PELVIC ANATOMY
AND PATHOLOGY
The uterus, tubes and ovaries are attached to the woman with a number of structures, many of them misnamed. The broad ligament is not really a ligament but rather two leaves of peritoneum in between which run the uterine vessels, lymphatics and nerves. The base of this “ligament” condenses to form the cardinal ligament that does serve a suspensory function. When this ligament weakens the uterus may prolapse through the vagina.

The tubes are suspended on a mesentery called the “mesosalpinx”.

When a woman is lying supine the tubes and ovaries are usually behind the uterus. Ovarian tumors may, therefore, most easily be felt in the cul-de-sac by means of a rectal examination.

The corpus (fundus) of the uterus is actually a different organ than the cervix if one considers the histology, blood supply, innervation and function of the two. The uterus is primarily an ejector while the cervix retains. The cervix is composed primarily of connective and elastic tissue while the uterus is mainly composed of smooth muscle tissue. Traditionally both cervix and fundus are removed in a “total abdominal hysterectomy”.

The size of the fundus and cervix are a function of its estrogen environment. During fetal life it exists in a very high estrogen setting and the estrogen sensitive muscle hypertrophies with respect to the cervix. In the menopause it becomes much smaller. A newborn baby may “menstruate” after birth since there is a sudden estrogen withdrawal that occurs at delivery.

**ENDOMETRIOSIS, MYOMETRIUM, AND UTERINE SARCOMAS**

Endometriosis, myometrial lesions, and sarcomas of the uterus will be discussed in this section. Internal and external forms of endometriosis are recognized. Their clinical and morphologic features and pathogenesis differ. Benign smooth muscle tumors of the uterus will be covered with respect to their locations and their degeneration.

Abnormalities in the structure of the uterus will be presented. Sarcomas of the uterus are rare, but a large variety of types are recognized.
Endometriosis is the condition in which normal endometrial tissue resembling the uterine mucous membrane occurs aberrantly, usually in sites within the pelvic cavity. In internal endometriosis, or adenomyosis, the endometrial tissue is confined to the uterine musculature. It may be diffuse or it may occur in a localized area and produce a nodule known as adenomyoma. External endometriosis occurs outside the wall of the uterus. In general, when the term endometriosis is used without qualification, the external form of endometriosis is meant. Internal endometriosis usually is referred to as adenomyosis.

**ADENOMYOSIS**

Adenomyosis results from a benign extension of endometrium into the uterine musculature and is associated with hyperplasia of the myometrium. This uterus is greatly enlarged. Note the hemorrhagic foci that are apparent in many areas within the hypertrophied musculature. These foci are the result of recent and old hemorrhage in the areas of endometriosis surrounded by whorls of muscle fibers. This diffuse type of involvement by adenomyosis results in a diffusely enlarged uterus, but the enlargement may be asymmetrical.

The condition arises from endometrium that extends irregularly into the myometrium along the perivascular spaces. These spaces subsequently may become isolated. The aberrant endometrial tissue is derived from the basalis and mimics it in appearance. In this photograph, note the foci of endometrial tissue are surrounded by smooth muscle. Some of the glands are dilated. By definition, adenomyosis is not diagnosed unless the aberrant tissue is at least 2 low-power fields away from the basal part of the endometrium.

The foci of endometrial tissue are composed of epithelium, usually in the form of glands surrounded by a small amount of endometrial stroma. The adjacent musculature is hypertrophic. Rarely, adenocarcinoma may arise in foci of adenomyosis.

**ENDOMETRIOSIS**

Common sites of external endometriosis are indicated in the column at the left. They include the ovary, uterine ligaments, rectovaginal septum, pelvic peritoneum, and sigmoid colon. Endometriosis is encountered less frequently in the umbilicus, surgical scars, hernia sacs, appendix and intestine, vagina, vulva, and cervix. Rarely, endometriosis is encountered at more distant sites that include retroperitoneal lymph nodes and even the soft tissue of the thigh.

In the ovarian lesions, hemorrhagic cysts develop as the result of proliferation of the endometrial tissue and associated bleeding.
Endometriosis in the pelvic peritoneum and on serosal surfaces, such as this example on the surface of the uterus, results in thickening and fibrous adhesions. Small purple or red spots may be identified in these areas of fibrous proliferation.

Fibrous thickening and foci of hemorrhage are apparent on the serosal surface of this uterus. The fallopian tubes, broad ligaments, and ovaries are matted together by dense adhesions. Several hemorrhagic cysts are apparent in the ovaries.

In more advanced lesions, the fibrous adhesions are dense and may require sharp dissection to remove the involved tissue. "Chocolate" cysts are present in the ovaries.

Areas of endometriosis in the ovary are characteristically cystic, as illustrated in this histologic preparation. These areas often are hemorrhagic.

At higher magnification, the lining of such cysts at least partly consists of endometrial tissue, including epithelium lining the surface and endometrial stroma. Hemorrhage in the stroma is apparent in this section.

