SPERMATIC CORD, SCROTUM, AND TESTES

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SUGGESTED READING


*Head to Toe Questions in Gross Anatomy:* Continue questions #607-756.

OBJECTIVE

This lecture is designed to reinforce the gross anatomy of the inguinal region, to explain descent of the testes and relate this process to the coverings of the spermatic cord, to explain the anatomy of the scrotum and testes, and to present the pathological anatomy associated with inguinal hernias.

LECTURE OUTLINE

I. Descent of testes (Grant’s Atlas: 12th Ed. Fig. 2.13, page 114)
   
   A. The testes do not develop in their definitive positions within the scrotum.
      
      1. Their development begins on the posterior wall of the coelom in the upper lumbar region.
         
         a. Their stroma develops from mesodermal ridges which overlap the medial parts of the mesonephros.
         
         b. Their germinal cells come from the overlying peritoneum and form the epithelial components (*seminiferous tubules*) of the testes.
         
         c. Connections with the adjacent mesonephros form the ducts of the testis and epididymis.
         
         d. The mesonephric duct forms the ductus deferens.

      2. Descent of the testis is governed by the *gubernaculum testis*.
         
         a. The gubernaculum is a retroperitoneal band of mesoderm, which is attached both to the retroperitoneal testis and the skin of the scrotum.
         
         b. The gubernaculum, while always retroperitoneal, penetrates the abdominal wall muscles and fascia in order to attach to the scrotum.
         
         c. For reasons not well understood, there is a relative shortening of the gubernaculum, causing the retroperitoneal testis as well as the peritoneum in front of it to be pulled down into the scrotum.
d. The scrotal outpouching of peritoneum, connected to the main peritoneal cavity, is named the *processus vaginalis*.

**Testis descends behind** the Processus Vaginalis

![Diagram of testis descending behind the Processus Vaginalis](image)

From: A Textbook of Human Anatomy, Roger C. Crafts, 1st Ed.

**e.** As the testis descends, it drags along from the lumbar region lymphatic vessels, sympathetic and afferent nerves, the testicular artery, and the testicular vein.

**f.** Descent from the lumbar region begins during the second month and is completed during the eighth month.

**g.** In females, the ovaries also descend, but only as far as the pelvic region.

1. Inferior to the ovary, the female gubernaculum persists as the round ligament of the ovary, which attaches the ovary to the uterus.

2. Inferior to the uterus, the gubernaculum continues as the round ligament of the uterus, which traverses the inguinal canal.

3. After passing through the inguinal canals, both round ligaments of the uterus attach to the subcutaneous fascia of the labia majora, which are homologous to the scrotum.

**3.** The processus vaginalis becomes invaginated by the testis, which after pushing forward is covered, except posteriorly, by two layers of this mesothelium, named the tunica vaginalis.
a. The mesothelial layer in direct contact with the capsule (or tunica albuginea) of the testis is named the visceral layer of the tunica vaginalis.

b. The mesothelial layer oriented toward the scrotum is named the parietal layer of the tunica vaginalis.

c. Because the invagination process can be thought of as a "fist pushed into an inflated balloon", one can understand that the two layers are continuous with one another and are separated by a narrow closed space, representing a remnant of the peritoneal cavity.

d. At the end of the 8th month, the processus vaginalis normally pinches off, separating the cavity of the tunica vaginalis from the main peritoneal cavity.

B. The spermatic cord has three tunics, which are derived from layers of the abdominal wall as the testis penetrates them during its descent.

1. The internal spermatic fascia begins at the deep inguinal ring and represents a continuation of the transversalis fascia.

2. The middle spermatic fascia begins half-way down the inguinal canal, where fibers from the internal abdominal oblique muscle invest the cord as the cremaster muscle.

   a. This layer of skeletal muscle and fascia is also known as the cremasteric layer.

   b. The fibers of the cremaster muscle run parallel to the spermatic cord, and contraction of this muscle elevates the testis.

   c. The cremaster muscle is innervated by the genitofemoral nerve, derived from ventral rami L1 and L2.

3. The external spermatic fascia is derived from the external oblique aponeurosis, and consequently begins at the margins of the superficial inguinal ring.

II. Scrotum

A. The scrotum is a pendulous sac that hangs down from the perineal region posterior to the penis.

1. The scrotum consists of skin and the dartos tunic.
a. The dartos tunic is a continuation of Scarpa's membraneous layer of abdominal subcutaneous fascia, which elsewhere in the perineal region is named Colles' fascia.

b. Because Camper's fatty layer of abdominal subcutaneous fascia does not continue into the scrotum (or onto the penis), there are no subcutaneous fat deposits in the scrotum (or on the penis).

c. The dartos tunic contains abundant smooth muscle fibers, which contract in response to cold, thereby contracting the scrotal sac and bringing the contained testes closer to the warmth of the body.

