handbook of OBSTETRICS & GYNECOLOGY

RALPH C. BENSON

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Preface

This Handbook is presented as a compact, ready reference for the student, house officer, and practitioner and as an abbreviated but reasonably comprehensive companion to the large, "standard" textbooks of obstetrics and gynecology. Although no effort has been made to provide definitive and complete discussions of either companion subject, we have attempted to provide a concise digest of important clinical concepts within this specialty. We trust that this book will enable the nonspecialist physician to properly diagnose and treat many of the disorders encountered in practice and to avoid certain any-day pitfalls. We have endeavored to stress brevity and clarity without dogmatism or oversimplification. Outlines of anatomy, physiology, pathology, differential diagnosis, and complications have been included both for review and to provide a logical background to treatment. A section on genetics has been provided and emotional factors pertaining to problems of women have been stressed. Regrettably, hundreds of pertinent, recent references could not be included.

In offering this Handbook, I am encouraged by the knowledge that the publishers already have scheduled a second edition in just two years, at which time it will be possible to correct omissions or errors of fact or emphasis which this volume may contain. I shall be grateful to those readers who inform me of inaccuracies or inequities which come to their attention. Hopefully, this Handbook will continue to be an exact, timely, and practical summary of modern gynecic thought and practice.

No one in today's world of medicine can write a book on a clinical discipline without incurring a vast indebtedness to other authors; to colleagues at his own institution; and to many others who have served as consultants in the preparation of the text. I am particularly obliged to Drs. Aubrey L. Abramson, Milton J. Chatton, Albert E. Long, and M. T. Southgate for many editorial services.

If there is any part of this Handbook about which I have no qualms, it is the series of illustrations by Laurel V. Gilliland, whose intelligent cooperation and considerable talent have done so much to make the challenging task of description far less difficult.

Ralph C. Benson

Portland, Oregon
September, 1964

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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 (para-urethral 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 celiotomy, peritoneoscopy, or culdoscopy.

The anatomy of the bony pelvis and the pelvic floor is discussed on pp. 15 and 20.

EXTERNAL GENITALIA

MONS VENERIS
(Mons Pubis)

Gross Appearance.

The mons veneris is a rounded pad of fatty tissue overlying the symphysis pubis; it is not an organ, but a region or 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.

