



AN ANATOMICAL STUDY OF DESCENT OF THE TESTIS – A SHORT REVIEW.

Anatomy

Dr. Shubhangi Yadav

Senior resident, Department of Anatomy, Institute Of Medical Sciences, BanarasHindu University, Varanasi, Uttar Pradesh – 221005

ABSTRACT

The testes are the primary reproductive organs or gonads in the male. They are ovoid in form and functions both as a reproductive and endocrine organs responsible for sperm and testosterone production. They are suspended in the Scrotum by scrotal tissues including the dartos muscle and spermatic cords.

In the early fetal period the testes are located posteriorly in the abdominal cavity. Their descent to the scrotum is not merely a simple migration. The mechanism of the descent of the testis has differently been described by different investigators, to shortening and active contraction of the gubernaculum, to increased intra-abdominal pressure, to a simple growth process and to the effect on the convex surface of the gland of the active contraction of the lower fibres of the internal oblique muscle, squeezing it through the canal.

In view of the persisting confusion, it was decided to review the previous studies regarding mechanism of the descent of the testis.

KEYWORDS

Undescended testis, Cryptorchidism, Gubernaculum

INTRODUCTION

The testes are the primary reproductive organs or gonads in the male. They are ovoid in form and functions both as a reproductive and endocrine organs responsible for sperm and testosterone production. They are suspended in the Scrotum by scrotal tissues including the dartos muscle and spermatic cords. Average testicular dimensions are 4-5 cm in length, 2.5 cm in breadth and 3 cm in anteroposterior diameter. Their weight ranges from 10.5 – 14 gms.

Developmentally gonads appear as a pair of longitudinal ridges, the genital ridges. They are formed by proliferation of the coelomic mesothelium. Primordial germ cells originate in the epiblast. During the 4th week, they migrate along the dorsal mesentery of the hindgut, reaching the primitive gonads, and invading the genital ridges in the sixth week. If the embryo is genetically male, the primordial germ cells carry XY sex chromosome.

Towards the end of the 2nd month, the urogenital mesentery attaches the testis and mesonephros to the posterior abdominal wall. With degeneration of the mesonephros the attachment serves as a mesentery for the gonad. Extending from the caudal pole of the testis is a mesenchymal condensation rich in extracellular matrices, the gubernaculum.

In the early fetal period the testes are located posteriorly in the abdominal cavity. Factors controlling descent of the testis in to scrotum are not entirely clear. However, the following factors may be conjointly responsible:

1. Gubernaculum testis: It is the guiding force for the descent. In the last two months the descent is accelerated, because the gubernaculum loses its hyaluronic acid, the cremaster muscle develops and the processus vaginalis is elongated. The cremaster muscle causes rhythmic contraction of the gubernaculum.
2. Increased intra-abdominal pressure.
3. Intra-abdominal temperature: Normal spermatogenesis takes place at a temperature 30C lower than the abdomen, which is available in the scrotum.
4. Contraction of the arched fibres of the internal oblique muscle.
5. Uncurling of the foetal curves.
6. Secretion of testicular hormone by the interstitial cells of fetal testis is probably the most important driving force for the descent.

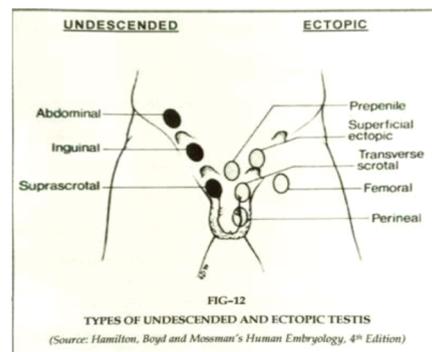
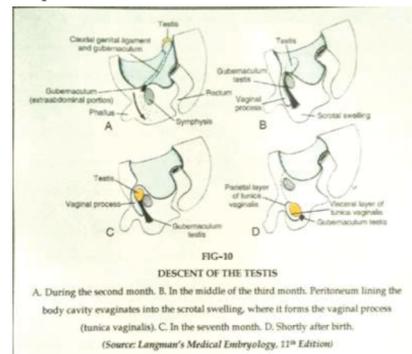
The testis descends-

- 1) In 3rd month of intrauterine life from loin to iliac fossa.
- 2) From 4th to 7th month it rests at the site of deep inguinal ring.
- 3) During 7th month travels through the inguinal canal.
- 4) In the 8th month lies at the superficial inguinal ring.
- 5) In the 9th month enters the scrotum.

Testicular descent may be arrested at any point along its route into the scrotum: a clinically undescended testis (Cryptorchidism) may be in the abdomen, at the deep inguinal ring, in the inguinal canal, or between the superficial inguinal ring and the scrotum. Occasionally, the testis may lie outside its normal path of descent and is termed an

ectopic testis. A unilateral undescended testis is present in 3% of boys at birth and 1% of boys by 3 months of age. Bilateral maldescent is seen in just over 1% of male births. Undescended testes can be associated with a higher risk of infertility and testicular tumours. There is evidence that surgical correction of an undescended testis at any age may not improve its spermatogenesis.

In view of the persisting confusion, it was decided to review the previous studies regarding mechanism of the descent of the testis. The aim of the study was to study the anatomical variations of the position of the testes in perinates.



REVIEW LITERATURE

John Hunter (1762) – an English anatomist, was the first to publish a detailed description of the gubernaculum.

Over the past two centuries a number of conflicting theories have been proposed to explain the mechanism of testicular descent.

