SEVENTH EDITION

handbook of OBSTETRICS & GYNECOLOGY

RALPH C. BENSON, MD

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RALPH C. BENSON, MD
Clinical Professor of Obstetrics and Gynecology and Emeritus Chairman, Department of Obstetrics and Gynecology, University of Oregon Health Sciences Center, Portland, Oregon

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Preface

In the seventh edition of this Handbook, the author has made extensive revisions and additions. Nonetheless, the format and objectives remain the same: to present to the medical student, resident, nurse practitioner, midwife, and busy physician a concise and readily available digest of the material necessary for the diagnosis and treatment of obstetric and gynecologic problems. We continue to stress the clinical aspects, but we have included recent advances in physiology as they apply to our knowledge of the subjects considered.

This Handbook was never intended to be a substitute for a complete primary textbook in obstetrics and gynecology—it is a supplement to them. Because of limitations of space, certain aspects of obstetric and gynecologic problems have been severely condensed or even omitted. For the same reasons, source references are not included. The author realizes that the concise format used tends to oversimplification and dogmatism, but we trust the gain to the reader in clarity and brevity will compensate for that defect.

A new chapter on diseases of the breast is included. Numerous new topics have been added, e.g., puberty, amenorrhea, and assessment of fetal status. Much additional up-to-date material has been provided on medical complications of pregnancy, elective abortion, and sexually transmitted diseases. New information on infertility, including in vitro fertilization, and contraceptive complications has been included. The sections on gynecologic malignancies have been thoroughly rewritten.

We have been most pleased with the success this Handbook has enjoyed abroad as well as in the USA. Spanish, Portuguese, Italian, and Polish editions are available. In addition, an English edition for distribution in Asia is printed in Singapore and a Middle East edition (in English) emanates from Beirut.

Our special thanks go to Dr. Leon Fox, whose critique and recommendations have been of very great help; to Elaine Burroughs for her skill and patience in preparation of the manuscript; and to Marjorie Saunders of Lange Medical Publications for her fine assistance in editing.

Once more, I am especially grateful to my associates, students, and others far and near whose helpful criticisms and suggestions have been invaluable.

Ralph C. Benson, M.D.

Portland, Oregon
May, 1980

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Anatomy & Physiology of the Female Reproductive System

The female reproductive system may be divided into the external and internal genitalia and their supporting structures.

The **external genitalia**, collectively termed the pudendum or vulva, comprise the following structures, all easily visible on external examination: mons veneris (mons pubis), labia majora, labia minora, clitoris, vestibule and external urethral meatus, Skene's glands (paraurethral glands), Bartholin's glands (vulvovaginal glands), hymen, fourchet, perineal body, and fossa navicularis. They present varying contours around the urogenital cleft, which lies anteroposteriorly between the vaginal and urethral openings. The contours of the external genitalia are determined by the bony configuration of the antero-inferior pelvic girdle as well as by the subcutaneous fat, muscle, and fascial arrangement.

The **internal genitalia** comprise the vagina, cervix, uterus, fallopian tubes, and ovaries. They require special instruments for inspection; the intra-abdominal group can be examined visually only by means of laparotomy, laparoscopy, or culdoscopy.

The anatomy of the bony pelvis and the pelvic floor is discussed on pp. 18 and 19.

EXTERNAL GENITALIA

MONS VENERIS
(Mons Pubis)

Gross Appearance.

The mons veneris, a rounded pad of fatty tissue overlying the symphysis pubis, develops from the genital tubercle. It is not an organ but a region or a landmark. Coarse, dark hair normally appears over the mons early in puberty.

During reproductive life the pubic hair is abundant, but after the menopause it becomes sparse. The normal female escutcheon is typically a "triangle with the base up," in contrast with the "triangle with the base down" male pattern.

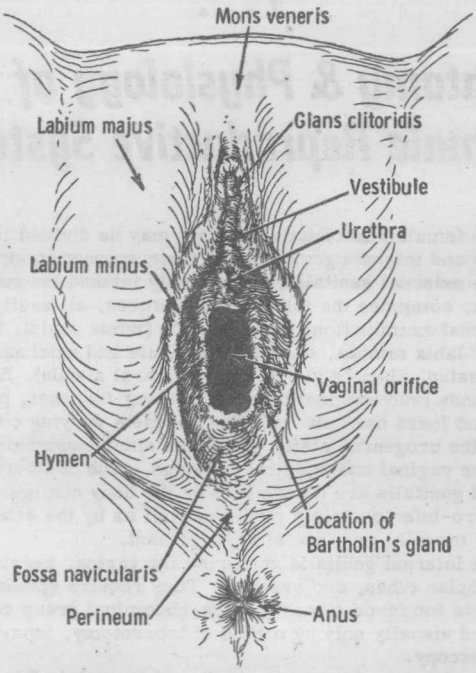

Fig 1-1. External female genitalia.

