THE IMPACT OF PREOPERATIVE LOCALIZATION OF UNDESCENDED TESTIS ON THE CHOICE OF THE SURGICAL APPROACHES

M.D. THESIS

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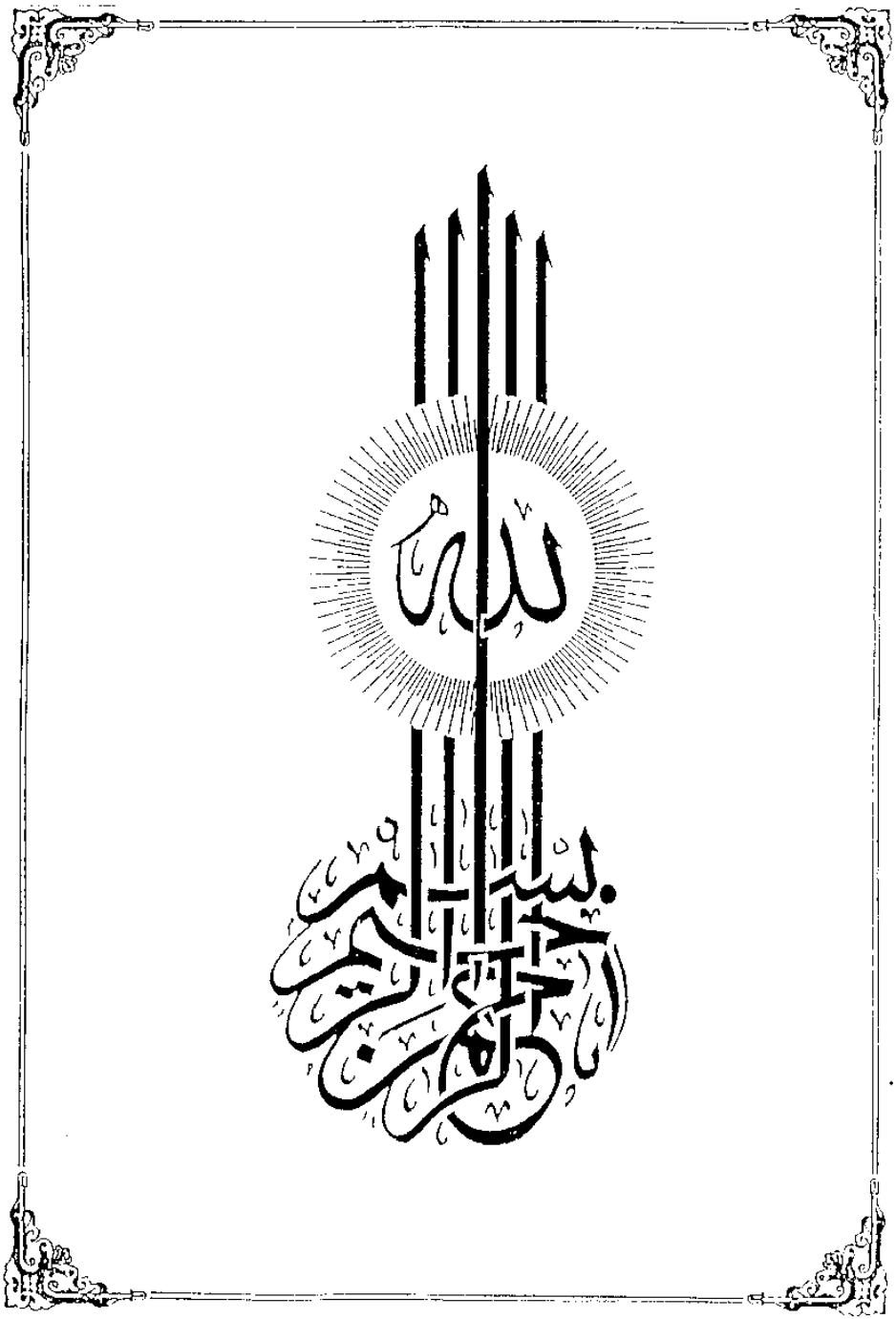
صدق الله العظیم



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C O N T E N T S

REVIEW OF LITERATURE

CRYPTORCHIDISM
EMBRYOLOGY

In early embryonic development of man the segmental mesonephros produces a long ridge on the posterior abdominal wall from the lower cervical down to the lumbar region . The mesonephric duct passes down along its border, in the posterior wall mesenchyme to the allantois. The urogenital ridge arises by the fourth gestational week as an invagination of the posterior wall of the coelomic cavity after degeneration of the pronephros. It extends from the lower cervical to the lumbar region . The urogenital ridge divides into the genital fold medially and into the mesonephric fold laterally by the sixth gestational week, and the primordial germ cells have migrated from the wall of the embryonic yolk sac along the dorsal mesentry of the hind gut to invade the genital ridges, this is appeared as a multilayered strip of epithelium covers the genital fold laterally and represents the gonadal precursor , extending caudad from the diaphragm (Witschi 1948) (Arey 1965).

By the seven weeks of gestation , under the influence of the H-Y antigen that is secreted from the XY primordial germ cells , the indifferent gonad differentiates into the fetal testis (Wachtel 1975) (Ohno 1979).

