

vessels called the "pars intermedia." The bulbs are covered by the sphincter vaginae muscle (bulbo-cavernosus). This is the homologue of the fused *bulbo-cavernosus* muscle in the male. We also see the anterior fibres of the

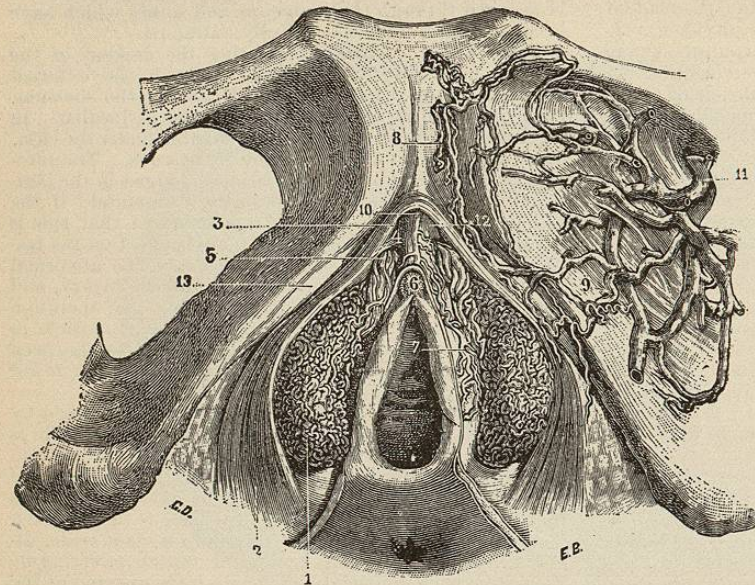


Fig. 3800.—The Bulb of the Vagina with the Venous System of the Clitoris, Viewed from in front. (After Kobelt.) 1, Bulb; 2, constrictor muscle; 6, glands of clitoris; 9, communication with the obturator veins; 13, cavernous body.

levator ani muscle embracing the vagina as they do the prostate gland in the male.

The *superficial fascia* and *Colles' fascia* have the same attachments as in the male, but differ in being perforated by the vagina.

The glands of Bartholin and Duverney are situated on each side of the commencement of the vagina behind the triangular ligament, and correspond to Cowper's glands in the male. Their ducts open on each side between the hymen and labium minus. It is not uncommon to have abscesses connected with these glands, to cure which they have to be dissected out.

The *clitoris* and *nymphæ* correspond to the penis in the male. The clitoris is composed of two corpora cavernosa and a rudimentary glans. It is much smaller than the penis, and is not perforated by the urethra. The corpora cavernosa are attached to the inner side of the pubic arch in front of the triangular ligament, and, as in the male, are covered by a muscle, the ischio-cavernosus (erector clitoridis). The glans is surrounded by a membranous fold, which is the homologue of the prepuce in the male.

The *vulvar cleft* opens on the surface between the two labia majora; anteriorly opening into this cleft is the urethra, and posteriorly is a recess called the fossa navicularis, and in the centre is the vagina. The space anteriorly between the clitoris and the urethra is called the vestibule, and this is bounded on each side by a labium minus.

The *labia majora* are two thick folds of skin covered with hair and united in front to form the mons veneris. In each labium are blood-vessels and dartous tissue as in the scrotum of the male, of which they are the homologue. The vestibule corresponds to the lower prostatic and membranous portion of the urethra in the male.

On separating the labia majora the nymphæ or labia minora are seen. These are folds of skin which are continuous above with the prepuce of the clitoris and below join the *labia majora* about the centre. As a rule they do not project beyond the labia majora, but in the dark races they are of larger size and project considerably be-

yond the vulvar cleft. In old age they are also more prominent.

The *hymen* is a thin fold of mucous membrane of vari- partially occludes the vaginal orifice; in some cases the vaginal orifice is completely closed, and then we have what is called an *imperforate hymen*. Occasionally the hymen is absent or has been destroyed by inflammatory action in childhood. Its presence is not necessarily a proof of virginity nor is its absence significant of the loss of the same. When the hymen has been ruptured, and in women who have borne children, the remnants are seen as small rounded elevations called "carunculæ myrtiformes."

The vessels and nerves of the female perineum do not differ essentially from those of the male; the pudic artery is smaller, while the superficial perineal artery going to the labia is larger. Owing to the small size of the clitoris as compared with the penis, the nerves and blood-vessels supplying it are much smaller.