Histology.

The skin of the mons contains sudoriferous and sebaceous glands. The amount of subcutaneous fat is determined by nutritional and possibly by steroid hormonal factors.

Innervation.

The sensory nerves of the mons are the ilioinguinal and genitofemoral nerves.

Blood & Lymph Supply.

The mons is supplied by the external pudendal artery and vein. The lymphatics merge with those from other parts of the vulva and from the superficial abdomen. The crossed lymphatic circulation from the labia within the mons is of clinical importance since it permits carcinoma metastases from one side of the vulva to appear in the inguinal glands of the opposite as well as the affected side.

Clinical Importance.

Dermatitis is common in the pubic area. Edema may occur secondary to vulvar varicosities or to carcinomatous infiltration of the lymphatics. Cancer elsewhere in the vulva may also involve the mons.

LABIA MAJORA

Gross Appearance.

In the adult female, these 2 raised, rounded, longitudinal folds of skin are the most prominent features of the external genitalia. They originate from the genital swellings extending down and backward from the genital tubercle; arising from the perineal body, they extend anteriorly around the labia minora to merge with the mons. The labia are normally closed in nulliparous women but then gape progressively with succeeding vaginal deliveries and become thin, with sparse hair in old age.

The skin of the lateral surfaces of the labia is thick and often pigmented; it is covered with coarse hair similar to that of the mons. The skin of the inner labia majora is thin and fine and contains no hairs.

Histology.

The labia majora are made up of connective and areolar tissue, with many sebaceous glands. They are homologous to the scrotum. A thin fascial layer similar to the tunica dartos of the scrotum is found within the labia just below the surface. The round ligaments of the uterus pass through the canal of Nuck to end in a fibrous insertion in the anterior portion of the labia majora.

Innervation.

Anteriorly, the labia majora are supplied by the ilioinguinal and pudendal nerves. Laterally and posteriorly they are innervated by the posterior femoral cutaneous nerve.

Blood Supply.

The labia majora are supplied by the internal pudendal artery, derived from the anterior parietal division of the internal iliac (hypogastric) artery; and by the external pudendal artery (from the femoral artery). Drainage is via the internal and external pudendal veins.

Clinical Importance.

No special function is performed by the labia majora. A cyst of the canal of Nuck is often mistaken for an indirect inguinal hernia. Adherence of the labia in infants may indicate vulvitis. External force or the complications of labor may cause vulvar hematoma.

LABIA MINORA

Gross Appearance.

The labia minora are small, narrow, elongated folds of skin between the labia majora and the vaginal introitus. They are derived from the skin folds beneath the developing clitoris. Normally the labia minora are in apposition in nulliparas, concealing the introitus. Posteriorly, the labia minora merge at the fourchet. The labia are separate from the hymen, which is an individual structure marking the vaginal entrance or introitus. Anteriorly, each labium merges into a median ridge which fuses with its mate to form the frenulum of the clitoris; and an anterior fold, which becomes the prepuce of the clitoris.

The lateral and anterior surfaces of the labia minora are usually pigmented; their inner aspect is pink and moist, resembling the vaginal mucosa.

Histology.

Neither hair follicles nor sweat glands are found in the labia minora. They are rich in sebaceous glands, however.

Innervation & Blood Supply.

The innervation of the labia minora is via the ilioinguinal, pudendal, and hemorrhoidal nerves.

The labia minora are not truly erectile, but a rich vasculature permits marked turgescence with emotional or physical stimulation. They are supplied by the external and internal pudendal arteries.

Clinical Importance.

The labia minora tend to close the introitus. They increase in size as the result of ovarian hormonal stimulation. After the menopause they all but disappear unless estrogens are administered. Squamous cell carcinoma of the vulva often originates in the labia minora; sebaceous cysts also develop in these structures. The presence of adherent labia minora in the infant is usually due to inflammation. Fusion may indicate sexual maldifferentiation.

CLITORIS

Gross Appearance & Histology.

This 2-3 cm long homologue of the penis is found in the midline slightly anterior to the urethral meatus. It is composed of 2 small, erectile corpora, each attached to the periosteum of the symphysis, and a diminutive structure (glans clitoridis) which is generously supplied with sensory nerve endings. The glans is partially hooded by the labia minora.

Innervation & Blood Supply.

