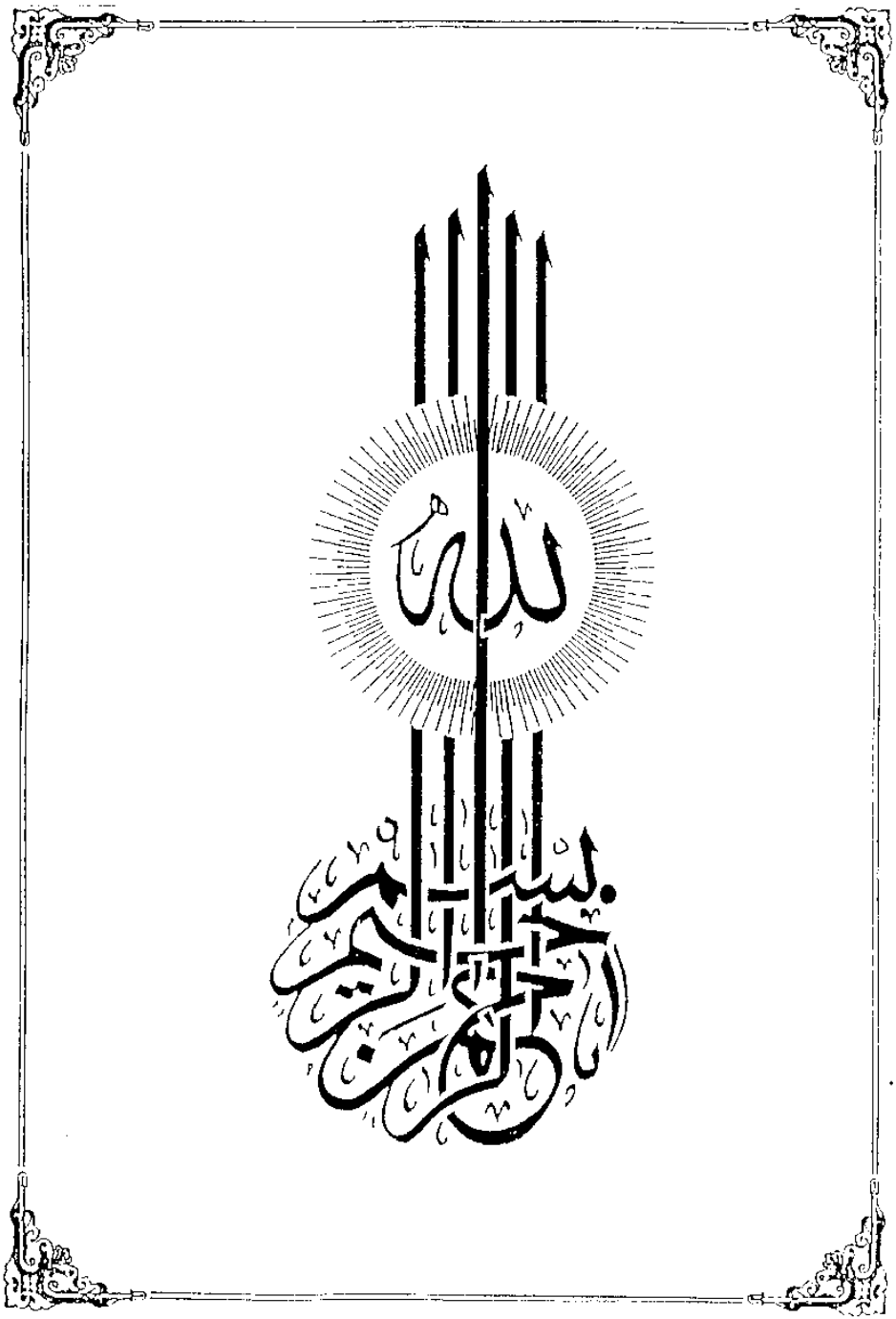

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INTRODUCTION

Cryptorchidism means a hidden testis. This occurs when the testis fails to descend into its normal post-natal anatomic location, the scrotum. Since the testis originally develops in the abdominal region, its descent may be inhibited anywhere along its normal pathway or it may be diverted from this route into an ectopic location (Rajfer, 1986).

This developmental anomaly represents one of the most common disorders of childhood. It affects all races, and there does not seem to be a geographic propensity.

The incidence of cryptorchidism has been reported to be 3.4% at birth in full term boys, 30.3% in premature infants, 0.8% at one year age and 0.9% in adulthood. Undescended testis is more common on the right side. In 10% of patients with cryptorchidism the defect is bilateral , and in 3% one or both testes are absent. There also appear to be a familial incidence in certain patient with cryptorchidism (Frey and Rajfer, 1982).