The *Perineal Body*, or the so-called perineum of the obstetrician, fills in the space between the vagina and the rectum; in section it is triangular in shape, with the base of the triangle downward, corresponding to the skin between the posterior part of the vagina and the anterior border of the anus. Anteriorly is the fossa navicularis, and posteriorly is the rectum. The perineal body measures at its base about one and one-quarter inches from before backward, and laterally extends from one tuberosity to the other; in this space is the tendinous point of the perineum, to which are attached several muscles, such as the levator ani, sphincter ani, transversus perinei, and sphincter vaginae. Laterally we have the ischio-caver-

laris, and posteriorly is the rectum. The perineal body measures at its base about one and one-quarter inches from before backward, and laterally extends from one tuberosity to the other; in this space is the tendinous point of the perineum, to which are attached several muscles, such as the levator ani, sphincter ani, transversus perinei, and sphincter vaginae. Laterally we have the ischio-caver-

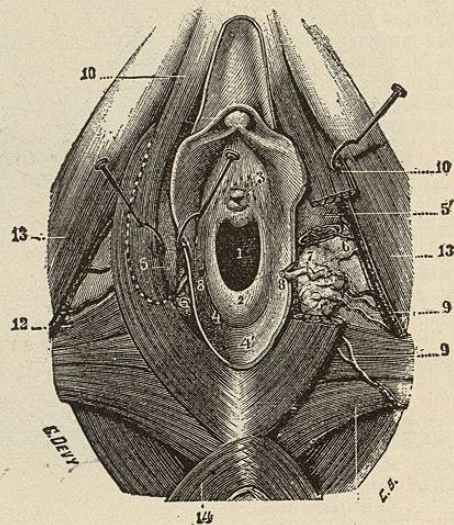


Fig. 3801.—Dissection of the Vulvo-vaginal Orifice with the Glands of Bartholin. 1, Orifice of vagina; 2, hymen; 3, meatus urinarius; 4, navicular fossa; 5, bulb of vagina; 6, vulvo-vaginal or Bartholin's glands; 7, 8, duct with opening cut through orifice of vagina; 10, constrictor vaginae partly resected on left side to show the glands of Bartholin; 11, transversus perinei muscle.

nosi muscles. Running across the perineal body we have a transverse septum which, in the female, is very strong and consists of connective tissue, yellow elastic tissue,

and involuntary muscular fibres; it can be felt as a hard body when examined through the posterior commissure of the vagina. The "perineum" is a highly distensible body, as is well seen in childbirth, when it is almost obliterated. Above the perineal body the vaginal and rectal walls are in apposition, loosely connected with areolar tissue. This so-called perineum is frequently torn in first labors, and if the rent be not sewed up immediately so as to enable union by first intention to take place, the vaginal orifice will be much enlarged and the support of the perineal body be lost. Occasionally these rents extend into the rectum, and a very miserable condition results, there being partial or complete incontinence of fæces. Operations undertaken for the repair of this condition are most successful even when of old standing. It is, however, much better to repair the rent as soon as possible after its occurrence.

Tearing of the perineum with general relaxation of the pelvic floor and increase in the intra-abdominal pressure predispose to prolapse of the uterus. This condition is rarely seen in the nullipara or in well-to-do multipara. It is the hard-working woman, who gets up to work too soon after childbirth, in whom this condition is most frequently seen.

Francis J. Shepherd.

PERIOSTEUM, ACTINOMYCOSIS OF.—Actinomy- cosis is rarely primary in the periosteum; but the periosteum is not infrequently involved by direct extension from actinomycotic processes in neighboring structures. In primary actinomycosis of the mouth the periosteum of the jawbone is first involved, later the bone; in actinomy- cosis of the lungs the process may extend to the pleura and thence to the periosteum of the ribs and vertebrae. In these cases of secondary extension there occurs first an *actinomycotic periostitis* with formation of granulation tissue. As a result of this a superficial caries is produced and the interior of the bone becomes involved. Here the process develops more rapidly, the bone becomes filled with granulation tissue, and expands into a honeycombed shell. Over this the periosteum may develop irregular masses or spicules of bone or thick layers of fibrous tissue. The microscopical picture is that of a strong re- active inflammation; numerous mast and plasma cells are present. The clinical and diagnostic features are given under the head of *Actinomycosis*.

Aldred Scott Warthin.

PERIOSTEUM, TUBERCULOSIS OF.—Primary tu- bercularis of the periosteum is regarded by most writers as a very rare condition; but it probably is of not infre- quent occurrence. Though the majority of cases of pri- mary tubercularis of the bones are of myelogenous origin, there can be little doubt that numerous cases begin as a *tubercularis periostitis (periostitis tuberculosa)*. The process begins with the formation of a granulation tissue be- neath the inner layer of the periosteum. This shows lit- tle tendency to caseate, but on the other hand becomes ossified. Small tubercles are found in the early stages, but the process shows a great tendency to self-healing through the formation of bone (ossifying periostitis). As a result of such healing, exostoses or hyperostoses are formed. The writer believes that many of the so-called inflamma- tory local hyperplasias of bone are tubercularis in origin. In other cases the process may break through the peri- osteum and a tubercularis sinus or a "cold abscess" may be formed; or in some cases the bone becomes involved, and the clinical picture becomes that of a bone tubercu- losis. Superficial caries may follow, either with or without the formation of deep foci. As in the case of gummatous periostitis, pseudo-cysts may be formed by the liquefac- tion of encapsulated caseous areas. The cyst wall may be bony. Secondary tubercularis of the periosteum is very common in connection with bone or joint tubercu- losis.

Aldred Scott Warthin.

PERIOSTEUM, TUMORS OF.—The primary tumors of the periosteum belong wholly to the connective-tissue growths. They are both benign and malignant; the

former, usually arising from the inner osteogenetic layer of the periosteum, are covered by its outer fibrous layer; the latter break through the fibrous layer and invade the neighboring tissues. Occasionally both benign and malig- nant forms may arise from the outer layer.