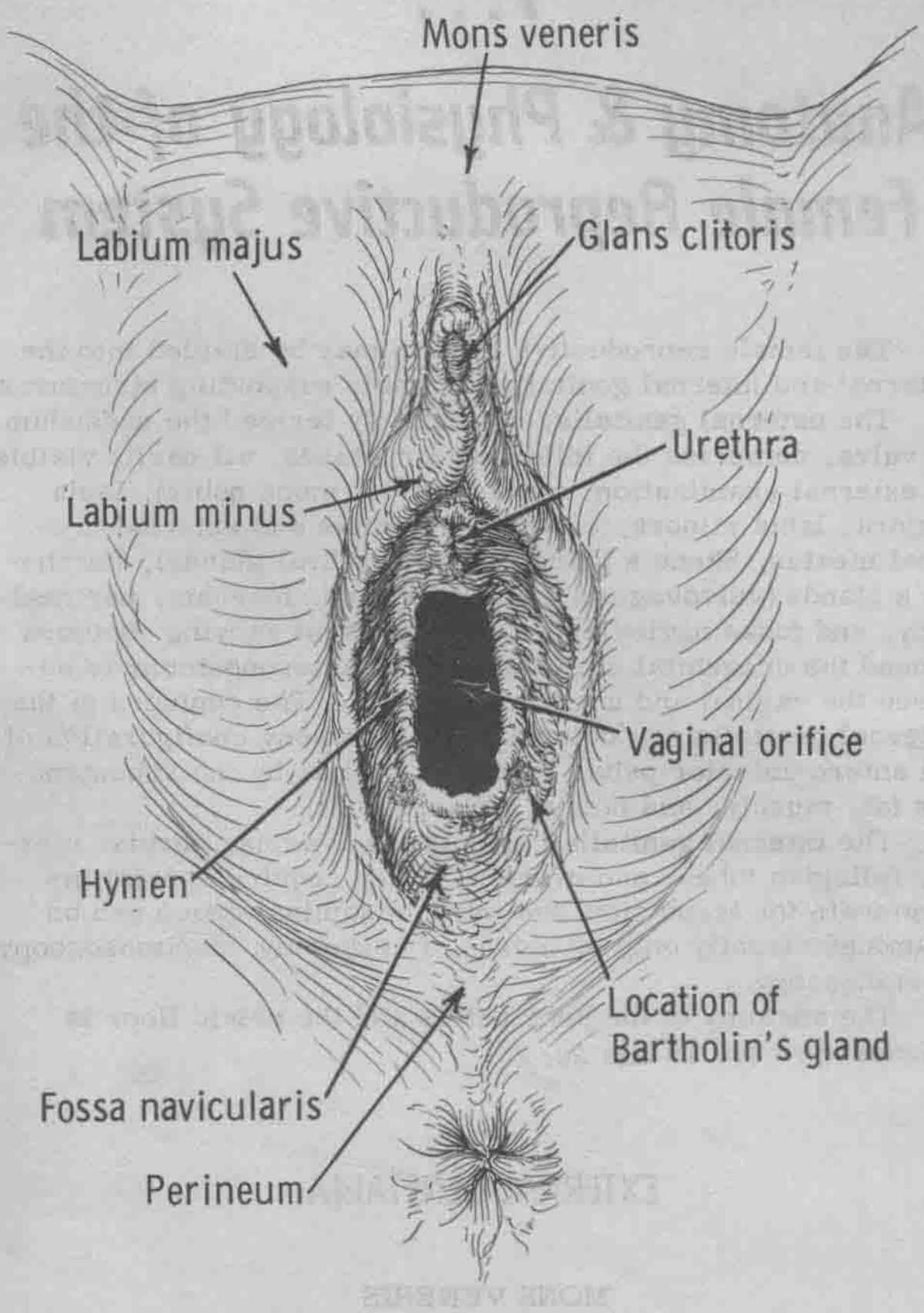

Fig 1-1. External female genitalia.

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 interest 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. 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 usually gape widely after childbirth 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 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. Normally the labia minora are in apposition, 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 divides 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 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. Fused labia minora in the infant 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 com-

posed 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 area between the labia minora is the vestibule. It contains the urethral, vaginal, and gland orifices. 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 with 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.

SKENE'S GLANDS
(Para-urethral 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 glands 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 are especially susceptible to gonococcal infection; infection is often first evident here. Following successful antigonorrheal therapy, nonspecific infection with other purulent organisms is common.

BARTHOLIN'S GLANDS & DUCTS (Paravaginal or Vulvovaginal 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 Bartholin's glands (paravaginal or vulvovaginal 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.

Gonorrhea frequently causes Bartholin's ducts to become abscessed and cystic, although the glands themselves are usually not affected. Nonvenereal bacterial infections uncommonly 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).

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 episiotomy can result in the loss of several hundred ml of blood; faulty repair may be followed by dyspareunia or by pelvic relaxation in later years.

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 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 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).

