INJURIES AND DISEASES OF THE PERITONEUM—LAPAROTOMY.

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General Considerations.—The injuries and diseases of the peritoneum are intimately associated with those of the abdominal and pelvic organs. Primary affections of the peritoneum are less common than those of the organs which it covers; but nevertheless they may be of great importance. Moreover, when disease of an abdominal organ reaches its peritoneal covering and there produces inflammation or new growth the effect upon the patient may be very great indeed, for from that time the disease affects not merely a single organ, but the most extensive serous surface of the body.

Three factors are worthy of especial notice in connection with peritoneal lesions: namely, the great extent of the peritoneum and the rapidity with which an inflammation can spread over a large part of its surface; second, the great capacity of this membrane for absorption, which may be of immense benefit to the system, or which may be of very great injury; and, third, the capability of the peritoneum when irritated to form a very large exudate. This exudate may be of a fibrinous character and result in adherence of the serous surfaces; or it may be of a fluid nature, rich in albumin, easily changed in character; or it may be seropurulent.

Anatomical Considerations.—The immense serous cavity of the peritoneum is a closed sac in man, while in woman it communicates with the outer world through the Fallopian tubes, uterus, and vagina. Diseases of these organs may therefore extend to and involve the peritoneum. The peritoneum lines the walls of the abdominal cavity and covers the various abdominal organs with a tissue which is in most places loose and movable, but which in certain places is firm and closely adherent to the underlying structures. Some abdominal organs are more or less firmly fixed by duplicatures of the peritoneum (liver, spleen, and female pelvic organs). Some portions of the intestine, such as the duodenum, ascending and descending colon, are only partially covered with peritoneum, while the rest of the small intestine, the transverse colon, and the sigmoid colon are attached by a duplicature. The duplicature or mesentery of the small intestine is indicated by a line extending from the left side of the second lumbar vertebra obliquely to the right iliac fossa. The transverse colon makes an arch

convex downward. The sigmoid colon on account of its long mesocolon is quite movable, but is usually situated in the left lower quadrant of the abdomen.

The motility of the greater portion of the intestinal canal facilitates a rapid spread of inflammatory processes over its serous surface. The numerous folds and pouches of the serous membrane, due to its being spread over the abdominal organs, makes its outline very complicated. For the same reason it is difficult to inspect the whole of the peritoneum, or to cleanse it, or to wash out its cavity. These duplicatures and pockets also make it possible for inflammatory products to become encapsulated more readily than is the case in simpler serous sacs. Some of these serous lined spaces and pouches are named. The subphrenic space, which is situated just beneath the diaphragm, is divided into a right and a left portion by the suspensory ligament of the liver. The liver forms the lower boundary of the right portion of the space, and together with the stomach and spleen the lower boundary of the left portion. The pancreas lies behind the stomach, rising slightly above the lesser curvature, and is covered by the posterior layer of the peritoneum. The stomach twists during the period of development, rotating upward and to the right, so that what was at first the left side of the stomach becomes its front, and the right side becomes its back. As a result of this rotation of the stomach a serous cavity is formed behind it, called the lesser peritoneal cavity or omental bursa, which communicates with the greater peritoneal cavity through the foramen of Winslow. The omentum is attached to the transverse colon, and the transverse colon is attached to the posterior abdominal wall by the transverse mesocolon. These structures therefore form a sort of transverse partition which separates the upper part of the abdomen from the lower part, and which in case of inflammation often becomes with the help of adhesions a real partition which is able to confine the inflammation to one portion of the peritoneal cavity. In a similar manner the mesentery and the small intestine divide the abdominal cavity into a right and a left portion.

The peritoneum covers the upper and posterior surfaces of the bladder, passing in men from the lower portion of the bladder to the rectum (Douglas's pouch). In women it covers the uterus, tubes, and ovaries, before reaching the rectum, so that between the uterus and bladder there is a vesico-uterine pouch, and between the uterus and rectum a recto-uterine pouch or the pouch of Douglas.

The whole area of the peritoneum is approximately equal to that of the skin.

For convenience the abdomen is divided into the following regions: The *epigastric*, situated in the median line and extending from the ensiform process to the umbilicus, contains the left lobe of the liver, the stomach, the pancreas, and the median portion of the transverse colon. In the *right hypochondriac* region are situated a portion of the liver, the gall-bladder, the right colic or hepatic flexure, and the right

kidney. In the *left hypochondriac* region are situated a portion of the gastric fundus, the spleen, the tail of the pancreas, the left colic or splenic flexure, and the left kidney. The *central* portion of the abdomen, below the umbilicus, contains the coils of small intestine. In the *right iliac* fossa are situated the cæcum with the appendix and the ascending colon, while in the *left iliac* fossa are to be found some coils of small intestine and the sigmoid colon. The bladder and the female pelvic organs are situated in the *pelvic* region; the rectum lies behind them in the hollow of the sacrum. Coils of small intestine often lie just in front of the rectum.