Benign Growths.—The *osteoma* is the most common benign growth of the periosteum, occurring usually as a circumscribed bony growth, termed an exostosis. The periosteal osteomata are classed by some writers under the general term *osteophyte*; but by others the latter term is used to indicate a very small bony growth of the periosteum. Larger, more diffuse periosteal osteomata are known as *hyperostoses*. A *circumscribed hyperostosis* differs from an exostosis in being less circumscribed and more superficial. According to their structure the periosteal osteomata may be classed as: *exostosis eburnea*, composed of hard compact bone without marrow spaces; *exostosis spongiosa*, composed of spongy bone about equally made up of bone tissue and marrow spaces; and *exostosis medullaris*, containing very large marrow spaces. The mar- row in the exostoses presents the same general appearance as the bone marrow proper. According to histogenesis the periosteal exostoses may be divided into two classes: those arising from the connective-tissue of the periosteum (*exostosis fibrosa*), and those of cartilaginous origin (*exos- tosis cartilaginea*). The former may arise either from the inner or from the outer layer of the periosteum; in the first case they are immovable (*immovable periosteal exostosis*), in the latter they are movable (*movable periosteal exostosis*). The cartilaginous exostoses may arise from a proliferation of the periost-perichondrium, usually from the epiphyseal cartilages. They occur most frequently in young chil- dren and are usually multiple. In other cases cartilage may first form from the periosteum, and this may later develop into bone. Exostoses are found most frequently on the cranial bones, the bones of the trunk, and the long bones of the lower extremities. Many of them are not neoplasms strictly, but are hyperplasias of inflammatory origin.

Chondroma of the periosteum is of less frequent occur- rence. It may develop from the inner layer (*immovable periosteal chondroma*) or from the outer layer (*movable periosteal chondroma*). The cartilage may be formed from pre-existing cartilage (*epiphyseal*), or from connec- tive tissue, or from embryonal inclusions of cartilage *Anlage*. They occur most frequently upon the short bones of the extremities, the shoulder blades, the ribs, and the femur. They are very likely to undergo secondary changes: myxomatous degeneration, calcification, etc. They show a marked tendency toward malignancy. *Osteochondroma* of the periosteum sometimes occurs; and there is also a peculiar growth, the *osteoid chondroma*, which may reach an enormous size. It is found chiefly on the long bones of young individuals and shows a tendency to become malig- nant. The surface of the growth is usually smooth, the cut surface partly hyaline and transparent, partly lamel- lated and reticular.

Fibroma of the periosteum is rare. It occurs most fre- quently in the periosteum of the bones of the mouth and nose (fibroid epulis and fibroid polyps). Through exces- sive development of blood-vessels the growth may as- sume the character of a telangiectatic fibroma. It is also very likely to become calcified (*fibroma ossificans*) or to undergo myxomatous change. Malignant changes may develop.

Myxomata arise rarely from the periosteum. They are seldom pure myxomata, but present the appearance of myxochondroma, myxofibroma, myxosarcoma, etc. They form round or oval masses covered on the outside by a dense layer of fibrous tissue.

Lipomata of the periosteum are known as parosteal lipomata. They are very rare, and are nearly always congenital. They usually contain areas of striped muscle fibres. The exact nature of these growths is not yet known. They have been reported as occurring on the anterior surface of the cervical vertebrae, body of the pubis, frontal bone, scapula, etc.

Angiomata of the periosteum are very rare. They

have been observed on the cranium and sternum. An ectatic condition of the blood-vessels is very common in all of the tumors arising from the periosteum.

Pseudo-cysts may be formed beneath the periosteum as the result of the liquefaction of the contents of subperiosteal hæmatomata or of subperiosteal tubercles or gummata.

Sarcoma is the most important of the primary growths of the periosteum, and—next to the periosteal exostosis—of most frequent occurrence. It may occur at any age, but is more frequent in the young. The periosteal sarcomata may occur in any part of the skeleton, but are more frequently seen near the ends of the long bones, particularly of the lower extremities. They may be divided into the *hard* and the *soft* forms. The soft growths show a variegated surface, and usually contain areas of softening and extravasation; the firmer whitish portions of the growth may be homogeneous or fibrous. The harder growths are usually whitish, and present a more or less fibrous, radiating surface. As a rule, the growths are more or less nodular. Originating in the majority of cases from the inner layer of the periosteum, the growth assumes a more or less spindle shape and tends to surround the bone. Later, it breaks through the periosteum and invades the soft tissues adjacent.

Microscopically, the periosteal sarcomata represent nearly every form of sarcoma: round cell, spindle cell, polymorphous cell, giant cell, alveolar forms, fibrosarcoma, osteosarcoma, osteoid sarcoma, chondrosarcoma, osteochondro-sarcoma, myxosarcoma, angiosarcoma, and numerous combination forms. The most common variety is the spindle-cell form containing bone or osteoid tissue. The most cellular, and consequently the softest forms, are the most malignant. The malignancy of the different varieties varies somewhat with the location. The giant-cell epulis of the jaw is of relatively slight malignancy, but a growth of the same structure on the long bones is much more malignant. The hard fibrosarcoma, and the osteo-, chondro-, and osteoid sarcoma, often show relatively slow growth and but little tendency to set up metastases; but under certain conditions any one of these forms may take on an increased malignancy. Metastases of periosteal sarcomata usually appear first in the lungs, later in the lymph glands, and finally in any part of the body. The metastases are frequently of a softer and more cellular nature than the primary, but may develop bone or osteoid tissue or even cartilage.

