
Overview of the Female Reproductive System

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Introduction

This chapter presents the most relevant and up-to-date aspects of the female reproductive system. The items directly involved are not many in number, consisting of the ovary, fallopian tubes, uterus, vagina, external genitalia, and breasts (the breast will not be discussed here). However, the reproductive system is coordinated with many other systems in the whole body for proper functioning. Our focus will be narrowly on the structures and function of the items listed as directly part of the female reproductive system with minimal inclusion of other ancillary systems. We present the gross anatomy first, then move to his-

tological anatomy, and finish with physiology. A clear understanding of the female reproductive system necessitates understanding all three aspects. From a clinical aspect, we would also want to include biochemistry, pathophysiology, and pharmacology but many other excellent texts can be used if this broader picture is wanted.

Anatomy of the Female Reproductive System

The female genital system consists of internal organs (including ovaries, uterine tubes, uterus, and vagina—see Fig. 2.1a, b) and external organs (perineum and vulva—see Fig. 2.2).

This system is located deep within the pelvic cavity and consists essentially of two parts: a glandular body, the ovary, where the oocytes are formed and steroids synthesized, and an extended duct system, which successively takes on the names of uterine (fallopian) tube, uterus, and vagina. These tubes serve a dual purpose of providing a channel for ejaculated sperm to swim up into the peritoneal cavity and to bring either a fertilized or unfertilized egg down to the uterus and eventually out of the body at parturition or menses. The uterine tube is a simple duct that collects the oocyte on the ovarian surface and leads it to the uterus. The uterus is responsible for housing and feeding the fertilized egg during its development and, once it is mature, expelling the fetus

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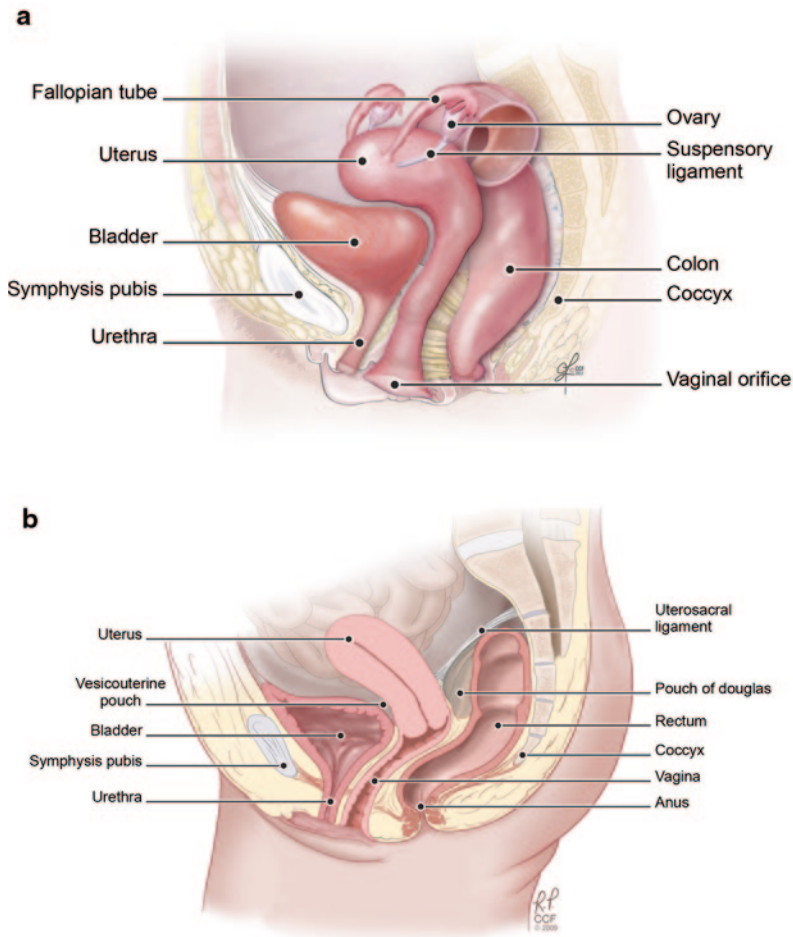


Fig. 2.1 a, b The female reproductive system: internal organs (*sagittal view*). (Reprinted with permission, Cleveland Clinic Center for Medical Art & Photography © 2008–2015. All Rights Reserved)

outside the female body. The vagina gives way to the fetus and placenta during labor, but is also an organ of copulation, which receives the penis and semen during intercourse. The inferior vagina ends in the vulva, which is formed by a set of organs of varying nature (dermal and erectile tissues), connecting it external to the body.