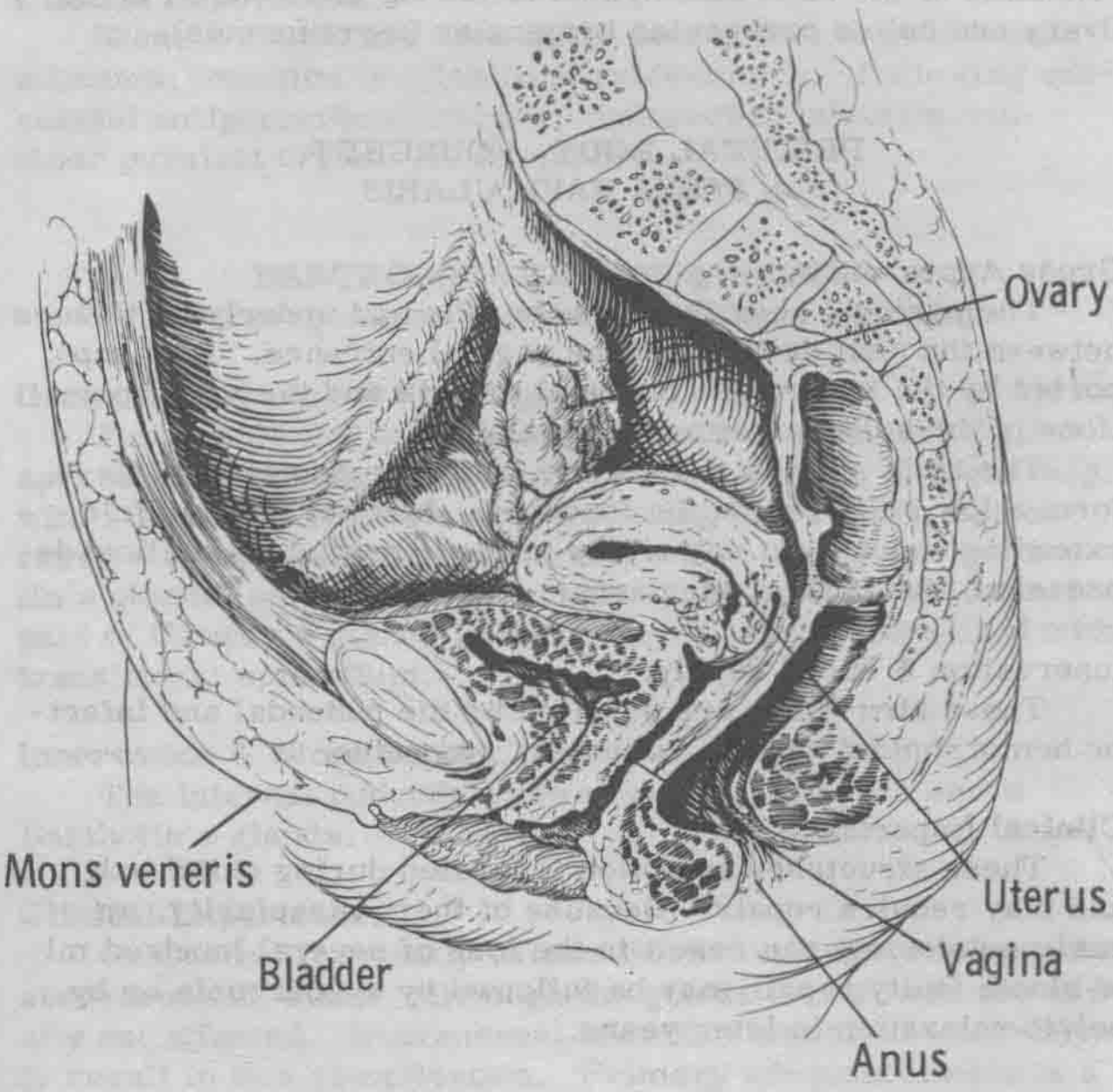

Fig 1-2. Midsagittal view of the female pelvic organs.

Histology.

The vagina is lined by mucous membrane, 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 external iliac and hypogastric nodes. This is important in vulvovaginal infections and cancer spread.