As the result of the growth of the periosteal tumor the bone may become infiltrated and rarefied, and in some cases undergo spontaneous fracture; or in other cases there is set up, in the neighborhood of the tumor, an ossifying osteomyelitis which leads to the most marked sclerosis of the bone. New bone is very frequently formed in the sarcoma, particularly next to the old bone upon which the tumor rests, so that the latter seems to spring from an osseous base. In other cases trabeculae or delicate spicules of bone may be formed in a radiating manner through the tumor mass, or irregular bony masses or spicules may be scattered through it (ossifying sarcoma or osteosarcoma). The degeneration of portions of the growth, as is commonly seen in the softer varieties, may lead to cyst formation, or to ulceration, abscess formation, or gangrene, as the result of secondary infection. Large hæmatomata may result from hemorrhage into the tumor. With the exception of the epulis and the hardest forms, sarcoma of the periosteum usually runs a malignant course. The growths show a great tendency to recur after operation, and as a rule they give rise to metastases.

Secondary tumors of the periosteum are not infrequent; both sarcoma and carcinoma may invade the periosteum from primary growths of neighboring structures. Secondary carcinoma is the more frequent. Caries and secondary involvement of the bone may result. An ossifying periostitis is almost always set up, so that the secondary tumors come to be more or less surrounded by newly formed bone, or contain irregular bony masses or spicules.

Aldred Scott Warthin.

PERIOSTITIS. See *Osteitis, etc.*

PERISTALSIS. See *Intestinal Movements.*

PERITONEUM. (ANATOMICAL.) See *Abdomen.*

PERITONEUM, NEW GROWTHS OF.—Primary tumors of the peritoneum are relatively rare; secondary involvement by malignant tumors, which are primary in some one of the abdominal or pelvic organs, is on the other hand of very frequent occurrence. Further, tumors which are primary in the retroperitoneal tissues are to be placed in a separate class from those which are primary in the tissues of the peritoneum proper, that is, which develop either from the endothelium or from its basement membrane.

Primary Peritoneal Growths.—The most important of the primary growths of the peritoneum is the *endothelioma*, often called *endothelioma carcinomatousum* or *endothelial cancer*. By some writers it is spoken of as *primary carcinoma* of the peritoneum, but the latter usage is confusing and should be avoided. The designation primary carcinoma of the peritoneum should be applied only to those rare carcinomata of the peritoneum which arise from the columnar epithelial cells of embryonal inclusions of intestinal *Anlage*. The primary *endothelioma* of the peritoneum forms multiple flat plaques or flattened nodules, which are more or less confluent or bound together by flattened cords or strands. Rarely the nodules may be larger and more elevated. About the larger plaques there are often seen numerous minute flattened nodules, solitary or becoming confluent into little groups. The color is usually white and the consistency soft; in some cases it is hard and firm (endothelioma fibrosum). The peritoneum about the plaques is more or less thickened. In many of the nodules a yellowish caseous centre is present, the appearances closely resembling small caseating tubercles. A serous or sero-fibrinous exudate, usually hemorrhagic, is often present in the early stages; in the advanced stages it is invariably so. Microscopically the flattened tumors are found to consist of a firm connective-tissue stroma enclosing cords and strands of cells, which are often low columnar, and arranged upon a basement membrane after the manner of gland cells; so that the tumor possesses a distinctly *tubular* character. In many of the tubule-like cords an apparent lumen may be seen. The surface endothelium is usually absent over the larger plaques and nodules, but over the small ones it may be greatly thickened, forming a layer consisting of many strata of cells. Simple necrosis and caseous necrosis are found throughout the larger growths, and occasionally there is a mucoid change. The vascular supply is usually rich. The cells of the tumor appear to rise both from the surface endothelium and from the endothelium of the lymph spaces and vessels (*endothelioma lymphangiomasum*). The anastomosing cords and strands follow the lymphatics. Metastasis into the solid organs is rare; secondaries when found occur in the pleura, dura mater, or other serous membranes. The pleura may be involved by direct extension. The growth is identical in structure with the flat tubular endothelioma of the other serous membranes; and it should be borne in mind that the peritoneal growths may be the result of direct extension from the pleura or they may be metastatic. The writer has seen one case in which the peritoneum, pleura, and dura seemed equally involved; and the only apparent reason for assigning the primary origin to the peritoneum was the greater area involved in the case of this membrane.

Primary angiosarcoma of the peritoneum occurs very rarely. It may develop as a plexiform angiosarcoma, consisting of newly formed blood-vessels, whose walls proliferate and form cylindrical masses of cells. Myxomatous change is not infrequent in these growths (*myxo-angiosarcoma*), and under such conditions the tumor may be mistaken for a colloid carcinoma. In other cases the sarcoma may show the structure of a *perithelioma*. Kaufmann describes a case in which the entire perito-

neum was covered with small warty or flattened nodules of grayish-red color and very vascular. Ascites was present, and the surface of the growths was covered with a thick fibrinous exudate.

