that one after another can be withdrawn without disturbing the enveloping skirt, which is last to be removed.

The period for withdrawing drains varies somewhat with the purpose for which they have been introduced; gauze placed to stop oozing should be removed in from twenty-four to forty-eight hours, while that used to drain infected or inflamed areas is allowed to remain in place some days longer.

The treatment of the sequelæ of injuries, as fistulæ, ventral herniæ, etc., does not naturally come under the present title.

Percival R. Bolton.

ABDOMINAL TUMORS, DIFFERENTIAL DIAGNOSIS OF.

—The word tumor is used here not in the restricted sense of a neoplasm but in the etymological sense of a swelling. It is at once evident from this that a large number of pathological processes affecting all the organs contained in the abdomen and the tissues making up the abdominal walls must be considered. This was deemed necessary because we start with the assumption that in a certain given case a tumor has been found in the abdomen and it is necessary to discover what and where it is. All details of etiology, pathology, and symptomatology have been omitted except in so far as they have a direct bearing upon the differential diagnosis. For such details reference must be made to more special articles. Furthermore, the diagnosis of conditions which ultimately lead to the formation of demonstrable tumors has been omitted, and the discussion of such conditions will be limited to their course after the formation of a tumor. For example, when speaking of cancer of the stomach it will be assumed that a tumor has been discovered.

When confronted with an abdominal tumor, it must be remembered that the diagnosis should go beyond the mere recognition of the existence of a tumor in the abdomen. We must determine first the organ or tissue in which the tumor is located, and second the nature of the tumor. If the tumor is believed to be a malignant neoplasm, we must decide, if possible, whether the tumor arose in the organ in which it is discovered or is merely a tumor secondary to a primary tumor in some organ yet to be determined. If the tumor found is believed to be primary, secondary deposits in other organs must be sought. In other cases we must hunt for the cause of the tumor. If, for example, a certain tumor is thought to be a gall bladder distended with fluid, effort should be made to ascertain the character of the fluid and the cause and site of the obstruction which prevents the escape of the fluid from the gall bladder. With so broad a subject it is evident that only the more important methods, facts, and pathological conditions can be discussed here.

After a brief discussion of the methods of examination employed, we will consider what might be called tumors of the abdomen as a whole, such as ascites, diffuse peritonitis, lipomatosis. Then the various organs will be grouped according to their relations to the colon, and each group considered in turn. The organs situated on the cephalic side of the transverse colon, the liver and gall bladder, the stomach, pancreas, and spleen, will be described first; then will follow the organs behind the colon, the kidney, adrenal bodies, and perirenal tissue; next will come the organs within the arch of the colon, the small intestines, mesentery and omentum, peritoneum, lymph glands, aorta, uterus, ovaries, bladder, spinal column, and lastly the colon, appendix, and walls of the abdomen. With each organ we shall as far as is possible take up first the circulatory disturbances, then the inflammatory processes, cysts, neoplasms, and malpositions. It is not necessary to state that this order cannot be followed absolutely, but it can be approximately, and will be found greatly to facilitate a grasp of this subject, probably the most difficult matter handled by the diagnostician.

METHODS OF EXAMINATION employed include the I. physical, II. chemical, and III. microscopical: the first having in general an especial bearing upon the localization of the tumor, while the second and third are of more value in determining the nature of the tumor.

I. *Physical Methods*—(A) Inspection. The patient should be placed on a firm narrow bed or table in such a way that the source of the light lies in a line with the median line of the body, either directly above or at the head or foot of the patient. The purpose of this is to avoid any uneven distribution of the shadows. The kind of light employed is usually a matter of indifference, but in cases in which there is reason to suspect the possibility of a jaundice the patient must be examined by daylight, for the well-known reason that no artificial light shows even the deepest shades of jaundice.

Take note first of the size of the abdomen, especially of any disproportion between the size of the abdomen and that of the other portions of the body. Next note the shape of the abdomen. Is the abdomen symmetrical? Are there any portions more prominent than the corresponding ones of the other side, or is the upper half out of proportion to the lower half? If any part appears large, does it appear sharply outlined or does it merge gradually into the surrounding parts? Does the surface of the enlargement appear smooth or nodular, and are the outlines rounded or irregular? Does the mass move; and if so, does it move with the respiration, the pulse, or independently of either? Almost any tumor of the abdomen may show respiratory or pulsatile movements (the exceptions will be stated later), but only a few show independent movements. These are tumors from the stomach, intestines, and uterus. Visible vermicular movements of the stomach and intestines are commonly seen in patients with thin abdominal walls and are not in themselves pathological. It is only when they are unusually intense and continuous and in combination with distinctly pathological symptoms that they need attention. The word vermicular quite accurately describes the motion, for it looks exactly as if some large worm were moving under the skin. The site and direction of the movement should be noted. In general the peristaltic movements of the stomach are limited to the upper and median portion of the abdomen and pass from left to right. Peristaltic movements of the stomach from right to left are pathological. The movements of the small intestines are central and irregular in direction. Those of the large intestine correspond to the relatively fixed position of the colon and vary in direction with the portion of the colon affected. The peristaltic movements above the site of any stricture in the gastro-intestinal tract, either acute or chronic, are more active than normal, and therefore persistently exaggerated movements point to some obstruction, but do not in themselves prove such obstruction.