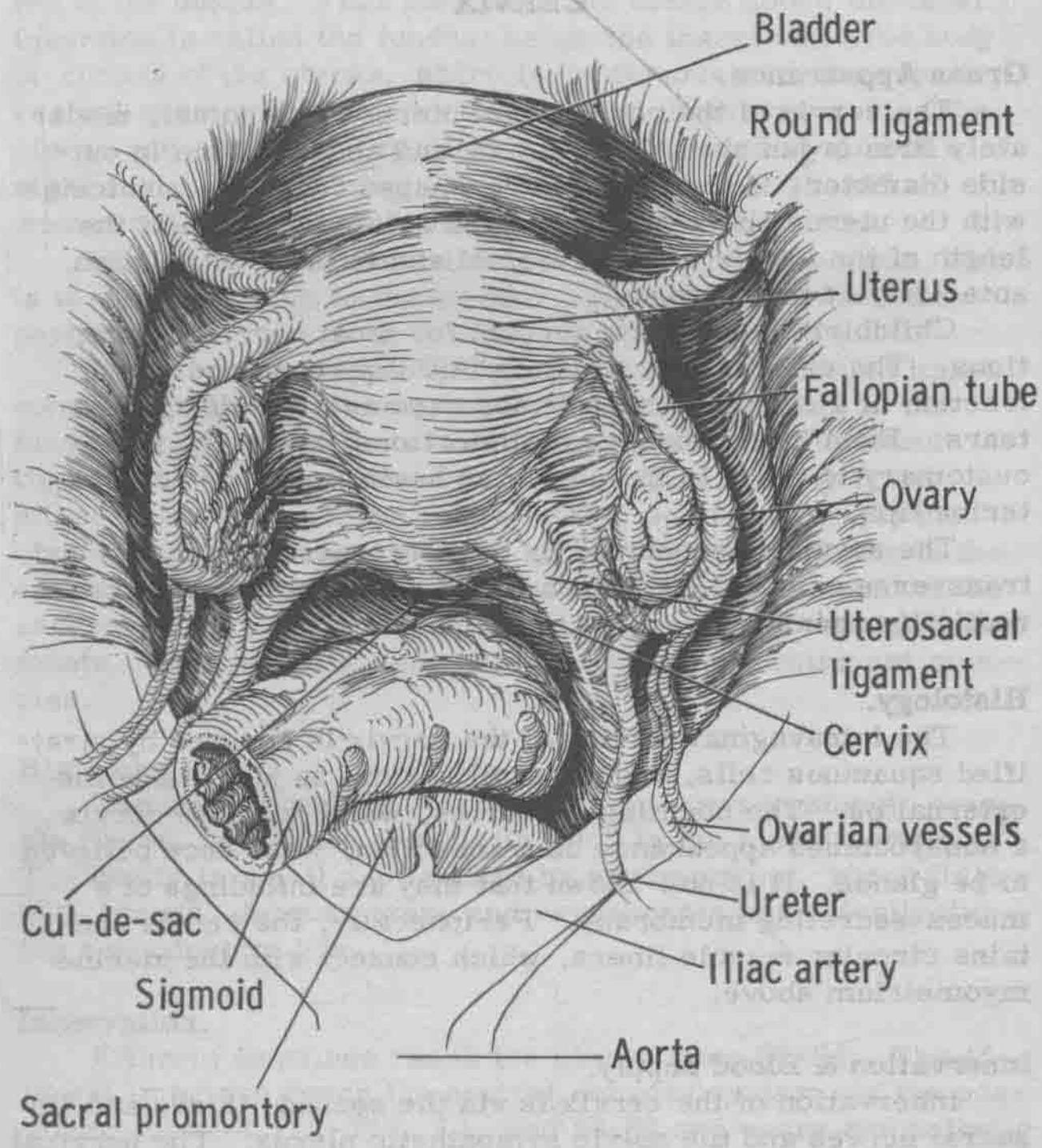

Fig 1-3. Pelvic organs (superior view).

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 exceedingly 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 in close relation anteriorly to the bladder.

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. Infection is a major cause of infertility; leukorrhea is often due to overactivity 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 in close relation to 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.

Histology.

The uterine wall is composed of interwoven smooth muscle fibers, which are especially thick in the fundal portion. The cavity is small and is lined by endometrium, which thickens, bleeds, desquamates, and regenerates periodically during reproductive life.

Innervation.

Efferent impulses reach the uterus from S2-S4. The afferent impulses reach the central nervous system via the posterior roots of T10-T12, L1, and S2-S4 and carry sympathetic stimuli.

Blood Supply.

The uterine circulation is derived from the uterine and ovarian arteries and veins. During pregnancy especially, these channels anastomose freely within the uterus and a much greater vasculature develops to supply not only the hyperplastic, hypertrophic uterus itself but also the growing placenta and fetus.

Clinical Importance.

The uterus is capable of enormous expansion to accommodate the products of conception. During pregnancy it increases in weight from about 30-40 gm to about 1 kg and its capacity is multiplied more than 4000 times. Normally, the fertilized ovum implants in the uterine cavity, where it develops through the embryonal and fetal stages. Delivery prior

to viability (28 weeks) constitutes abortion and, almost invariably, death of the fetus. After viability, the likelihood of survival of the newborn increases in direct proportion to the duration of pregnancy.