Primary carcinoma of the peritoneum is of very rare occurrence. The cases observed have been of a cylindrical-cell variety, with mucoid change (colloid carcinoma), and the growth advanced diffusely over the peritoneum. According to Birch-Hirschfeld the origin of these growths is from the epithelium of embryonal "rests" of intestinal *Anlage*.

Primary benign tumors of the peritoneum are rare. *Lipoma*, *fibroma*, *myxoma*, and *chylangioma* have been observed. The lipomata arise chiefly as tumor-like hyperplasias of the epiploic appendices or from the omentum. The cases of fibromata and myxomata reported as arising in the peritoneum are of somewhat doubtful nature. Inflammatory hyperplasias of connective tissue may have been mistaken for neoplasms. The majority of the benign growths undoubtedly arise in the retroperitoneal tissues. Polypoid lipomata of the peritoneum may become freed through tearing of their pedicles; as free bodies they are likely to become calcified.

Mesenterial cysts (*chyle cysts*, *cystic lymphangiomata*) are of rare occurrence. They have been observed in children. They form bladder-like, thin-walled cysts, which often reach a large size, holding several litres of fluid. The intestines may be adherent to the anterior surface of the cyst, and thus give rise to percussion signs of an area of tympanitic dulness passing over an area of absolute dulness.

Decidua-like proliferations of the peritoneum occur during pregnancy. They are usually confined to the pelvis, but may spread over a larger part of the peritoneum. After delivery they undergo resolution and become calcified.

Secondary Growths.—Secondary carcinoma of the peritoneum is of very frequent occurrence. The primary is most often located in the stomach, pancreas, gall-bladder, intestine, testis, ovary, or uterus. The peritoneum may be involved by *contiguity*, by *continuity*, or by *metastasis*. In the latter case a *dissemination* or *implantation metastasis* may occur over the entire peritoneum; the deeper parts, the pelvis, flanks, and root of mesentery, showing the most extensive growth. The dissemination of the growth is aided by the accompanying ascites, which is often very great. This may be secondary to the development of the carcinoma, or it may occur before the latter. It is usually hemorrhagic in character. In some cases the development of the peritoneal secondaries is very rapid, partaking of the nature of an inflammatory process, and giving the clinical picture of a peritonitis (*peritonitis carcinomatosa*); or in other cases the secondaries may form scattered or confluent nodules (*carcinosis peritonei*). In the latter case ascites may or may not be present; in the former it is always present to a greater or less extent. The nodular and the diffuse forms pass into each other without sharply defining lines.

The general characteristics of secondary carcinoma of the peritoneum depend upon the nature of the primary growth. *Adenocarcinoma* forms usually nodular peritoneal metastases; they are chiefly located on the under surface of the diaphragm, in the flanks, pelvis, and omentum. The nodules are white, soft, often showing mucoid change. The arrangement along the lymphatics is often very striking. Confluence of the nodules gives rise to flattened warty masses. *Medullary carcinoma* forms soft nodules of large size, showing necrosis, umbilication, hemorrhage, etc. The metastases of this variety into the peritoneum are less common than are those of the other forms. *Scirrhus* carcinoma forms a diffuse fibroid thickening of the entire peritoneum, accompanied by peritonitis which often covers up the appearances belonging to the new growth. The small intestines may be contracted into a hard mass not larger than the fist. The appearances are those of a chronic fibroid peritonitis rather than of a new growth, and the condition is often mistaken for the same. On section the thickened serosa

is hyaline, hard, and tendon-like. In all cases in which such fibroid change of the peritoneum is found, the lymph glands should be carefully examined for metastases, secondary scirrhus being more easily recognized in the lymph glands than in other structures. The pylorus, gall-bladder, and prostate should be thoroughly examined for the primary, which may be of insignificant size. The diffuse *mucoid* or *colloid carcinoma*, which is usually primary in the stomach, gall-bladder, or testis, produces very marked and characteristic appearances in the peritoneal cavity—particularly in the omentum and in the neighborhood of the stomach. The entire peritoneum may be infiltrated. The serosa, in particular of the omentum, is greatly thickened, covered with glassy, translucent, yellowish or yellowish-red masses containing mucin. The omentum may be changed into a thick, homogeneous mass, through which run strands and fibres of connective tissue enclosing the colloid substance (honeycomb appearance). The smaller, younger nodules may be white, opaque, and firmer. The *cystocarcinoma* of the ovary or testis may give rise to extensive peritoneal metastases, the entire surface of the membrane being sometimes composed of cysts filled with a mucoid substance. The peritoneal cavity may become entirely filled with a colloid-like mass. Psammocarcinoma of the ovary may give rise to peritoneal metastases, containing calcareous masses.

Secondary Sarcoma of the peritoneum is more rare; melanotic sarcoma, myxosarcoma, lymphosarcoma, osteosarcoma, chondrosarcoma, spindle-cell sarcoma, and angiosarcoma have been reported.