Undescended testes include two main groups: retractile or truly maldescended. The latter group can be further redefined as obstructed, functionally dystopic, or ectopic. The functionally dystopic division includes high scrotal, canalicular (emergent), or abdominal (Scorer and Farrington, 1971).

The descent of the testis into the scrotum normally occurs rather rapidly in the 8th month of intrauterine life and the final stages of descent often take place in the first few months after birth and that descent after infancy is uncommon. Even when it does occurs, the testis will suffer degenerative changes proportional to the delay (Moffat, 1982).

If a testis is not fully descended by the age of one year, it is unlikely to descend fully without assistance (Scorer and Farrington, 1979).

Normal testicular descent depends upon several factors and either one or more of them may be operative in any particular case (Witherington, 1984).

The complications of maldescended testis include neoplasia, subfertility, torsion, trauma and the psychological effects on the patient. It is important to know the age at which active treatment should be undertaken to avoid complications.

The treatment of maldescended testicle is either hormonal or surgical. The hormonal treatment is in the form of administration of human chorionic gonadotropin (HCG) or gonadotropin releasing hormone (Gn-RH, LH-RH), but the basic therapy for the majority of maldescended testis is orchiopexy (Witherington, 1984).

AIM OF THE ESSAY

The objective of this essay is to review the literature dealing with maldescended testis, with the purpose of a better understanding of such anomaly. To achieve this goal, the following parts will be included:

- Embryology, Anatomy and Physiology of the Testis.

- Pathogenesis and Pathology of Maldescended Testis.

- Diagnosis of Maldescended Testis.

- Complications of Maldescended Testis.

- Treatment of Maldescended Testis.

- Evaluation.

EMBRYOLOGY

DEVELOPMENT OF THE TESTIS AND ITS DUCTS

The urogenital system develps from a number of different embryonic tissues that are at first widely separated. During the process of development their relative positions change considerably and the junctional regions between the various components undergo much modification.

Early Develompent

The urinary and genital systems develop mainly from a longitudinal ridge of mesoderm that extends downwards from the region of cervical somites to the caudal end of the embryonic coelomic cavity. This is known as the nephrogenic ridge or cord and it lies in the dorsal body wall, on either side of the root of mesentry which, at this stage, is attached along the midline of the embryo. The nephrogenic ridge gives rise to the gonad and to three generations of excretory organs, namely the pro-, meso-, and metanephros.

The pronephros is non functional in human embryo, consisting only of a few rudimentary tubules at the cranial end of the nephrogenic ridge. These open into a longitudinal pronephric duct that runs down the lateral side of the nephrogenic rdige before turning medially to open into the cloaca.

Thr pronephric tubules disappear completely within two

weeks of their appearance although certain mediastinal cysts are said to be derived from their remnants. The pronephric duct, however, is not wasted but is taken over by a later, more caudally placed series of tubules that form the mesonephros, and the duct is known as mesonephric (or Wolffian duct.

The mesonephros forms a longitudinal ridge projecting into the coelomic cavity. The two mesonephroi lie on either side of the root of the mesentry. On the medial side of the mesonephros, the gonad is represented by an elongated mesodermal swelling connected to the mesonephros by a thick mesentery. When the mesonephros is fully developed and at its largest, the most cranial mesonephric tubules are already degenerating. The main mass of tubules are mature and functioning and the most caudal tubules are still in the process of differentiation. The mesonephros functions as an excretory organ in the embryo. Near the lower end of the mesonephric duct a small outgrowth from the duct grows dorsally and then cranially to meet the lowermost part of the nephrogenic ridge forming the ureteric bud.

Metanephros consists of two components, the ureteric bud that forms the collecting ducts and the metanephrogenic cup which form the nephrons themselves (Moffat, 1982).

The Paramesonephric Duct (Mullerain Duct)

The paramesonephric duct (Mullerian duct) develops

lateral to the mesonephric duct, it forms the uterus, the uterine tubes and part of the vagina in female.

Determination of Sex

The gonad, lying on the medial side of the nephrogenic ridge, is of histologically undetermined sex until the embryo reaches a crown-rump length of about 7 mm. The sex has, however, been determined at the time of fusion of the gametes, the presence of a Y-chromosome indicating maleness (chromosomal sex).

Recently it has become apparent that this is not invariably true and research in the last decade has suggested that the differentiation of the indifferent gonad into a testis is probably dependent upon the presence of a weak antigen that was already known to cause rejection of skin graft from male to female in certain strains of mice. This is known as the H-Y antigen (Histoincompatibility focus on the Y-chromosome). The presence of this antigen is usually associated with the presence of a Y-chromosome. The presence of H-Y antigen apparently leads to the transformation of the neutral gland into testis. With this establishment of gonadal sex, the production of testosterone and Mullerian inhibiting hormone begins when the Leydig and Sertoli cells commence their activity. This occurs at about the 8th week, independently of pituitary gonadotropins.