Uterine developmental anomalies and tumors cause gynecologic problems such as abnormal uterine bleeding and pelvic pain. These result in obstetric complications also—particularly dystocia.

Cancer of the uterine corpus is the second most common female genital malignancy, exceeded only by cervical carcinoma.

FALLOPIAN TUBES

Gross Appearance.

The fallopian (uterine) tubes are a pair of delicate, peristaltic ducts 10-12 cm in length. Each extends posterolaterally from the cornu of the uterus and opens into the peritoneal cavity just below and medial to the ovary on the same side. The diameter of the canal varies from 1-2 mm at either end to more than twice that in the midportion. The distal tube is connected with the ovary by a single elongated fimbria which retains the ovary and tubal extremity in close proximity.

Histology.

The fallopian tubes are composed of thin, superficial longitudinal and deep circular smooth muscle layers. They are lined by cuboidal epithelium (endosalpinx), which is similar to endometrium but has a sparse stroma. Many filmy transverse plicae or folds characterize the endosalpinx, especially in the distal half of the tube. The fallopian tubes are encased in a peritoneal fold, the mesosalpinx, a portion of the broad ligament of the uterus.

Structurally, the fallopian tubes vary in different segments. The distal end of the tube, which communicates with the peritoneal cavity through a minute opening (abdominal ostium), is fimbriated and almost erectile when turgid. The cavity of the distal 2-3 cm of the tube is termed the infundibulum because of its cornucopia-like shape. Continuous with this segment and about 6-8 cm long is the ampulla, which is somewhat dilated. The narrower isthmus, 1-2 cm in length, extends from the ampulla to the uterine wall. The portion of the tube within the uterus proper (the interstitial segment) is about 1 cm long. The lumen of the tube is narrowest at this end.

Innervation & Blood Supply.

The nerve supply to the tubes is similar to that of the uterus. The blood supply to the proximal portions of the tubes is via the uterine artery; to the distal portions, via both

the uterine and ovarian arteries. Drainage is via the uterine and ovarian veins. The ampulla drains laterally through the mesosalpinx and broad ligaments to the hypogastric and iliac nodes. The isthmus and infundibulum drain toward lymph nodes supplying the uterus and ovaries.

Clinical Importance.

The ovum is fertilized in the fallopian tube and, after 3-4 days of movement down the tube, implants in the uterine endometrium. If both tubes are completely occluded, conception cannot occur. With partial occlusion, retention of the fertilized ovum within the tube may result in a tubal pregnancy. Infection of the tube (salpingitis) with resultant scarring and occlusion is a common sequel to septic abortion or gonorrhea.

OVARIES

Gross Appearance.

The ovaries, or female gonads, are a pair of whitish, ovoid, flattened, solid organs, about $1.5 \times 3 \times 3.5$ cm, found in the true pelvis. In the nullipara, each ovary usually rests almost vertically against the peritoneum of the lateral pelvic wall in a shallow depression, the ovarian fossa. This space is bounded by (1) the obliterated umbilical artery medially; (2) the ureter and uterine vessels laterally; and (3) the obturator nerve and its accompanying artery and vein inferiorly. The fimbriated end of the tube usually curls up and over the superior medial aspect of the ovary.

The ovary is suspended between the lateral pelvic wall and the uterus by the mesovarium, which is part of the posterior segment of the broad ligament of the uterus. It is also loosely attached to the uterus by a band-like ovarian ligament, which traverses the broad ligament.

Histology.

The ovary is composed mainly of fibroareolar tissue. The cortex, or outer one-third to one-half of the ovary, is covered by a single layer of cuboidal cells, the so-called germinal epithelium. The cortical stroma is composed of characteristic spindle- or oat-shaped cells. The inner one-half to two-thirds of the ovary is the medulla.

The cortex of the newborn ovary contains thousands of ova in various stages of development. Before puberty each ovum is surrounded by a single layer of epithelial cells and is termed a primordial follicle. These follicles, each measuring about 0.25 mm in diameter, contain a single, eccentrically placed, large, well developed sex cell with a granular hyperchromatic nucleus. The epithelial layer is composed of