Primary cystadenoma of the ovary may give rise to implantation metastases or may involve the peritoneum by continuity, spreading first over the broad ligament and then over the peritoneum. In the case of the papilliferous cystadenoma or surface papilloma of the ovary, portions of papillae may be broken off and transported by gravity, peristalsis, or movement of ascitic fluid, and may develop over the peritoneum, wherever they may lodge. Rupture of an ovarian cystadenoma may lead to the covering of the peritoneum with mucoid or colloid material, which, becoming partially organized, gives rise to the condition known as *pseudomyxoma peritonei*. This is not of the nature of a neoplasm, but represents a reaction on the part of the peritoneum, tending to organize the foreign substance spread over its surface. If in the colloid or mucoid substance living epithelium or portions of papillae are transported, these may grow and form benign growths which later may become malignant. As a rule, such transported epithelium usually dies or forms small cysts which remain stationary after reaching a certain size.

Transplantation Metastasis.—In puncture for the relief of ascites or in operations for the removal of malignant tumors, abdominal metastases may be set up in the puncture or in the seat of surgical wounds (*inoculation metastases*).

Dermoid cysts and *teratomata* occur in the peritoneum of the pelvis, in the mesentery, and in the omentum. In the latter case a primary tumor of the ovary may become adherent to the omentum and later lose its connection with the former organ.

Pseudo-cysts arise from collections of exudate between peritoneal adhesions.

Primary retroperitoneal tumors are much more frequent than those primary in the peritoneum. *Lipomata* of large size (sixty-three pounds) have been reported. They may be mistaken for ovarian cysts. It is important to note that the retroperitoneal lipoma forms an elastic, fluctuating tumor, from which on aspiration no fluid can be drawn (pseudo-fluctuation). *Myxolipoma*, *fibroma*, *myxoma*, *fibrosarcoma*, *myxosarcoma*, and *angiosarcoma* of the retroperitoneal region have been described. The writer has seen a round-cell sarcoma, apparently primary in the retroperitoneal tissue, weighing eighty pounds. The retroperitoneal organs were not directly involved and showed only changes due to pressure. Secondary ma-

lignant tumors in the retroperitoneal lymph glands are of frequent occurrence in carcinoma of the uterus, etc. (See also *Omentum*.) *Alfred Scott Warthin.*

PERITONEUM, SURGICAL AFFECTIONS OF.—The anatomy and physiology of the peritoneum are discussed under the heading *Abdomen*. (*Anatomical*.) The pathology of acute and tuberculous inflammation will be found in the article on *Peritonitis, Septic and Tuberculous*, in THE APPENDIX. Under the heading *Diaphragm* will be found a description of subphrenic abscess and its treatment, while additional information in regard to the peritoneum may be found in the articles entitled *Abdomen*. (*Surgical*); *Abdominal Tumors*; *Appendicitis*; and in the article immediately preceding this. In the present article the surgical treatment of lesions of the peritoneum is briefly given.

Acute traumatism of the peritoneum is of little significance apart from traumatism of the organ which the peritoneum covers. The effect of direct injury to the peritoneum is often the formation of adhesions between opposed peritoneal surfaces. A familiar illustration of this is seen in umbilical and inguinal herniæ. Such adhesions will produce slight or serious symptoms, according to their situation and extent. If the attachments are between unimportant organs (for instance, between the omentum and the parietal peritoneum), occasional discomfort may be the only result. If more sensitive organs are involved (for example, the stomach or the intestine) the pain suffered may be very great and the function of the affected organ may be seriously interfered with. Furthermore, such adhesions in the form of bands are a not infrequent cause of intestinal obstruction.

Adhesions due to a single traumatism or to an acute attack of inflammation tend to atrophy, and in the course of time they may completely disappear. Thus the scar of a laparotomy may for a time be attached to visceral peritoneum, while at a second laparotomy performed some months afterward it may be found entirely free. Adhesions are due to a loss of peritoneum resulting from traumatism or inflammation. If, therefore, raw surfaces can be avoided at operation, resulting adhesions will be reduced to a minimum. This can be accomplished in several ways. The peritoneum can be sutured over the pedicles of tumors and over fresh wounds. Or, if the peritoneum in the vicinity is not sufficient for the purpose, the omentum may be used to cover the raw surface by stitching it in place; or grafts may be cut from the omentum and stitched over the raw surface; or, finally, sterile peritoneum from the ox may be stitched over the raw surface. This method has been recently advocated by Morris, who has given the name "cargile membrane" to artificial peritoneum of this sort.

For clinical and therapeutic purposes acute inflammation of the peritoneum is best divided into circumscribed and diffused, or general peritonitis. If the circumscribed peritonitis is not purulent, it may be treated by rest, external cold, etc., unless the organ from which it springs requires more radical treatment—for example, circumscribed peritonitis due to threatened perforation of the appendix. If the circumscribed peritonitis is purulent, such symptomatic treatment is dangerous, since no one can say how soon the inflammation may break through the fibrinous adhesions which circumscribe it and spread to other parts of the peritoneum. Therefore it should be relieved by incision and drainage.