2. The dartos layer forms a septum, which divides the scrotum into two unconnected compartments.

B. Although the scrotum houses the testes, it is derived from skin, and therefore has cutaneous nerves and vessels.

1. Anteriorly, sensory innervation is provided by the ilioinguinal nerves and the genital branches of the genitofemoral nerves.

2. Posteriorly, sensory innervation is provided by the perineal branches of the posterior femoral cutaneous nerves and the scrotal branches of the perineal divisions of the pudendal nerves.

3. The dartos muscle is innervated by sympathetic fibers traveling with the sensory nerves.

4. The scrotal lymphatics drain into the superficial inguinal lymph nodes (unlike the lymphatics of the testes, which drain into lumbar lymph nodes).

III. Testes - produce sperm and male hormones

A. The testis is covered by the visceral layer of the tunica vaginalis, except posteriorly, where there is a bare area associated with vessels, nerves and ducts.

1. The capsule of the testis (tunica albuginea) is just deep to the visceral layer of the tunica vaginalis.

2. The tunica albuginea is very tough and unelastic. so that edema (swelling) of the testis (as would occur after a contusion) builds up extreme pressure within the capsule and causes severe pain.

3. The histological structure of the testis and epididymis will be covered during the Histology Course.
B. The epididymis, which lies along the posterior surface of the testis, connects the duct system of the testis to the ductus deferens.

1. The head of the epididymis, located at the superior pole of the testis, is connected to the testis by the efferent ducts within it.

2. The body of the epididymis lies along the posterior surface of the testis, between the head and tail, and contains the highly coiled tubule of the epididymis. The body is separated from the testis by a space, the sinus of the epididymis.

3. The tail of the epididymis, attached by connective tissue to the inferior pole of the testis, contains the junction of the epididymal tubule and the ductus deferens.

C. The ductus deferens conveys sperm from the epididymis, where they are stored, to the ejaculatory duct, which enters the prostatic urethra.

1. During orgasm, stored sperm enter the ductus deferens and are propelled by the contraction of its smooth muscle into the prostatic urethra.

2. In the prostatic urethra, sperm are mixed with fluid from the seminal vesicles, the prostate, and the bulbourethral glands, forming semen, the fluid in which the sperm become motile.

3. From the prostatic urethra the semen is propelled distally out of the urethra by rhythmic contraction of muscles to be discussed with the male perineum.

IV. Hernia - any protrusion of a viscus or other structure through an opening that it does not normally traverse. Hernias through the abdominal walls can occur in a number of locations.

A. Umbilical hernia - rare in the adult except after surgical incisions through the linea alba

B. Obturator hernia - rare

C. Lumbar hernia - rare

D. Diaphragmatic hernia - rare and usually congenital

E. Femoral hernia

1. More common in females than in males

2. Hernia passes through the femoral canal

3. The hernial sac, if palpable, is felt lateral to the pubic tubercle.
F. Inguinal hernia - the inguinal region is the most frequent location for hernias (ECA, pp. 136-137; Grant’s Atlas: 12th Ed. Fig. 2.14, page 115). There are two types of inguinal hernias:

1. **Indirect inguinal hernia** - the most common type of hernia, often associated with a patent (i.e. open) processus vaginalis
   
   a. The hernial sac (an outpouching of peritoneum filled with an abdominal viscus and/or fat) traverses the entire inguinal canal and often continues into the scrotum. (Review the walls of the inguinal canal.)
   
   b. The inferior epigastric vessels are found medial to the mouth of the hernial sac.

2. **Direct inguinal hernia** - usually a hernia of old age
   
   a. The hernial sac protrudes directly through the medial inguinal fossa (the location of Hesselbach's triangle) and then the superficial ring, producing a bulge in the skin (almost never extending into the scrotum).
   
   b. The inferior epigastric vessels are found lateral to the mouth of the hernial sac.

![Image of Inguinal Hernia Diagrams](From: Grant's Atlas of Anatomy)
V. Folds and fossae on the internal surface of the anterior abdominal wall and their relationships to hernias

A. Obliterated urachus (allantoic duct) - in the adult is named the median or middle umbilical ligament, which raises a fold of peritoneum named the median umbilical fold.

1. The supravesical fossae are just lateral to the median umbilical fold.

B. Obliterated umbilical artery - in the adult is named the medial umbilical ligament, which raises the medial umbilical fold. One fold lies on each side of the body.

1. The supravesical fossae are medial to the medial umbilical folds.

2. The medial inguinal fossae are lateral to the medial umbilical folds.

3. The medial inguinal fossa is the site through which a direct inguinal hernia would project.

C. Inferior epigastric blood vessels - raise a fold of peritoneum named the lateral umbilical fold. One fold lies on each side of the body.

1. The lateral inguinal fossae are lateral to the lateral umbilical folds.

2. Indirect inguinal hernias would project through the lateral inguinal fossa to enter the inguinal canal via the deep inguinal ring.
Lectures on Abdominal Walls and Spermatic Cord

Figures from Grant's Atlas of Anatomy (11th Ed.)

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