In some areas, glandular structures often are present in the endometrial tissue.

As the result of hemorrhage, the endometrial tissue is destroyed in some areas of endometriosis. In this illustration, endometrial tissue is apparent at the left, and granulation tissue and scar tissue are present at the right. The granulation tissue is infiltrated with lymphocytes and macrophages.

In this illustration of endometriosis of the ovary, altered blood is present in the cystic spaces and the wall is lined by granulation tissue, deep to which is a layer of scar tissue. Numerous foamy macrophages are present in the granulation tissue.

Endometrial tissue in aberrant sites is subject to the same proliferative and neoplastic changes as the endometrium that normally is found in the uterine cavity. In this illustration, atypical hyperplasia is present in an area of endometriosis of the ovary. In some instances, endometrioid carcinoma of the ovary develops as the result of progression of such a lesion. It is likely, however, that some ovarian endometrioid carcinomas arise from the germinal epithelium without preexisting endometriosis.

In this section of the uterine cervix, an area of endometriosis is present at the left and an adenoacanthoma developing in the endometriosis is present at the right.

The adenoacanthoma in the area of endometriosis is seen at higher-magnification. It is identical to the adenoacanthomas primary in the endometrium.
Endometriosis of the posterior cul-de-sac is seen in this colposcopic examination.

On biopsy, the area of vaginal endometriosis is illustrated. Note the endometrial-type epithelium and stroma and the areas of hemorrhage within this stroma.

Endometriosis of the umbilicus is illustrated in this clinical photograph. Although the umbilicus is one of the less frequent sites of endometriosis, it is a dramatic one. The patient bled from the umbilicus with each menstrual period.

Endometriosis of the anterior abdominal wall, away from the umbilicus, is relatively frequent in cesarean section scars. This specimen was obtained from such a scar. The patient had a history of periodic swelling and pain in the scar at the time of her menstrual period.

This is a nodule of endometriosis of the abdominal wall removed at the time of a repeat cesarean section. Note the results of the hormones of pregnancy on the endometriosis, including the pronounced decidual reaction.

Endometriosis of the intestinal tract occurs chiefly in the terminal ileum, sigmoid colon, and appendix. Note the hemorrhage and puckering of the serosa of the terminal ileum in this specimen.

After fixation of another specimen of endometriosis of the ileum, a cross section was made to demonstrate the marked narrowing of the lumen that results from the hypertrophy of the muscularis.

Histologically, endometriosis of the ileum results in hypertrophy of the muscular coat, usually with relatively slight fibrosis.

At higher magnification of the previous section, the areas of endometriosis are characterized by the dilated glands containing secretory products and the associated small amount of endometrial stroma.

The appendix is the site of endometriosis in this illustration. Appendiceal endometriosis rarely produces clinical symptoms. It usually is an incidental finding in an appendix removed for other reasons.

The direct transplantation of endometrial tissue to abdominal incisions at the time of cesarean section, or hysterotomy, has long been recognized as the source of one form of endometriosis. The theories of development of other instances of endometriosis include retrograde menstruation and blood vascular dissemination. In a given instance, any one of these theories may be correct.

**LEIOMYOMAS OF THE UTERUS**
Smooth muscle tumors of the uterus are very common; they occur in more than one third of women over the age of 35 years. The majority of these are small tumors, and the patients are asymptomatic. Of those patients who seek medical advice, the presenting complaints include discharge or bleeding from the vagina, pain, and pressure effect. The leiomyoma is a circumscribed - but not truly encapsulated - tumor. This lesion is firm, and it bulges above the adjacent myometrium on section. The myometrium retracts around it so that the tumor can be readily "shelled out." It is glistening gray and composed of interdigitating bundles of smooth muscle. The incidence of leiomyomas observed in black women is three times greater than the incidence in white women. A hormonal relationship has been suggested because leiomyomas apparently are more commonly associated with endometrial hyperplasia, polyps, and carcinoma. These tumors enlarge in pregnancy and decrease in size in the postpartum period.

Leiomyomas occur in intramural, subserosal, and submucosal locations. The subserosal and submucosal leiomyomas may become pedunculated. The submucosal leiomyomas are the most important clinically despite their small size because bleeding symptoms may occur. Leiomyomas also occur in the cervix and broad ligaments as well as in the fundus of the uterus.

The multiple leiomyomas in this uterus are intramural and subserosal. Some of the subserosal leiomyomas are pedunculated.

On dissection, the typical circumscribed masses with interdigitating whorls of tissue are apparent in this misshapen uterus.

Leiomyomas of the uterus originate from the smooth muscle cells of the myometrium. These lesions are composed of interdigitating bundles of spindle-shaped cells with abundant eosinophilic cytoplasm. Few mitoses are present. When the cells are cut in longitudinal planes, their spindle shape is readily apparent. When the cells are cut across, as seen in several foci in this photomicrograph, the nuclei appear round rather than elongated.