The clitoris is supplied by the hypogastric and pudendal nerves and pelvic sympathetics, and by the internal pudendal artery and vein.

Clinical Importance.

Cancer of the clitoris is rare, but it is extremely serious because of early metastases. The inguinal and femoral nodes are usually first involved.

VESTIBULE & URETHRAL MEATUS

Gross Appearance & Histology.

The triangular area between the labia minora anteriorly, onto which the urethra opens, is the vestibule. It is covered by delicate stratified squamous epithelium.

The urinary meatus is visible as an anteroposterior slit or an inverted V. Like the urethra, it is lined by transitional epithelium. The vascular mucosa of the meatus often pouts or everts. This makes it appear more red than the neighboring vaginal mucosa.

Innervation & Blood Supply.

The vestibule and terminal urethra are supplied by the pudendal nerve and by the internal pudendal artery and vein.

Clinical Importance.

Caruncles, as well as squamous cell or transitional cell carcinoma, may develop in the urethrovestibular area.

PARAURETHRAL GLANDS
(Skene's Glands)

Gross Appearance & Histology.

Immediately within the urethra on its posterolateral aspect are 2 small orifices leading to the shallow tubular ducts or glands of Skene. The ducts are lined by transitional cells, and are the sparse equivalent of the numerous male prostatic glands.

Blood Supply.

Like the vestibule and urethral meatus, Skene's glands are supplied by the internal pudendal artery and vein.

Clinical Importance.

Skene's glands, which supply minor amounts of mucus, are especially susceptible to gonococcal infection, which may be first evident here. Following successful antigonorrheal therapy, nonspecific infection with other purulent organisms

is common. With recurrent skenitis, destruction of the ducts with electrocautery may be necessary.

PARAVAGINAL OR VULVOVAGINAL GLANDS & DUCTS (Bartholin's Glands & Ducts)

Gross Appearance & Histology.

Just inside the lower vagina, on either side, are 2 tiny apertures. Each is connected by a narrow duct, 1-2 cm long, with a small flattened mucus-producing gland which lies between the labia minora and vaginal wall. These are paravaginal or vulvovaginal glands, or Bartholin's glands, the counterpart of Cowper's glands in the male. The ducts are lined with transitional epithelium.

Innervation & Blood Supply.

The internal pudendal nerve, artery, and vein serve Bartholin's glands.

Clinical Importance.

Bartholin's glands secrete mucus which acts as a lubricant during coitus. Gonorrhea frequently causes Bartholin's ducts to become abscessed and cystic, although the glands themselves are usually not affected. Nonvenereal bacterial infections occasionally result in this complication. Primary adenocarcinoma is a rare neoplasm in the external genitalia, but it may originate in Bartholin's glands. Transitional cell epidermoid carcinoma of Bartholin's duct may also occur.

HYMEN

Gross Appearance & Histology.

A circular or crescent-shaped membrane just inside but separate from the labia minora marks the entrance to the vagina. This moderately elastic barrier partially or, in rare instances, completely occludes the vaginal canal. It is a double-faced epithelial plate covering a vascular, fibrous tissue matrix.

Innervation & Blood Supply.

The hymen is supplied by the pudendal and inferior hemorrhoidal nerves, arteries, and veins.

Clinical Importance.

A tight hymen may result in symptomatic gynatresia, in which case hymenotomy or dilatation will be required. The remnants of the lacerated hymen following intercourse or delivery are called carunculae hymenales (myrtiformes). Hymenal or perineal scars may cause dyspareunia.

PERINEAL BODY, FOURCHET, & FOSSA NAVICULARIS

Gross Appearance.

The perineal body includes the skin and underlying tissues between the anal orifice and the vaginal entrance. It is supported by the transverse perineal muscle and the lower portions of the bulbocavernosus muscle.

The labia minora and majora converge posteriorly to form a low ridge called the fourchet. Just beyond this fold, extending about 1 cm anteriorly to the hymen, is a shallow depression, the fossa navicularis.

Innervation & Blood Supply.

These structures are supplied by the pudendal and inferior hemorrhoidal nerves, arteries, and veins.

Clinical Importance.

These structures are often lacerated during childbirth and may require repair. Because of their vascularity, an early or deep episiotomy can result in the loss of several hundred ml of blood; faulty repair may be followed by dyspareunia or by reduced sexual satisfaction.

SKIN GLANDS

Small and large coiled subcutaneous sweat glands are situated all over the body except beneath mucocutaneous surfaces, e.g., the labia minora or vermilion border of the lips.

Normally, the fluid secretion of small coiled (eccrine) sweat glands, which have no relationship to hairs, has no odor.