By the tenth gestational week , the caudal end of the enlarging gonad has developed a mesorchium and lies at the boundry between the abdomen and pelvis. Two ligaments on each side of the

urogenital analge can be encountered as a continuation of the mesonephros : cranially, the diaphragmatic ligament and caudally, the gubernaculum . Cranially the gubernaculum onto the wolffian duct, and caudally, it extends into inguinal canal (Hadziselimovic 1983).

Around 14 weeks, important changes occur within the mesonephros. Its upper part is still in continuation with the dorsal abdominal wall over a thread-like elongated diaphragmatic ligament . The cranial portion of the epididymis start to develop. The coiling of the wolffian duct clearly recognisible at this stage of development (Hadziselimovic 1983).

At 17 weeks the position of the gonads is deep within the inguinal ring and the transabdominal movement of the testis is terminated . With disappearance of the diaphragmatic ligament , the elevation of the long diameter of the testis into vertical axis has occured . Three portion of the epididymis are recognizable at this time: the caput , the cauda , and the corpus epididymis. The epididymis now completely surrounds the testis (Hadziselimovic 1983).

Because the body trunk elongates chephalad more rapidly than the the slower-growing genital fold, there is a gradual caudal shift of the maturing gonadal tissue until it lies approximately ten segments below its level of origin (Arey 1940) .

The embryonic development of the testis may be divided into

three phases : intra-abdominal (1-7 months), canalicular (7-8 months), and scrotal (8-9 months). As the anterior abdominal wall develops , the gonad becomes attached at the site of the future inguinal canal by fibers of developing corda gubernaculum (gelatinous cord filled with hyaluronic acid) which is first appears during the fifth week of gestation as a ridge of mesenchymal tissue extending from the genital ridge through a gap in the anterior abdominal wall musculature to the genital swellings, which is the site of the future scrotum **(Burton 1958) (Backhouse 1964).**

The contractile nonstriated muscle fibers , and perhaps other components of the gubernaculum, are believed to cause the testis to migrate through the inguinal canal by the seventh fetal months. the gubernaculum is attached superiorly to the proximal tip of the vas deferens and is believed to divide distally into several tails extending to the dartos muscle in the scrotum, Colles's fascia in the perineum, the pubic tubercle, and crest, the inguinal ligament , and the facia latain the femoral triangle **(Lemeh 1925).**

Although the testis normally follows the course of the of the scrotal extention , occasionally it may follow on of the gubernacular tails to an ectopic location in the perineal, suprapubic , or femoral areas. The descent of the testis is attributed to the three combined factors of intra-abdominal pressure, intramuscular pressure due to the contraction of the muscles draped around the canal and the guidance of the gubernaculum **(Sonneland 1925).**

At the third month of gestation during the descent of the testis into the scrotum , it carries with an extention of the peritoneal cavity , the processus vaginalis. Later, the testis becomes covered by a reflected fold of the processus, although it lies entirely outside the peritoneal cavity. **(Snyder 1959) (Kiesewetter et al., 1969).**

At the seventh month of gestation , just prior to actual descent of the testis , rapid alterations occur simultaneously in the form of enlargement of the testis and spermatic cord and the vessels of the cord lengthen and become tortous, and the gubernaculum begins to swell as well as rapid extention of the processus vaginalis into the scrotum, increasing the mobility of the testis **(Backhouse 1960) (Backhouse 1964).**

As the scrotum and the inguinal canal become stretched by the developing gubernaculum , the gonad sits on top of the gubernaculum slips very rapidly through the inguinal canal into the scrotum. **(Wyndham 1943)(Backhouse 1981)**

The left testis is believed slightly to precede the right in its descent , which possibly accounts for the fact that unilateral undescent is more frequent on the right . The testis and gubernaculum are covered by the peritoneum before the descent begins along the inguinal canal, dorsal to the peritoneal cavity. **(Backhouse 1960)**

After development of the testes, ductal system and external genitalia , the testis lies on a conically shaped gubernaculum waiting for descent to occur and the testis, now is assumed an intra-abdominal position behind the internal inguinal ring . In reality, the testis is never more than 1.3 mm from the internal inguinal ring at any time during its development **(Wyndham 1943) (Backhouse 1981)**

MECHANISMS OF TESTICULAR DESCENT :

Epididymotesticular descent occurs only within the mammalian species. From comparative anatomical studies, it appears that the epididymotesticular descent into scrotum, and thus scrotal formation in general, has been influenced primarily by necessity of migration of the cauda epididymis to this region **(Bedford 1978).**

Various theories have been popularized to explain the exact mechanism by which the testis moves from the abdomen into the scrotum . The growth process theory was initially popularized by Cleland 1856 , who concluded that the descent of the testis was independent of mechanical forces. He attributed the process of testicular descent to complementary processes : atrophy of the gubernaculum and elongation of the processus vaginalis , which somehow carried the testis from the abdomen to the scrotum . The dfifferential growth theory adhers the concept that as the body wall grows , the testis is kept in proximity to the internal inguinal ring. It is then pulled

into scrotum by the relatively immobile gubernaculum as a result of rapid growth of body wall during last trimister of pregnancy . However, it has been demonstrated that the gubernaculum actually increases in size prior to descent and that it actually grows faster than the body whole , therby casting doubt on the validity of this theory. **(McMurrich 1923) (Hunter 1927) (Lemeh 1960).**