An adnexal system is adjoined to the ovary, ducts, and vulva: This adnexa consists of various glands, developed around the lower end of the vagina and urethra, as well as muscles, membranes and fascia comprising the perineum.

Internal Organs

Ovary

The ovaries host oocytes and produce sex hormones. In the young woman, the ovary is an oval-shaped glandular body, pinkish white in color, measuring about 3–4 cm long, 1.5–2 cm wide, and 1–1.5 cm thick. Before puberty, the surface of the ovary is smooth and homogeneous: However, with age, repeated ovulations make it increasingly rough and irregular. The ovary has two surfaces, medial and lateral; two borders, mesovarian and free; and two extremities, uterine and tubal.

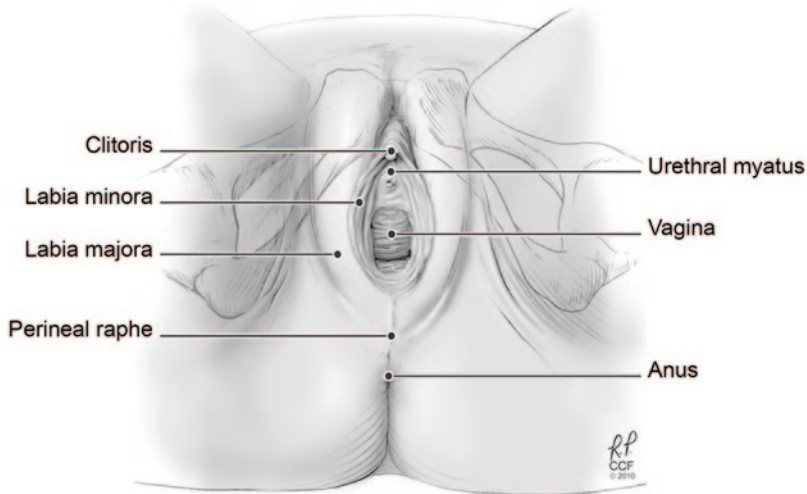


Fig. 2.2 The female reproductive system: external organs. (Reprinted with permission, Cleveland Clinic Center for Medical Art & Photography © 2008–2015. All Rights Reserved)

Relations

The ovary is located on the medial surface of the true (minor) pelvic wall, in a recess called the ovarian fossa. The medial surface of the ovary faces the pelvic cavity and it is in contact, on the right side, with the small intestine, cecum, and vermiform appendix and, on the left side, with the sigmoid colon. In nulliparous woman, the fossa is bounded by the broad ligament of the uterus, anteriorly; the external iliac vessels, superiorly; and the ureter and internal iliac vessels, with their uterine and umbilical branches, posteriorly. In multiparous woman, the ovary moves posteriorly, toward the infra-ovarian fossa, limited by the ureter and uterine vessels, superiorly; the border of the sacrum, posteromedially; and the superior edge of the piriformis muscle, inferiorly.

The anteroinferior border of the ovary presents the ovarian hilum and attaches to the posterior lamina of the broad ligament of the uterus by a peritoneal fold named mesovarium. The beginning of the uterine (fallopian) tube, fimbriated end, starts at the mesovarian border of the ovary, and lies along the superomedial border of the ovary, ending at the superolateral border of the uterus. The uterine entrance of the two fallopian tubes defines the inferior border of the uterine fundus (Fig. 2.3).

The lateral extremity of the ovary is attached to the lateral wall of the pelvis by the ovarian

suspensory ligament, a fold of the posterior lamina of the broad ligament of the uterus that conveys the ovarian vessels and nerves to the mesovarium and ovarian hilum. The uterine extremity of each ovary is attached to the posterior side of the uterine horn by a band of fibrous tissue, the proper ovarian ligament, which is situated within the broad ligament and contains the ovarian branch of uterine artery.