Large coiled (apocrine) sweat glands, which open into hair follicles, are found over the mons, the labia majora, and the perineum as well as in the axillas. These glands, which begin to secrete an odorous fluid at puberty, are more active during menstruation and pregnancy. The sweat glands are controlled by the sympathetic nervous system.

Hidradenomas are tumors which originate in sweat glands. Rarely, they are malignant.

Sebaceous glands are associated with and open into hair follicles. However, on the labia minora, where hairs are absent, sebaceous glands open on the surface. At puberty, an oily secretion with a slight odor is produced. The fluid lubricates and protects the skin from irritation by vaginal discharges. Gland secretion is mediated by hormonal and psychic stimuli. The activity of the sebaceous glands diminishes in old age.

Sebaceous cysts, almost invariably benign but often infected, develop from sebaceous glands.

INTERNAL GENITALIA

VAGINA

Gross Appearance.

The vagina is a thin, muscular, partially collapsed rugose canal 8-10 cm long and about 4 cm in diameter. It extends from the urogenital cleft to the cervix and curves upward and posteriorly from the vulva. The cervix protrudes several cm into the upper vagina to form recesses, the fornices. Since the posterior lip of the cervix is longer than its anterior lip, the posterior fornix is deeper than the anterior fornix. The vaginal diameter and all fornices, especially the lateral ones, become more shallow during the climacteric.

The vagina lies between the bladder and the rectum and is supported principally by the transverse cervical ligaments (cardinal ligaments, Mackenrodt's ligaments) and the levator ani muscles.

The peritoneum of the posterior cul-de-sac (pouch of Douglas) and the posterior vaginal fornix are close together at the vaginal vault (a detail of surgical importance).

Histology.

The vagina is lined by stratified squamous epithelium,

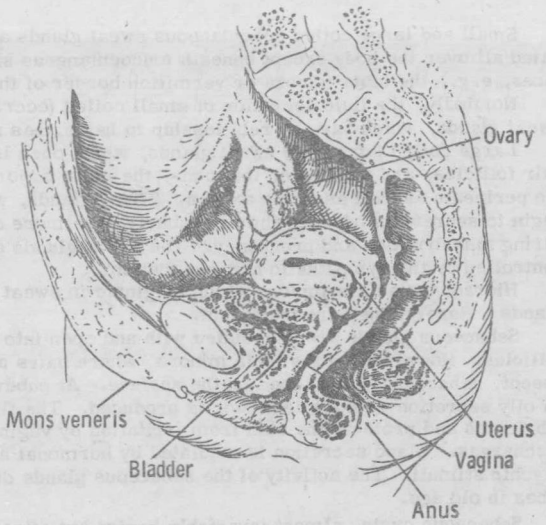

Fig 1-2. Midsagittal view of the female pelvic organs.

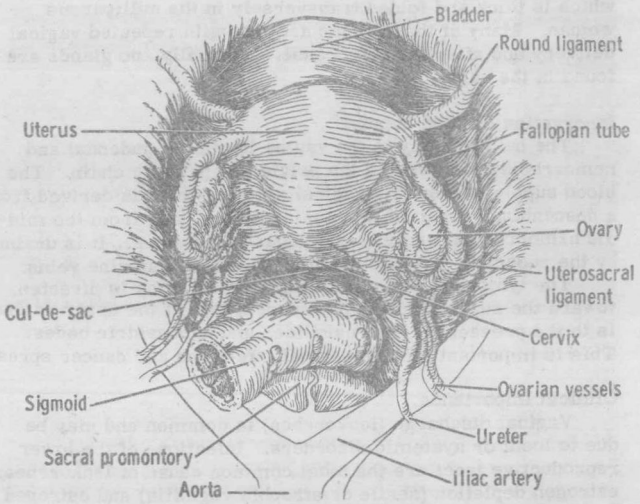

Fig 1-3. Pelvic organs (superior view).

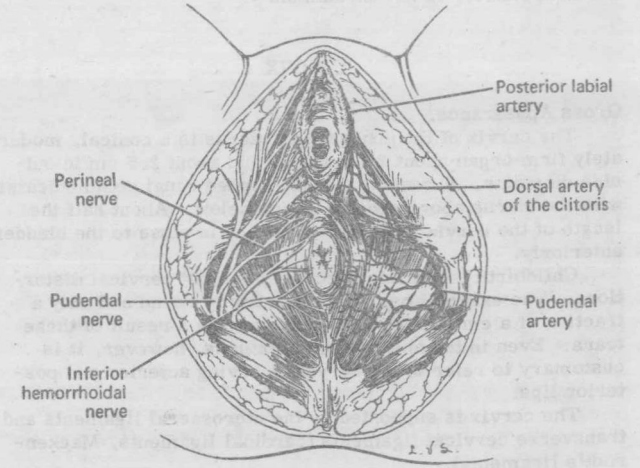

Fig 1-4. Arteries and nerves of perineum. (Reproduced, with permission, from Krantz K.E.: Chapter 2 in Current Obstetric & Gynecologic Diagnosis & Treatment, 2nd ed. Benson R.C. [editor]. Lange, 1978.)

which is thick and folded transversely in the nulliparous woman. Many of these rugae are lost with repeated vaginal delivery and after the menopause. Normally, no glands are found in the vagina.