Theories of Propulsion:

Hutson et al. (1997) have suggested that the patent processus vaginalis

probably works along with intra-abdominal pressure which is transmitted to the testes during transvaginal migration.

Theories of Traction:

Hadziselimovic (1983): observed that peristaltic and secretory activity in the epididymis changes its centre of gravitation, causing descent of the epididymis, carrying testes with it.

Growth theories:

Heyns et al. (1990) stated that the dilatation of the inguinal canal and scrotum through the uptake of water by hyaluronic acid in the extracellular substance of the gubernaculum is another factor responsible for descent.

Theory of involution:

Rajfer and Walsh (1977) represented that atrophy, degeneration or shrinking of the gubernaculum brings about testicular descent. However, Wells (1943) proposed that the gubernaculum is not at all required for descent.

Hormonal factors:

Frey and Rajfer (1984) represented experimentally that in the presence of androgen, a silicon prosthesis will descend from the abdominal cavity in to the scrotum but such descent occurs rarely when androgen is removed. So androgens play a pivotal role along with abdominal pressure in the descent of the testis in to the scrotum.

Toppari and Kaleva (1999)., Main et al. (2009) proposed that Androgens under control of an intact hypothalamo-pituitary gonadal axis changes the microelastic properties of the gubernaculum and decrease in the turgidity of it allow intra-abdominal pressure to push the testicle in to the scrotum. C.L.Acerini (2008) added some other factors like anti-mullerian hormone and members of HOX gene family responsible for the descent.

The conflicting observations of various investigators seem to revolve around three issues:

1. The cranial and caudal attachments of the gubernaculum.
2. The type of cell forming its active constituents.
3. The changes that take place in the gubernaculum and its surrounding structures during testicular descent.

Attachments of gubernaculum:

Lockwood (1888) presented multiple distal attachments of the gubernaculum to the saphenous area, pubis, root of the penis, scrotum and perineum.

Rajfer (1986) supported Lockwood's theory and added another branch of the gubernaculum to the opposite scrotal compartment.

Active constituents of the gubernaculum:

Gubernaculum is a condensation of mesenchymal tissue appearing at the 7th week of embryonic development within the subserous fascia on either side of the vertebral column extending from the gonad to the fascia between the developing external and internal oblique muscles proposed by Clarnette et al. (1996).

Changes in the gubernaculum and its surrounding structures:

Tickle (2003) observed that primitive mammary line has homology with the apical ectodermal ridges of the limb buds, and hence it is likely to contain similar activated signaling systems as seen in limb bud development. These signals certainly initiate outgrowth of gubernaculum from the abdominal wall, so it can migrate to the scrotum.

Hutson and Hasthorpe (2005) proposed that testicular descent occurs in two steps – trans-abdominal mediated by mullerian inhibiting substance and inguino – scrotal mediated by androgen.

Conclusion

Undescended testis is the most common anomaly of the male genitalia. A child with cryptorchidism is susceptible to sterility as an adult and the aim of the therapy is to obtain a scrotal position of the testes at an early age to allow them to reach their maximum functional potential. Keeping this objective in mind the present study has been undertaken to review the various proposed mechanisms of the descent of the testes. As it is now clear from previous studies that descent of the testis occurs due to combined action of some factors as gubernaculum, intra-abdominal pressure, contraction of arched fibres of internal

oblique muscles and testicular hormones.

REFERENCES

1. Hunter J. (1762)., Observations on the state of the testes in the fetus and on the hernia congenital. In medical commentaries. Part 1..pp. 107-120.Ed W Hunter, London: A Hamilton for a Miller.
2. Hutson JM, Hasthorpe S, Heyns CF. (1997) Anatomical and functional aspects of testicular descent and cryptorchidism. Endocrine Reviews. 18, 259-280.
3. Hadziselimovic F. (1983). Embryology of testicular descent and maldescent. In Crptorchidism (ed. F.Hadziselimovic), pp.11-34.Berlin,Heidelberg, New York: Springer-Verlag.
4. Heyns CF, Human HJ, Werely CJ., (1990) .The glycosaminoglycans of the gubernaculum during testicular descent in the fetus. Journal of Urology 143: 612-617.
5. Rajfer J and Walsh PC., (1977). Testicular descent. Birth defects: Original Article series 13, 107-122.
6. Wells LJ., (1943). Descent of the testis: Anatomical and Hormonal considerations. Surgery 14, 436-472.
7. Frey HL and Rajfer J.(1984): Role of the gubernaculum and intra-abdominal pressure in the process of testicular descent. Journal of Urology., 131: 574-579.
8. Toppari J and Kaleva M.(1999) Maldescendus testes. Horm Res; 51 (6): 261-269.
9. Main KM, Shakkeback NE, Toppari J.(2009). Cryptorchidism as part of the testicular dysgenesis syndrome: The environmental connection. Endocr Dev; 14, 167-73
10. Lockwood CB.(1888) .Development and transition of the testis, normal and abnormal. Journal of Anatomy and Physiology 22, 505-541.
11. Rajfer J.(1986). Congenital anomalies of the testis. In Campbell's Urology. Pp. 1947-1968. Philadelphia: W.B Saunders.
12. Clarnette TD, Hutson JM (1996). The genitofemoral nerve may link testicular inguino-scrotal descent with congenital inguinal hernia.
13. Tickle E (2003) Patterning systems from one end of the limb to the other. Dev Cell; 4(4): 449-58.
14. Hutson JM and Hasthorpe S (2005) Testicular descent and cryptorchidism: the state of the art in 2004. Journal of paediatric Surgery 40, 97-302.