Vascularization and Innervations

1. **Arteries:** The greatest part of the blood supply to the ovary comes from the ovarian arteries, direct branches of the abdominal aorta that arise at the L2–3 level. These arteries course inferiorly inside the suspensory ligament, along the posterior wall of the abdomen, running anterior to the psoas major muscle and ureter. The right artery also lies anterior to the inferior vena cava. Running superoanteriorly to the iliac crest, they cross anterior to the external iliac vessels and enter the broad ligaments to reach the ovarian flaps where they anastomose with the ovarian branches of the uterine arteries, the ovarian anastomotic arches. After sending branches to the ovary through the mesovarium, they continue medially to supply the uterine tubes.

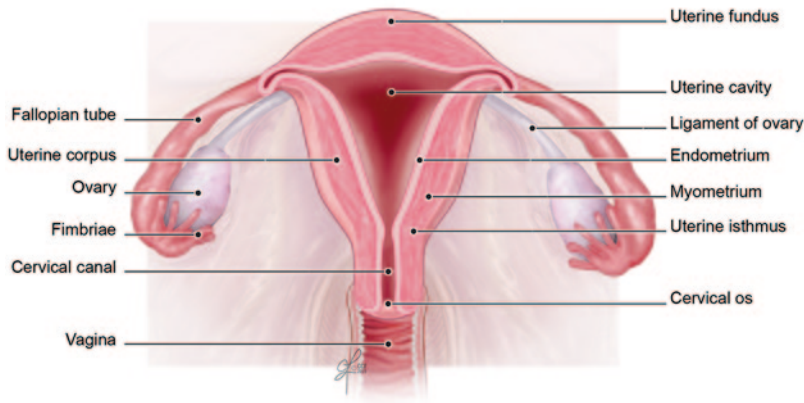


Fig. 2.3 The female reproductive system: internal organs (*coronal view*). (Reprinted with permission, Cleveland Clinic Center for Medical Art & Photography © 2008–2015. All Rights Reserved)

2. Veins: The venous drainage of the ovary is through the ovarian veins, which leave the ovaries through the hila and form the pampiniform plexuses which surround the ovarian arteries. This plexus is situated in the thickness of the broad ligament and communicates with the uterine venous plexus, medially. Laterally, the plexus resolves in a single ovarian vein that follows the pathway of the ovarian artery and reaches the inferior caval vein, on the right, and the renal vein, on the left.
3. Lymphatics: The lymphatic vessels follow the ovarian artery and veins and join those from the uterine tube and fundus. They drain into aortic ganglia.
4. Nerves: The innervations of the ovary comes from the ovarian plexus, formed by fibers derived from the aortic and renal plexuses that descend along the ovarian vessels and contribute to the autonomic innervation of the ovary, uterine tube, and broad ligament of uterus. In addition, the ovary receives one or two branches from the lateral cervical nerve (branch of the inferior hypogastric plexus).

Fallopian Tube

Fertilization of the ovulated ovum may take place at the ovarian surface if sperm are in the rectouterine recess (pouch of Douglas) within the peritoneum at the time of ovulation, or in the

fimbriated end of the fallopian tube. The fallopian tube subsequently transfers the zygote to the uterine cavity by ciliary and peristaltic action as estradiol increases.

The uterine tube is a muscular-membranous tubular-shaped structure that extends medially from the ovary to the uterine horn where it opens proximally into the uterine cavity through the myometrium and endometrium. The oviducts' distal end opens directly into the peritoneal cavity near the ovary; thus a direct communication exists between the peritoneal cavity and the body exterior coursing from the fallopian tube through the uterus and out the vagina.

The fallopian tube measures about 10 cm in length and 1 cm in diameter (isthmus). It stretches, posteriorly and laterally, in the direction of the pelvic wall, surrounding the corresponding ovary.

Topographically, the uterine tube can be divided into four parts: intrauterine, isthmus, ampulla, and infundibulum.

1. The intrauterine part, or intramural part, is the shortest (1 cm) and narrowest (1–2 mm) segment. It crosses the myometrium of the uterine horn and opens into the uterine cavity through the uterine ostium (its diameter is smaller than the abdominal ostium).