The traction theory adhers to the concepts that the cremasteric muscle or meandering-shaped gubernaculum, lead to traction to the testis during testicular descent. Support for this traction theory comes from the observation that severance of the genitofemoral nerve , which innervates the gubernaculum prevents testicular descent in rodents **(Tayakkononta 1963)**

However, in human fetus there is only weak attachment between the gubernaculum and the scrotum and this is probably insufficient to support any traction on the testis. Regarding the cremaster muscle, it is well established that the sole function of this muscle is to retract the testis; consequently , traction of the testis into the scrotum by cremaster muscle is unlikely **(Wyndham 1943) (Tayakkononta 1963) (Bergh et al., 1978).**

But on the other hand , the gubernacular configuration should create a downward force on testes and epididymis , causing descent into scrotum . This event is under control of Dihyrotestosterone (DHT) **(Rajfer and Walsh 1977) (Elder et al., 1981) (Rajfer 1981).**

Serious endovers were made to explain that the development of the processus vaginalis and growth of cremastric muscle under androgen influence were responsible for epididymotesticular descent. The processus vaginalis , according to this hypothesis , must be adequately developed as a prerequisite for testicular descent. However from clinical and experimental points of view, it appears uncommon to find deficiency in the growth of the processus vaginalis as the only feature of cryptorchid state unless there is a mechanical barrier to their development (Backhouse 1981).

Wensing 1973, described the gubernacular swelling as being a motor of testicular descent, and recently a " water trap " theory was created to explain downward movement of epididymotesticular unit. According to this hypothesis, the marked swelling of the gubernaculum which dialates the inguinal canal and scrotum, and as a result of this gubernacular configuration , it may passively exert traction on the testis by the force of its expansion, which is due largely to an accumulation of water within the gubernaculum. This process is under control of of Dihyrotestosterone (DHT) and is mediated by intracellular glycosaminoglycans. Whereas the swelling of gubernaculum, which actively should take the testis down. (Rajfer and Walsh 1977) (Elder et al., 1981) (Rajfer 1981) (Heynes and DeKlerk, 1985)

There is a good experimental evidence to suggest that the epidydimal theory of testicular descent , which is based on normal attachment of the epididymis to the testis and assumption that

differentiation and maturation of the epididymis induces testicular descent . However, this theory may not be as important initially thought (Hadziselimovic 1981) (Frey and Rajfer ,1982).

The hypothesis , of the role of increased intra-abdominal pressure states that the increased intra-abdominal pressure is the primary force responsible for testicular descent which was supported recently, Elder et al., 1981 and Frey et al., 1983, who presented an evidence in the rabbit and rat , respectively to support the theory of abdominal pressure. (Gier and Marion 1969) (frey et al., 1983) (Weil 1984)

There are anatomic or mechanical factors for limitations of testicular descent , which could include , peritoneal adhesions, a tight inguinal canal or annulus , a short spermatic artery, an insufficient gubernaculum , or even functional problems such as gubernaculum malfunction or cremasteric muscle hypertrophy . The vas deferense is rarely , if ever shortened . Undescended testes are commonly associated with gastrochisis , omphalocele, extrophy of the bladder , and splenogonadal fusion and peritoneal adhesions from meconium peritonitis (Given and Guiney 1978) (Mengel 1981) (Ellis 1983).

In other cases , an undescended testis may result from a structural abnormality , for example, in prune belly (Eagle-Barrett) syndrome , patient characteristically have hypoplastic or absent abdominal musculature, massive hydroureteronephrosis with vesicoureteral reflux , a large

bladder, prostatic hypoplasia, an absent gubernaculum and inguinal canal , and high bilaterally undescended testes. In these patients , the testes fail to descend because the gubernaculum is absent or because of inadequate intra-abdominal pressure **(DeKlerk and Scott 1978).**

Hormonal influence on testicular descent :

Cryptorchidism is a syndrome that may be caused by malformation or anatomic or hormonal factors. A limited number of patients 10-15%, have major anatomic defects that are obviousy responsible for cryptorchidism , such as an ectopic gubernaculum or exteriorized inguinal hernia. Most other patients, have only minor abnormalities such as shortness of the spermatic cord or persistence of the peritoneo-vaginal channel , which can hardly be considered the primary cause of testicular maldescent , so that any other primary defect could be speculated. In fact , endocrinologic studies have often demonstrated the heterogenicity of hormonal data in cryptorchidism. **(Battin and Colle 1977) (Bierich and Giarola 1979)**

As early as 1931 , **Shapiro** questioned the effects and opportunity of hormonal treatment with chrionic gonadotropin , but the technique available for endocrine investigation did not succeed in demonstrationg hormonal abnormalities in cryptorchid children and adults, either treated or untreated, until 1970's .

The development of highly and sensitive and accurate methods