Innervation & Blood Supply.

The nerve supply to the vagina is via the pudendal and hemorrhoidal nerves and the pelvic sympathetic chain. The blood supply is from the vaginal artery, which is derived from a descending branch of the uterine artery, and from the middle hemorrhoidal and internal pudendal arteries. It is drained by the pudendal, external hemorrhoidal, and uterine veins.

The lymphatic drainage of the lower vagina is directed toward the superficial inguinal nodes; that of the upper vagina is to the presacral, external iliac, and hypogastric nodes. This is important in vulvovaginal infections and cancer spread.

Clinical Importance.

Vaginal discharge (leukorrhea) is common and may be due to local or systemic disorders. Infections of the lower reproductive tract are the most common cause of leukorrhea; estrogen depletion (senile or atrophic vaginitis) and estrogen or psychic stimulation are other causes.

Primary cancer of the vagina is very rare, but secondary carcinoma of the vagina, most frequently from extension of cervical cancer, is not uncommon.

CERVIX

Gross Appearance.

The cervix of the nonpregnant uterus is a conical, moderately firm organ about 2-4 cm long and about 2.5 cm in outside diameter. A central spindle-shaped canal communicates with the uterus above and the vagina below. About half the length of the cervix is supravaginal and is close to the bladder anteriorly.

Childbirth lacerations account for most cervical distortions. The external os, which is initially round and only a fraction of a cm in diameter, may gape as a result of these tears. Even in the absence of distortions, however, it is customary to refer to the cervix as having anterior and posterior lips.

The cervix is supported by the uterosacral ligaments and transverse cervical ligaments (cardinal ligaments, Mackenrodt's ligaments).

Histology.

The intravaginal portion of the cervix is covered by stratified squamous cells, which usually extend to just inside the external os. The countless crevices, which give the cervix

a honeycombed appearance on transection, were once believed to be glands. It is now known that they are infoldings of a mucus-secreting membrane. Peripherally, the cervix contains circular muscle fibers, which connect with the uterine myometrium above.

Innervation & Blood Supply.

Innervation of the cervix is via the second, third, and 4th sacral nerves and the pelvic sympathetic plexus. The cervical artery and vein, major branches of the uterine circulation, carry most of the blood to and from the cervix.

Clinical Importance.

Cervical cancer is the second most common female malignancy; breast carcinoma is first. Cervical infection is a major cause of infertility; leukorrhea is often due to inflammation of the mucus-secreting membrane.

BODY & FUNDUS OF THE UTERUS

Gross Appearance.

The uterus is a muscular organ with a narrow central cavity situated deep in the true pelvis between the bladder and the rectum. It is shaped like an inverted pear. The adult nonpregnant uterus is approximately 7-8 cm long and is about 4 cm in its widest diameter. The fallopian tubes join the uterus, one on either side, about two-thirds of the distance to the top of the uterus. That portion of the uterus above the tubal insertion is called the fundus; below the insertion is the body or corpus of the uterus, which is continuous with the supravaginal segment of the cervix. In the nulliparous woman the uterus and cervix are usually directed forward at almost a right angle with the long axis of the vagina, but 25-35% of women will have a retroverted or retroflexed uterus.

Except for the antero-inferior portion of the corpus, which is covered by the bladder, the uterus is covered by peritoneum.

The uterus is supported by (1) the muscular round ligaments (ligamentum teres), each of which originates in the fundus laterally and ends in a labium majus; (2) the broad ligaments, wide peritoneal folds sweeping laterally from either side of the corpus to the lateral pelvic walls; (3) the uterosacral ligaments, fibrous strands which originate in the cervico-uterine junction and insert into the periosteum of the sacrum; (4) the transverse cervical ligaments (cardinal ligaments, Mackenrodt's ligaments); and (5) the levator ani muscles and accompanying fascia.

Histology.

The uterine wall is composed mainly of interwoven smooth muscle fibers, which are especially thick in the fun-