2. The isthmus is located immediately lateral to the uterus and connects the uterine tube to the horn of the uterus. The isthmus is short (about 2–3 cm), it narrows (2–3.5 mm) toward the uterus and has the thickest wall.
3. The ampulla begins laterally to the isthmus. The ampulla is the longest (7–8 cm) and widest part of the uterine tube (8–9 mm) and represents more than half of its total length. The ampulla curves at the level of the lateral extremity of the ovary as it becomes the infundibulum surrounding the ovary. Textbooks identify the ampulla as the normal place of fertilization, a theory not based on prospective, observable research, but rather a hypothesis needing confirmation. Normal fertilization could just as well take place in the infundibulum or in the peritoneal cavity.
4. The infundibulum, or ovarian part, is the distal (most lateral) end of the uterine tube. The infundibulum forms a funnel with the widest part directed laterally. The fimbriae are located on the peripheral edge and consist of 10–15 finger-like projections distributed around the surface of the ovary which are closely linked to the ovary by a variable fimbrio-ovarian ligament. The narrowest part of the infundibulum, directed medially, is the abdominal ostium, about 2–3 mm in diameter, which is the opening into the peritoneal cavity. After ovulation, the fimbriae “capture the oocyte” and lead it toward the abdominal hole in the uterine tube over approximately 3½ days. The inner surface of the uterine tube has numerous, intricate, mucous longitudinal folds that give it a labyrinthine aspect.

Except for the intramural portion, the uterine tube is covered by the peritoneum of the uterine broad ligament, the mesosalpinx, or mesentery of the tube, through which the vessels and nerves reach the oviduct.

Relations

The isthmus is posterior to the urinary bladder and the round ligament of uterus, anterior to the ligament of ovary, and inferior to the small intestine, greater omentum, and sigmoid colon. The

ampulla and infundibulum are in close proximity to the ovary and share its relationships: left—sigmoid colon and mesocolon; right—inferior aspect of caecum and vermiform appendix when it is in the pelvis.

Vascularization and Innervation

1. Arteries: The oviduct receives arterial blood by the tubal arteries which branch from the uterine (medial 2/3) and ovarian (lateral 1/3) arteries reaching the uterine tube through the mesosalpinx, where they form the infra-tubarian anastomotic arch from which come numerous spiral arterioles that supply the wall of the tube.
2. Veins: The uterine tubes' venous drainage follows a reverse pathway to the arteries. They form arches and drain into the uterine (medially) and ovarian (laterally) veins.
3. Lymphatics: The lymphatic vessels of the fallopian tubes follow the same path as those coming from the uterine fundus, draining into the pelvic lymph nodes and from the ovary, ascending with the ovarian veins and draining into the aortic lymph nodes.
4. Nerves: Both, ovarian and uterine plexi share the innervation of the uterine tube. Sensory afferent fibers come from segments T11–L1.

Uterus

In the nonpregnant woman, the uterus is a hollow, muscular, thick-walled, inverted pear-shaped organ, where the fertilized oocyte develops. The nonpregnant uterus measures about 6.5–7.5 cm in length, 4.5–5.5 cm in width, and is about 2.5–3 cm thick. During pregnancy, it is greatly enlarged to accommodate the embryonic and fetal development. The uterus lies between the urinary bladder, anteriorly, and the rectum, posteriorly (Figs. 2.1a, b, 2.4a, b).

The uterus is made up of three parts: the fundus (superior to the fallopian tube entries), the body, and the cervix. The body and cervix are separated by a short isthmus.

The uterine body and fundus forms the superior two thirds of the uterus. Transversely expanded and ventro-dorsally flattened, the uterus

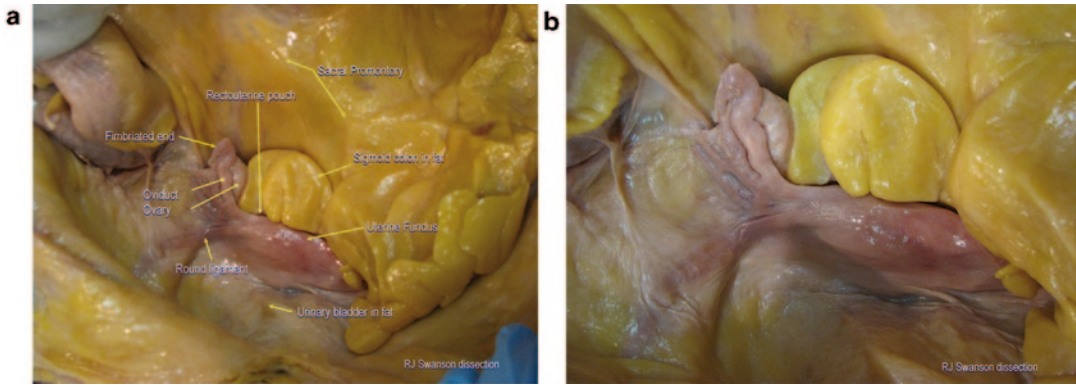


Fig. 2.4 **a** Uterine fundus, right oviduct and ovary in situ in 58-year-old cadaver abdomen (*labeled*). **b** Uterine fundus, right oviduct and ovary in situ in 58-year-old cadaver