Leiomyomas of the uterus frequently undergo degeneration. The types of degeneration usually described include hyaline and cystic

The most frequently observed type of degeneration of leiomyomas of the uterus is hyaline degeneration. It is present to some degree in approximately 70% of the leiomyomas of the uterus. The areas of hyalinization are characterized histologically by acellular, uniformly eosinophilic areas. Because of the presence of large amounts of connective tissue within many of the leiomyomas, they often are known as fibromyomas or "fibroids."
The submucosal leiomyomas produce bleeding symptoms, caused in part by thinning of the overlying endometrium. At the time of menstruation, the exposed vessels are not capable of retracting in the usual manner. In addition, there is no basal zone from which the overlying thin layer of endometrium can regenerate.

These features are illustrated again in the microscopic appearance of this submucous leiomyoma. Note the thin layer of endometrium at the right over the surface of the leiomyoma.

Submucous, pedunculated leiomyomas may prolapse through uterine cervix. They are subject then to the development of infection and infarction.

In this instance, the submucous leiomyoma prolapsed through the cervical os and became infarcted and infected.

The inflammation in this partly necrotic leiomyoma is apparent histologically.

Necrosis in intramural leiomyomas also occurs relatively frequently as a result of obstruction of blood flow to the tumor. Only one artery supplies the leiomyoma. In many instances, the infarcted leiomyoma is red—the so-called red degeneration.

Some of the infarcted leiomyomas do not have the red appearance illustrated in the previous slide. In this instance, the area of necrosis is yellow.

The histologic appearance of the infarcted leiomyoma is one of a relatively homogeneous, eosinophilic mass.

At a somewhat later state, fibrous proliferation at the periphery and calcification may be evident. These necrotic leiomyomas often become almost completely calcified.

Massive edema occurs in leiomyomas, resulting in cystic degeneration.

The edema and early cyst formation are apparent in this microscopic preparation.

Some tumors of the uterus are composed of smooth muscle and adipose tissue, as illustrated here. These usually are designated as lipo-leiomyomas.

Microscopically, such tumors are composed of mature adipose tissue, areas of hyalinization, and scattered foci of smooth muscle fibers.

Atypicalities also occur in leiomyomas, so that they may be confused histologically with leiomyosarcomas. In all of these benign lesions, however, the mitotic rate is characteristically less than 5 per 10 high-power fields. In some
patients receiving hormones such alterations in leiomyomas occur. In this instance, the fibers are enlarged, occasionally multinucleate, and separated by edema fluid. Such alterations sometimes are designated as atypical leiomyomas. They differ from leiomyosarcomas in that mitoses are relatively infrequent.

Atypical leiomyomas of the uterus also occur in patients who are pregnant.

This illustration is of an intramural smooth muscle tumor that grossly is not suspect for malignancy.

Histologically, the tumor is very cellular. The nuclei are relatively uniform, and mitoses are extremely difficult to identify. This type of smooth muscle tumor usually is designated as a cellular leiomyoma.

In other smooth muscle tumors that grossly are not thought to be malignant, areas of very unusual cells may be found. In these bizarre leiomyomas, some areas of rather characteristic leiomyoma are present, as is seen in the bottom part of this illustration. The pleomorphic cells in the upper half of the photograph are quite striking.

At higher magnification, the bizarre multinucleate and pleomorphic nuclear patterns are apparent.

The lesion known as leiomyoblastoma (epithelioid leiomyoma, clear cell leiomyoma) is illustrated. These tumors have been reported more frequently in the wall of the gastrointestinal tract, especially the stomach. They are unusual smooth muscle tumors that may give rise to metastases occasionally, and the mitotic index may not give evidence of this occurrence. The leiomyoblastoma is characterized by the following features: the cytoplasm of the cells often is clear; in areas of the tumor, hyalinization around individual cells is present; and association of tumor cells with blood vessels with apparent origin from the walls of the vessels is discernible. All of these features are illustrated in this photograph. In this case, metastases were present.

Intravascular leiomyoma of the uterus is a rare tumor. It is characterized by nodular masses of histologically benign smooth muscle growing within veins. The intravascular growth takes the form of visible, worm like projections that may extend variable distances in the uterine and hypogastric veins. Direct extension from the pelvic veins into the inferior vena cava and into the right atrium has been reported, and in some instances, the result has been fatal. The lesion may arise either from the wall of veins within the myometrium, or as the result of unusually extensive vascular invasion from a leiomyoma of the myometrium. Growth of the lesion beyond the uterus usually is present. Leiomyomatosis peritonealis disseminate is a rare, bizarre entity characterized by the presence of subperitoneal nodules, seemingly composed of smooth
muscle disseminated throughout the abdominal cavity. The lesions are characteristically described in association with pregnancy, but cases occur in nonpregnant women. The condition usually has a favorable clinical prognosis.