The peritoneum is a connective-tissue structure of great elasticity whose parietal layer is attached to the abdominal wall by loose cellular tissue containing much fat. It is easily stripped off by blunt dissection. Wherever the abdominal wall is naturally weak, or is weakened by disease, the peritoneum may be pushed outward, thus forming an abnormal pouch called a hernia.

The free surface of the peritoneum is covered with a single layer of endothelial cells between which, at least in the region of the diaphragm, are openings which are in direct communication with the lymphatic system. The healthy peritoneum has a shiny, smooth surface which is lubricated with a minimum amount of fluid so that opposing surfaces readily slip one upon the other.

There are few bloodvessels or lymph-vessels in the peritoneum. What nerves there are spring from the sympathetic system and from the phrenic and vagus nerves. In its normal condition the peritoneum is not very sensitive, but it becomes extremely so when inflamed. Lennander says that the parietal peritoneum contains a great number of sensitive nerves, while the vesical peritoneum covering the stomach, intestine, mesentery, and gall-bladder, possesses no nerves which are capable of giving sensations of pain, touch, heat or cold. This statement has been verified by many surgeons who have opened the abdomen under local anæsthesia.

Physiological Pouches.—There are certain peritoneal pouches in which the intestinal coils may become strangulated. The most important are:

1. The foramen of Winslow is the opening between the larger and lesser peritoneal cavities, which owes its origin to the rotation of the stomach which takes place early in fœtal life.

2. Waldeyer calls attention to a pocket which exists between the liver, duodenum, and upper end of the right kidney in case the renal ligament is unusually developed.

3. The intersigmoid pouch is situated in the line of attachment of the left layer of the sigmoid mesocolon. This pouch has been ascribed by some observers to the folds produced by bloodvessels, and by others to the effect of fœtal development.

4. There are three pericæcal pouches, the anterior ileocæcal, the ileo-appendicular, and the posterior ileocæcal. The last-named pouch varies greatly in different individuals, since it depends upon the fœtal

fusion of the cæcum and colon, and the development of the parietal peritoneum.

5. The left duodenojejunal pouch is dependent on the development and course of the inferior mesenteric vein. Broesicke calls attention to several folds in the duodenojejunal flexure which are the result of fœtal fusion.

There are other less well-marked pouches which may be produced by vascular folds of the anterior abdominal wall, or of the iliac fossæ, or of the retrovesical space.

Transudation and Resorption.—It has been shown that the diaphragmatic portion of the peritoneum contains little openings which connect with the lymphatic system, and through which fat-drops and fine grains of powder as well as fluids may reach the thoracic duct and by it the general circulation. It is not known whether other portions of the peritoneum possess similar lymphatic openings. The absorptive power of the peritoneum for fluids is so great that an animal will take up from 3 to 8 per cent. of his body weight in an hour, while poisonous substances injected into the peritoneal cavity will act more quickly than when they are inserted into the intestinal canal. It has also been shown that while an increase of the normal peristalsis does not hasten this absorption, that a decrease of peristalsis will markedly delay it. Bacterial inflammation and chronic inflammation due to mechanical injury will also delay absorption. This peritoneal absorption is not a purely physical process, but rather a vital physiological one.

The peritoneum has also a great power of transudation. If a concentrated solution of sugar or glycerin is injected into the peritoneal cavity of an animal, the peritoneum is capable of diluting it by transudation equivalent in an hour to 4 or even 8 per cent. of the body weight. Under other circumstances the peritoneum is capable of producing a plastic cystic exudate in a very short time. Foreign bodies which are aseptic are quickly enclosed by a fibrinous exudate and by cells derived from the subserous tissue. Fibroblasts press into this exudate and lead to the formation of bloodvessels and connective tissue, so that the foreign body becomes completely surrounded by new connective tissue. If the foreign body which is thus encapsulated is capable of disintegration, it will ultimately be resorbed.

The peritoneum possesses many properties favorable to surgical operations. It can take up great quantities of fluid. Up to a certain point it can take up and render harmless bacteria. Extensive injuries of the serous coat, whether brought about by mechanical, thermal, or chemical agents, can be healed so that no permanent defect remains. A considerable quantity of ligated tissue, stumps of ligatures, and foreign substances may remain in the peritoneal cavity and become encapsulated without disadvantage. The recuperative power of the peritoneum is far greater than that of other soft tissues of the body. However, its power for protection in these various directions is limited to conditions in which the pathogenic bacteria present are not too

numerous nor too virulent. When this limit of safety is passed, the peculiar properties of the peritoneum greatly increase the danger. Peritoneal exudates form an excellent culture-medium in which bacteria can increase in a short time with great rapidity. Furthermore, the power of resorption of a serous membrane may load the blood with pathogenic bacteria and their toxins, so that the vitality of the body-cells is destroyed.