abdomen (*close-up, unlabeled*). (Courtesy of Dr. R. James Swanson)

shares its anterior surface with the urinary bladder (vesical surface) and its posterior surface with the rectum (intestinal surface). Both surfaces are convex.

The uterine fundus is superior to the uterine body and is the rounded part superior to the uterotubal union. The regions of the uterus where the fallopian tubes attach are the uterine horns. The proper ovarian ligament enters the uterine wall posterior and inferior to the fallopian tube insertion while the round ligament, a continuation of the proper ovarian ligament, leaves the uterine wall anterior and inferior to the fallopian tube to proceed into the internal inguinal ring, ending internally in the base of the labia majora.

The uterine cavity is triangular and flattened in the coronal plane presenting tubal angles, superiorly, and a cervical angle inferiorly. The cavity appears as a narrow slit in the sagittal plane.

The uterus is implanted in the superior aspect of the vaginal fornix. Two segments can be distinguished in the cervix, namely the vaginal and supravaginal portions. The supravaginal portion of the cervix is the uterine isthmus (approximately 1 cm in length), a narrow transition zone located between the body and the cervix. The isthmus is more evident in nulliparous than multiparous women. In this region the uterine cavity becomes significantly narrowed, forming the isthmic channel, and opening into the uterine cavity through the anatomical internal os.

The cavity of the cervix (cervical canal) is lined by longitudinal folds in which transversely oblique (palmate) folds converge. Superiorly the cervix continues into the isthmus and opens into the uterine cavity through the histological internal os. The inferior cervical aspect, the vaginal part, opens to the vaginal cavity through the external uterine os. This orifice is surrounded by the anterior and posterior cervical labia (Fig. 2.3).

The uterine wall consists of three layers from the lumen outward, that is, endometrium, myometrium, and perimetrium. The endometrium is a mucosal layer firmly attached to the myometrium which partially sloughs off during menstruation. The myometrium is a muscular layer which is 12–15 mm of smooth muscle in the nonpregnant state, but thickens considerably during pregnancy. The main branches of the blood vessels and nerves of the uterus are found in this layer. The perimetrium is the outer serosal layer of peritoneum resting on a thin layer of connective tissue (CT).

Pelvic Structure

An obtuse angle (100–120°) is formed between the cervix and the body of the uterus with the uterus tipped anteriorly, ante flexion (referred to as anteversion in relation to the vagina). The position of the uterus is maintained by dynamic factors, which include the muscles of the pelvic diaphragm and the urogenital part of the perineum,

and by static factors, which include the pelvic ligaments and fascia, and the peritoneal folds of the pelvic region.

The main support of the uterus is the pelvic floor, formed by the pelvic diaphragm and reinforced superficially by the perineum. The pelvic viscera, vessels and nerves, surrounding the uterus, and the endopelvic visceral fascia that surrounds these structures support the uterus inside the pelvic cavity. The uterus is further fixed in place by a complex ligamentous system formed by the pubocervical, cardinal, uterosacral, and round ligaments which join the broad ligaments of uterus on either side. The pubocervical ligaments are equivalent to the puboprostatic ligaments in men. The cardinal ligaments expand from the supravaginal cervix and vaginal fornix to the lateral wall of the pelvis. They are situated at the base of the broad ligament, forming part of the parametrium (not lining the uterus but extending laterally from it in the cervical area). The uterosacral (rectouterine) ligaments extend from the lateral part of the uterine cervix and vaginal fornix to the pelvic surface of the sacrum. Located above to the levator ani muscle, they contribute to maintain the normal relation of the uterine cervix and the sacrum. The round ligaments of uterus (10–12 cm long) originate on the anterior surface of the uterine horn (near the uterotubal junction). They pass anteriorly between the layers of the broad ligament to pierce the internal inguinal ring and canal. These round ligaments leave the abdominal cavity and pass through the mons pubis to attach to the base of labia majora. They contribute to the maintenance of uterine anteversion.