It has been shown that gonadal differentiation and the

develoment of external genitalia can take place in the absence of the pituitary, which only takes over between the 8th and 12th weeks. The production of male sex hormones then leads to establishment of somatic sex and the development of male genitalia (Moffat, 1982).

Development of the testis and its ducts

In the early stages of differentiation of the gonads, specialized cells which are larger than the ordinary mesenchymal cells of the gonad appear. These are the primordial germ cells which will eventually give rise to the ova or spermatozoa. These cells originate from the endoderm in the region of the yolk sac and reach the gonads by migration. The germ cells have pseudopodia and show amoeboid movement, which perhaps suggests the method of their migration. In the testis, the mass of cells splits up into gonadal cords by fibrous tissue septa which are continuous with a thick fibrous tunica albuginea. The cords contain the premordial germ cells and they become canalized to form the seminiferous tubules.

The seminiferous tubules are continuous with a rete testis which, in turn, joins up with a number of mesonephric tubules which have lost their glomeruli. In this way, the rete testis communicates with the mesonephric duct; the mesonephric tubules will become the vasa (ductuli) efferntia. The duct itself then lengthens and that part of it immediatelyadjacent to the vasa efferntia becomes elongated and tightly coiled to form the epididymis. Some of the remaining

mesonephric tubules persist to form the ductuli aberrant and paradidymis while the cranial end of the duct itself becomes the appendix of the epididymis (Moffat, 1982).

The main part of mesonephric duct develops a thickened muscle wall and becomes the vas (ductus) deferens which, owing to the changes that have already been outlined, comes to open into the prostatic urethera. Its terminal part becomes dilated to form ampulla and the seminal vescile develops as an outgrowth from this.

The Mullerian duct degenerates and its cranial part forms the appendix testis and the lower end which may contribute to the prostatic utricle (Moffat, 1982).

Descent of the Testis

A band of mesoderm extends from the lower pole of the testis to the abdominal wall in the future inguinal region and in this the gubernaculum develops. It projects into the coelomic cavity so that it forms a well defined ridge that eventually has a mesentery " the plica gubernaculi ". The gubernaculum is a thick cord of mesenchyme, of roughly the same diameter as the testis, in which the lower pole of the testis and the tail of the epididymis are embedded. It extends down the posterior abdominal wall through the region of future inguinal canal and into the genital swellings. The histological structure of the gubernaculum is that of loose mesenchyme i.e. numerous stellate cells are embedded in a copious matrix, rich in acid mucopolysaccharides particularly hyaluronic

acid, and not unlike Wharton's jelly in appearance. The whole mass forms a finger-like process with the testis and epididymis embedded in its upper third and its lower end tapering off in the substance of genital swelling. It is thus a much shorter structure than is generally supposed, and the descent of the testis is only through a very short distance and that even in the earliest stages of descent the testis is never very far from the deep inguinal ring. Most of the intra-abdominal descent is, in fact, relative, and caused by straightening out of the lumbar spine and growth of the posterior abdominal wall. Since the gubernaculum does not increase in length, the posterior abdominal wall grows upwards away from the testis. The testicular vessels, nerves, and lymphatics thus increase considerably in length even though the testis remains more or less in situ (Moffat, 1982).

The initial phase of testicular descent is known as trans-abdominal migration and this is produced by the differential growth of the fœtus rather than true gonadal migration. The distance travelled by the testis during this stage is only several millimeters (Rajfer and Walsh, 1978).

The mesenchyme of the gubernaculum is invaded by a blind-ended diverticulum of peritoneum from the lining of coelomic cavity. This is the processus vaginalis and it covers the front and sides of the testis and the gubernaculum so that the plica gubernaculi now extends down into the future scrotum. In the outermost layers of the gubernaculum

the mesenchymal cells differentiate into skeletal muscle to form the cremasteric muscle and into connective tissue to form the external and internal spermatic fasciae.

Before the final stage of the testicular descent, the jelly-like tissue of the gubernaculum expands to dilate the pathway along which the testis will travel, the lower end, in particular, expanding to form the gubernacular bulb in the scrotal region. The gubernaculum is not, however, attached to the scrotum, since a separation zone appears between the two so that the bulb at the distal end lies free in the scrotum.

The epididymis and gubernaculum move down together at first and then the gubernaculum becomes both actually and relatively shorter as the testis descends. The process takes place over a relatively short period during the 7th or 8th month of fœtal life. When the testis is fully descended, the processus vaginalis becomes closed off from the general peritoneal cavity to form the tunica vaginalis, which still encloses the testis and epididymis on the front and sides. As soon as the testis is fully descended the dilated inguinal canal closes down so that the testis can not re-enter the abdomen.

The role of the gubernaculum is still uncertain inspite of all anatomical studies that have been carried out. It appears to be unlikely that it actually pulls the testis down since it has been shown experimentally that testis