The prognosis and treatment of diffuse or general peritonitis are in a most unsatisfactory state, partly on account of the difference of opinion as to what constitutes a diffuse peritonitis, and partly because of the difficulty of determining, even when the abdomen is open, how extensively the peritoneum is inflamed. Some surgeons would limit the term general peritonitis to those cases in which every portion of the peritoneal cavity is involved in the inflammation. Such a widespread inflammation rarely occurs, and is perhaps never recovered from. It seems better, therefore, to use the term diffuse or general peritonitis as indicating inflammation, not limited by

well-marked adhesions, having a tendency to extend and sufficiently widespread to make the general symptoms much more prominent than the local ones. Such general symptoms usually become prominent when the inflammation extends to the peritoneum covering the small intestine. Thus peritonitis may exist for a long time in the pelvis, or in the lesser peritoneal cavity without giving rise to the well-known symptoms of general peritonitis. There are also many cases of appendicitis in which, if operation is performed early, the appendix is found not shut away from the general peritoneal cavity. To describe such a case as one of general peritonitis, merely because the surrounding coils of intestine are more or less covered with a fibrinous exudate which has not had time to mat them firmly together, is entirely misleading, and yet this is frequently done by writers who have reported cures of general peritonitis. It is therefore impossible to state the prognosis in a given case or a hundred cases of true diffuse peritonitis other than to say that the prognosis is bad. But it is by no means hopeless.

Unfortunately, the ideas of treatment of diffuse peritonitis are widely at variance, so that one can do no more than to state the different methods by which responsible surgeons believe that they have saved their patients. If diffuse peritonitis is threatened, though not well established, the action of the intestine can be stimulated by the use of cathartics or stopped by opiates, while the rectum and perhaps the colon can be emptied by injections of water, salt solution, soap-suds, oil, etc. Some surgeons employ opiates to decrease peristaltic action, on the ground that peristalsis tends to spread the inflammation; while others claim that the salvation of the patient depends upon increased peristalsis, which will increase the resorptive power of the peritoneum. To decide between these two plans of action is particularly difficult, because no one can say whether a threatened diffuse peritonitis would or would not have spread and killed the patient had the treatment been of a different character. When the inflammation has extended to the peritoneum covering the small intestine, the intestine is paralyzed, and cathartics have no effect, and there is certainly no indication for the use of opium.

In considering the operative treatment of diffuse peritonitis it will be well to take up the steps in the operation one at a time, since there is no general agreement in regard to any one of them. Some surgeons advocate a single incision and some multiple incisions, the latter in the hope of obtaining a more thorough drainage. At any rate, the incision or incisions should permit the surgeon to inspect and cleanse so much of the peritoneal cavity as may be involved in the inflammation.

The second step in the operation is the cleansing of the affected peritoneum from pus, fibrin, and foreign materials, feces, etc., if such be present. This may be done by irrigation with sterile hot one-per-cent. salt solution or by wiping the peritoneum with gauze compresses wrung out of such solution, or with dry compresses. If irrigation is employed, it should be abundant, so that the abdominal cavity may be quickly flushed. Some surgeons bring the small intestine out of the abdominal wound and others omit this step, which is spoken of as evisceration. The object of cleansing is to remove in the shortest possible time and with the least possible loss of heat the greater portion of the infectious exudate. How best to accomplish this with the least injury to the peritoneum is a question to be settled by the individual surgeon. Probably moist gauze is less irritating to the peritoneum than dry gauze.

If irrigation is employed the fluid which remains after cleansing may be sponged out, or it may be left in place. Some surgeons fill the abdomen with salt solution and close the abdominal wound, claiming that the dilution of the infectious material and the increased resorption from the peritoneum thereby produced are of the greatest benefit to the patient.

If the intestine is greatly distended with gas, some

surgeons empty it by puncture or by one or more short incisions. Such openings are forthwith closed by Lembert sutures. Others take advantage of the operation to inject into the lumen of the small intestine an ounce or more of saturated solution of sulphate of magnesia, believing that the strong peristaltic action which often follows will markedly benefit the patient.

Those who leave fluid in the abdominal cavity suture the wound without drainage. The patient is then placed in bed with the hips elevated so that the diaphragmatic portion of the peritoneum in which the lymphatic circulation is the most active shall be the most dependent portion. Others pass gauze or glass or rubber drains in various directions, either through the chief abdominal wound or through other wounds made especially for drainage in the lumbar and iliac regions, or into the vagina, or even into the rectum in case of pelvic suppuration. Mikulicz's handkerchief drain may also be used. [See *Abdomen*. (*Surgical*.)] Rehn recommends that a tube be passed through the mesentery of the small intestine and allowed to emerge in either loin, so that irrigation may frequently be made through it.

After-treatment consists in the application of heat externally and within the rectum, the subcutaneous injection of cardiac stimulants if necessary, and the subcutaneous or intravenous injection of salt solution; the object of all of these procedures being to combat shock. If the patient is troubled with vomiting, the stomach should be washed out. No opium should be given, and only so much morphine subcutaneously as is absolutely necessary to control pain.

Tuberculosis of the peritoneum may be accompanied by an abundant serous exudate or it may give rise to a fibrinous exudate with adhesions and contractions, or it may assume an ulcerative form.