The broad ligaments of uterus are folds of the peritoneum that extend between the borders of the uterus to the lateral walls and floor of the pelvis, contributing to the maintenance of the normal position of the uterus.

The fundus and the anterior and posterior surfaces of the body of the uterus are coated by the pelvic peritoneum. When they reach the uterine borders, the peritoneal laminae attach together and extend to the pelvic wall forming, on each side, the uterine broad ligament. Superiorly, the laminae of the broad ligament are continuous and surround the uterine tube, forming the mesosalpinx.

Relations

The pelvic floor and the complex system of attachments provide the uterus a relatively stable position inside the pelvis. Its central position gives the uterus anterior, posterior, and lateral relations with the surrounding organs.

1. Anterior: The anterior surface of the uterus rests on the posterior surface of the urinary bladder. The peritoneum that lines these two surfaces forms the vesicouterine pouch.
2. Posterior: The posterior surface of the uterus rests on the posterior surface of the rectum to form the rectouterine pouch. This peritoneal recess separates the uterus from the rectum and is usually occupied by the small intestine, the sigmoid colon, and a small amount of peritoneal fluid. This space is also where ejaculated sperm reside for up to 7 days after intercourse.
3. Lateral: The lateral surfaces of the uterus are attached to the broad ligament; mesometrium superiorly and parametrium inferiorly.

Vascularization and Innervation

1. Arteries: The arterial blood to the uterus comes from an anastomotic network of the uterine and vaginal arteries, branches of the internal iliac arteries, the ovarian arteries, and branches of the abdominal aorta. At the level of the uterine horn, the uterine artery is divided into several branches, including a tubal branch and an ovarian branch.

On its path, the uterine artery emits collateral branches downstream (vesicovaginal, cervical-vaginal, cervical, and ureteral), irrigating the uterine cervix, the superior part of the vagina, base of the urinary bladder, and terminal segment of the ureter.

2. Veins: The venous drainage of the uterus flows into the uterine venous plexuses that accompany the uterine arteries in their path through the mesometrium. Each plexus is drained mainly by the uterine veins (toward the internal iliac vein) and also by the ovarian

veins (toward the inferior vena cava on the right, and the renal vein on the left).

3. Lymphatics: The lymphatic vessels from the wall of the uterus form an abundant plexus located in the mesometrium and the parametrium. Drainage follows three main routes:
 - a. The majority of the lymphatic vessels from the uterine fundus follows the ovarian vessels and drains into the aortic lymph nodes (a small part may follow the round ligament and drain into the external iliac or inguinal lymph nodes).
 - b. Lymph vessels from the uterine body enter into the broad ligament and drain into the external iliac lymph nodes.
 - c. Cervical lymphatic vessels follow the uterine artery and drain into the internal iliac and sacral ganglia.
4. Nerves: The uterine nerves come from the uterovaginal plexus and are grouped into two pedicles directed to the uterine body and cervical-isthmus, respectively. This plexus is located at the base of the broad ligament on each side of the cervix.

Vagina

The vagina is the lowest portion of the female genital tract. It receives the penis during intercourse and is the natural route for elimination of uterine secretions and the fetus and annexes during child birth.

The vagina is a fibromuscular tube 7–10 cm in length and 2.5–3 cm wide. Its inner surface is rough (vaginal rugae) with superior-to-inferior longitudinal folds called rough anterior and posterior columns. The anterior columns contain horizontal (medial to lateral) folds along the inferior 2 cm length.

The vagina stretches from the uterine cervix to the vestibule where it opens between the labia minora and majora. The vestibular end of the vagina is anterior to the cervix. The entire vagina is inferior to the uterus, posterior to the urinary bladder and urethra, and anterior to the rectum. It passes between the medial borders of the levator ani muscles to pierce the urogenital diaphragm in conjunction with the urethra. Both of these

tubular structures are surrounded by sphincters that are derived from the levator ani muscle.

Relations

1. Anterior: The superior aspect of the anterior wall of the vagina is 1 cm shorter than the posterior aspect in their connection to the cervix. From mid-vagina inferiorly, it is related to the terminal segments of the ureters as they enter the inferior portion of the bladder at the trigone (bladder segment), and the upper part of urethra (urethral segment).

The female urethra is only 3–4 cm long and opens in the vestibule, through the external urethral orifice. It has two sphincters. The internal urethral sphincter is smooth muscle, poorly vascularized, and sometimes so thin that it is discounted as a true sphincter. The external urethral sphincter is more robust skeletal muscle from the levator ani located in the perineum. These sphincters control the flow of urine.

2. Posterior: The posterior part of the vaginal fornix is covered by the peritoneum and comes in direct contact with the bottom of the rectouterine pouch (peritoneal segment). At this level, the vaginal wall allows entry into the pelvic cavity and a surgical approach to the abdominal and pelvic viscera (surgical transvaginal path). At the floor of the pelvis, the vagina is anterior to the perineal body, a central point of various ligamentous attachments which separates the vaginal os from the anal canal.
3. Inferior: The loose CT of the rectovaginal septum, which separates the back wall of the vagina from the rectum, provides vaginal palpation through the rectum.
4. Lateral: The superior vaginal fornix is in contact laterally with the base of the broad ligament of the uterus and the pelvic segment of the ureter. More inferiorly, the lateral vaginal walls come into contact with the edges of the levator ani muscles and, inferior to those pelvic diaphragm muscles, with the greater vestibular glands and bulbs of vestibule (perineal segment of vagina).

Vascularization and Innervation

1. **Arteries:** The vagina is supplied by the vaginal artery. This artery will either be a branch from the uterine artery or it will come directly from the internal iliac artery. Irrigation in the upper segment is directly from the uterine artery through its vesicovaginal and cervicovaginal branches. In addition, branches from the middle rectal artery usually reach the inferior segment of the posterior wall. From its origin, the vaginal artery descends toward the top of the vagina and anastomoses with branches from the opposite side and from the uterine and middle rectal arteries. This anastomosis forms a median longitudinal trunk known as the “azygos artery of the vagina.” In addition to the vagina, the vaginal artery also participates in supplying the inferior urinary bladder, the bulbs of the vestibule and the contiguous portion of the rectum.
2. **Veins:** Each side of the vaginal veins form a plexus (submucosal and superficial), which communicates with the uterine, bladder, and rectal plexi, and are drained by the uterine, vaginal, and rectal medial veins (they terminate in the internal iliac veins).
3. **Lymphatics:** Lymphatic drainage from the vagina is abundant and shows a segmental distribution. The lymph vessels from the top accompany the uterine artery and drain into the internal iliac and obturator lymph nodes. The vessels of the middle part accompany the vaginal artery and drain into the internal iliac and gluteal lymph nodes. Lymphatics from the lowest part drain into the superficial inguinal and pararectal nodes.
4. **Nerves:** The nerves innervating the upper part of the vagina and cervix are autonomic and derive from the uterovaginal plexus. The inferior hypogastric plexus (sympathetic) and the pelvic splanchnic nerves (parasympathetic) are mainly vasomotor but also transmit mechanoreceptor impulses from muscle and adventitia. Nerves which innervate the inferior part of the vagina are somatic and reach the vagina via the pudendal nerve (sacral nerve roots).

External Organs

Perineum

The perineum is formed by the soft tissues inferior to the pelvic diaphragm ending with the skin. The external configuration of the perineum varies according to the position of the individual:

1. When standing, the perineum takes the form of a sagittal cleft between the proximal ends of both thighs. Narrow and hidden, this space broadens anteriorly to end at the pubic symphysis and broadens posteriorly to end at the coccyx.
2. In dorsal decubitus (gynecologic or lithotomy position), the perineum forms a rhomboid- or diamond-shaped area with an anteroposterior axis. The anterior vertex is the inferior symphysis pubis; the posterior vertex is the coccyx; the lateral vertices are the ischial tuberosities.

The diamond-shaped perineum has the urogenital diaphragm as its roof and the skin as its floor. In common language, the perineum is called a person's bottom. This area contains a significant amount of adipose tissue with nerves, vessels, erectile tissue, and a few very small muscles within it. From posterior to anterior, the three openings of anus, vagina, and urethra also pierce the perineum. For a more detailed treatment of the perineum, a number of excellent texts are cited in the bibliography.