The prognosis is in general an unfavorable one, although many cures have been reported as the result of both internal and surgical treatment. Recovery is more likely to follow operation when the disease is present in the serous form; but even in such cases one should be careful not to mistake a temporary improvement after operation for a permanent cure. As far as is known Spencer Wells was the first to open the abdomen of a patient having tuberculosis. He did so through a mistake in diagnosis. The patient recovered. Since then many surgeons have operated intentionally, and the good results have been variously attributed to the entrance of light or air, to the mechanical irritation of the peritoneum, or to a simple escape of the serous exudate. A more careful examination of the results of operation makes it doubtful whether such an exploratory laparotomy has any great therapeutic effect. It seems more probable that most of the patients who have recovered after such a laparotomy would have recovered without it, while operation has often a distinctly bad effect upon a patient whose tuberculous peritonitis is associated with fever. The abdomen is usually opened by a three- or four-inch incision in the median line. The fluid which is present is allowed to escape and is carefully sponged out and the various peritoneal pouches may or may not be dusted with powdered iodoform. The abdominal wound is closed by suture, or a drain may be left in its lower angle for a week or more. The shock of such an operation is naturally slight and most patients rapidly recover. A certain amount of fluid quickly appears, but may be resorbed. If it is not, a second operation may be performed. Such a quick recovery from operation may be looked for in the serous and fibrinous forms of the disease, while operation performed upon a patient suffering from purulent or suppurative tuberculous peritonitis will very likely be followed by intestinal fistula and death. Of course, if a focus of the disease is found in some organ which can be safely sacrificed it should be removed. An accompanying disseminated serous tuberculosis will probably be cured if its original focus is removed. But, as stated above, many patients who appear cured at first afterward suffer from a recurrence of the disease or die from tuberculosis in some other organ. However, as the

risk of operation is so slight, it seems justifiable in these cases even if it is a mere aid to the natural forces of the body in their effort to overcome the disease.

Benign tumors of the peritoneum, or, strictly speaking, of the subserous tissue, are fibroma, lipoma, and myxoma. Such tumors usually develop in the root of the mesentery, in the mesocolon, or in the omentum, and are described under the headings *Omentum* and *Retroperitoneal Tumors*. In the mesentery are also found serous, chylous, and hemorrhagic cysts as well as congenital dermoid and teratoid cysts. Echinococcus cysts are found in the peritoneal cavity, where they develop after the rupture of some primary cyst of the liver or other organ. Actinomycosis, starting usually from the cæcum, may produce in the peritoneum inflammatory swellings, some of which will contain the characteristic pus of this disease.

The treatment for benign tumors is their radical removal. This also applies to echinococcus cysts when they are so situated as to make removal feasible. If they are not removable, they should be drained externally. Actinomycosis should be treated by removal, if possible, but, if this is not practicable, by curetting, cauterization and drainage, and by the internal administration of iodide of potassium.

Malignant tumors of the peritoneum are secondary to malignant disease of some abdominal organ. Under such circumstances hundreds of metastatic nodules may be scattered over the peritoneum. There is generally a sero-hemorrhagic exudate. Such a condition is of course inoperable and the abdomen should be closed at once. A metastatic nodule in the peritoneum may be excised for microscopical diagnosis and the wound closed by one or two stitches. Thus one avoids the risk of troublesome hemorrhage which may follow excision of a portion of the primary growth.

Plastic operations upon the peritoneum for the sake of covering raw surfaces have been spoken of above and are also described under the heading *Omentum*, for it is the omental peritoneum which is usually employed for grafting. *Edward Milton Foote.*

PERITONITIS, SEPTIC AND TUBERCULOUS. See THE APPENDIX.

PERITYPHLITIS. See *Appendicitis*.

PERONINE—benzyl-morphine hydrochloride, $C_{17}H_{21}CH_2.O.OH.C_17H_{17}NO.HCl$ —is an odorless, bitter, white powder, composed of prismatic crystals and having the nature of an alkaloid. It is soluble less than one per cent. in cold water and in ten parts of boiling water, and is nearly insoluble in alcohol and chloroform. It is closely related to codeine, dionine, heroin, and morphine.

For the treatment of the cough of tuberculosis, Schroeder, who was the first to study this drug, considered it intermediate in value between codeine and morphine. His report, however, covers only twelve cases, in two of which it produced sweating and difficult expectoration, and in two others of which it failed to influence the cough. Nowak, in eighteen cases, found the cough less frequent and intense, but dry, and expectoration more difficult. At times there were burning in the bronchi and copious perspiration. Munk reports good effects on cough even after morphine and codeine had proved inefficient. He also found peronine calmate to an epileptic who suffered from frequent attacks of frenzy. All the writers agree that there is no habit formation. Mayor found it to be three times as toxic to rabbits and guinea-pigs as is codeine, and believes its cardio-depressant effects too pronounced to permit its use in medicine. Other writers, however, report no unpleasant effect on cardiac, respiratory, or digestive functions.

Besides its antitussive action, peronine is slightly analgesic and hypnotic. It is employed in tuberculosis, whooping-cough, emphysema, bronchitis, and similar affections in doses of 0.02–0.05 gm (gr. $\frac{1}{8}$ – $\frac{1}{4}$). Schroeder