Vulva

The vulva contains the external female genitalia and the urethral os (opening). The vulva's skin is ovoid shaped with an anteroposterior axis. Anteriorly, the vulva extends from the wall of the abdomen at the symphysis pubis, posteriorly to the anus. The lateral limits are the medial sides of the thighs at the genitofemoral folds.

When the thighs are abducted, the cleft opens exposing the mons pubis, the labia majora and minora, and the vestibule. The bulbs of vestibule and the clitoris, which are also part of the vulva, are located deep to the labial formations.

1. *Mons pubis*: The mons pubis is a rounded relief located anterior to the pubic symphysis and from which it extends inferiorly to the labia majora. The inguinal folds are its lateral boundaries. The mons pubis consists of a pad of fatty CT covered by skin. During puberty, thick hair begins to appear (pubarche), which acquires the typical triangular female distribution. Both fat and hair decrease after menopause.
2. *Labia majora*: The two labia majora are longitudinal skin folds, with adipose and fibrous tissue deposits, located infero-posteriorly to the mons pubis at each side of the pudendal cleft. They provide protection to the vestibule, where the urethra and vagina open. Although they are symmetrical, their size depends on fat content so they vary in size and distribution among women. They extend anteriorly from the mons pubis, posteriorly to the perineal raphe, about 2.5 cm from the anal orifice. The labia majora are joined superiorly to form the anterior (labial) commissure, a relatively thick arc that is continuous with the mons pubis. Inferiorly, a very thin and transverse skin fold, the posterior (labial) commissure, extends between the labia majora anterior to the anal orifice and perineal body.
3. *Labia minora*: The two labia minora are thin and delicate skin folds located medially between the labia majora and lateral to the vestibule. On each side, a labial sulcus separates the major from the minor labia. The labia minora surround the vestibular space on each side where the urethra and vagina exit. The anterior ends of the minor labia are divided into two expansions, one inferior and the other superior. The superior expansions meet with each other superoanterior to the clitoris forming a hood of skin named the prepuce or foreskin of the clitoris. The inferior expansions join with each other inferior to the clitoris and form the clitoral frenulum. Posteriorly in young women, the labia minora are linked by a small skin fold called the frenulum of the labia minora. The labia minora lack hair and fat and have abundant sebaceous and sweat glands opening onto their surfaces. The skin of the inner surface is very thin, presents the typical pink color of mucosa and contains many sensitive nerve endings, making it very sensible to direct mechanical stimulation.
4. *Vestibule*: The vestibule is the space located between the medial surfaces of the labia minora. When the vulva is closed, the vestibule is a virtual space and is reduced to a simple interlabial slit. However, when the vulva is open, it takes the shape of an oblong funnel. At the base or superior aspect of the funnel will be the opening for the urethra, paraurethral glands, vagina, and ducts of the greater and lesser vestibular glands.
 - a. *The external urethral orifice* is situated 2–3 cm posterior to the clitoris and 1 cm anterior to the vaginal opening. Lateral to the vaginal os are the paired external orifices of the paraurethral gland ducts. The paraurethral glands are homologous to the male prostate.
 - b. *The vaginal orifice* is posterior to the external orifice of the urethra. The size and appearance vary according to the condition of the hymen. The hymen is a thin fold of mucous membrane, skin, and fibroelastic tissue that attaches to the edge of the vaginal orifice. The hymen is usually perforated before menarche which allows unobstructed menstruation flow. Prior to intercourse or the use of tampons, the adult woman normally has a complete hymen with either a perforation or septum. After the first use of tampons or sexual intercourse, the hymen's torn remains form small tubers called hymenal caruncles.
 - c. *The paired greater vestibular glands* are round or oval-shaped, 0.5–1 cm in diameter and located posterolateral to the vaginal orifice. The glandular duct is short, narrow, and emerges from the anterior part of the gland. The greater vestibular glands are homologues of the bulbourethral glands in the male and their secretion lubricate the vaginal vestibule during sexual intercourse.
 - d. *The paired lesser vestibular glands* also lie in the vestibule and exit into the space

Exercise and Human Reproduction

Induced Fertility Disorders and Possible Therapies

Vaamonde, D.; du Plessis, S.S.; Agarwal, A. (Eds.)

2016, XVI, 351 p. 59 illus., 19 illus. in color., Hardcover

ISBN: 978-1-4939-3400-3