The independent movements of the uterus are of two sorts: fœtal and uterine. The presence of the fœtal movements is at times a most important point in the differentiation of abdominal tumors. The movements are altogether irregular in time and intensity, and may be simulated by the peristalsis of the small intestines. The expulsive contractions of the uterus are not often visible, but may be so.

Inspection of the abdomen includes attention also to any subcutaneous collateral circulation, either arterial or venous. Such circulation often gives the clew to the site of the obstruction, which necessitates a collateral circulation and may give some idea of the degree of the obstruction. Note also any localized œdema or inflammatory process.

Often much valuable information may be gained by changing the amount of gas in the stomach and intestines. Not only do we gain information as to the exact location and size of these organs, but we learn much of their relation to the tumor found. Various methods have been employed for this purpose, but the following require only such apparatus as should be in the armamentarium of every physician. The stomach may be inflated by means of a Seidlitz powder mixed after drinking instead of before, or one can use saleratus in solution followed by vinegar. This method is not entirely without danger, because the pressure resulting from the gas evolved cannot be accurately estimated. Accidents, however, are rare. Another method consists of the passage of the stomach tube and inflation of the viscus by means of a pump. This has the advantage of enabling one to use as much or as little gas as desired, and permits the immediate removal of the air if necessary.

The colon is inflated by passing the rectal tube well up into the descending colon and forcing in air by means of a pump, the ordinary bicycle pump being perfectly adapted to the purpose. A rather large, cone-shaped rectal tip is better than the rectal tube, for it prevents the escape of the air, but is not so easily supplied as the tube. As the air passes upward and distends the colon we are able to learn the exact course of the colon and its relations to the tumor.

Harris, of Chicago, has recently drawn especial attention to the value of the relation of the colon to abdominal tumors in the differential diagnosis of such tumors. He substitutes for the old and superficial division of the abdomen into nine areas—the right and left hypochondriac, lumbar, and inguinal regions, the epigastric, umbilical, and hypogastric regions—an anatomical division into four areas. The borders of these areas are not fixed by external points, but are located by the inner or mesial layer of the longitudinal colon and the inferior or caudal layer of the transverse colon. The resulting areas are a central area, surrounded by mesocolon; a right and left posterolateral area, lying external to and behind the mesocolon; and a superior area, lying above the transverse mesocolon. While the boundaries of these areas are not fixed, their position is easily ascertained by determining the position of the colon by air distention.

In the central area, surrounded by the distended colon, are found tumors of the omentum and mesentery, retroperitoneal tumors, localized peritoneal exudates, tumors of the small intestines, tumors of displaced and movable kidneys, and all tumors of the female generative organs rising into the abdomen.

In the superior region we find tumors of the liver, gall bladder, stomach, lesser omentum, pancreas, retroperitoneal lymph glands, and aneurisms of the cœliac axis.

Tumors of the spleen pass forward close to the anterior wall, in front of the splenic flexure of the colon and the neighboring parts of the transverse and descending colon.

Tumors of the kidneys, suprarenal bodies, and the connective tissue bordering on these organs, tumors from remains of the Wolffian bodies, carry the colon inward and forward. But tumors from floating kidneys may appear in the central area, *i.e.*, surrounded by the colon.

(B) Palpation. This method of examination is of much more general application than inspection, for many tumors easily palpable are not visible. Palpation should always be preceded by thorough and certain evacuation of the bowels, otherwise fecal masses may lead to errors. The patient should be examined first in the dorsal position, but in some cases a lateral, a knee-chest, or an erect position will yield results not otherwise obtainable. The patient should relax the abdominal muscles as completely as possible. This is often easier when the thighs are flexed on the abdomen and the mouth held open. In difficult cases better relaxation is obtained if the patient is placed in a bath of warm water and examined in the bath. In still more difficult cases general anæsthesia must be employed. Palpation should be made gently but firmly, and any pressure used should be applied gradually; counter-pressure from behind is often a help. Sometimes, and this is especially true when there is considerable fluid in the abdominal cavity, one obtains the best results by dipping the stiffly held fingers suddenly downward, depressing the abdominal walls to varying depths. Bodies can often be felt and outlined in this way that cannot be felt at all by the ordinary method of palpation.

Attention should be given to the following points: the location, size, shape, motility, and tenderness of the tumor. Note also any change in position or ease of palpation caused by distention of stomach and colon.

In all cases in which it is impossible absolutely to exclude a neoplastic origin for the tumor palpated, the rectum and vagina should be examined.

(C) Percussion. This method is far less valuable here than in examination of the chest, but should never be omitted, and in certain cases exceeds the other methods of examination in value. Its main uses are the determination of the position of the diaphragm, the shape of the upper border of the liver, the presence or absence of free fluid in the abdominal cavity, and the position and approximate size and shape of the stomach and colon after they have been distended by gas or fluid. Percussion is the main means of determining the relation of the colon and stomach to the tumor found, and what was said under the heading of Inspection in this regard could be repeated here; might perhaps have been more properly placed here, for percussion is used much more often than inspection for this purpose.

Tumors of the abdominal organs cause abnormal areas of dulness only when superficially located or of large size, and the resulting area of dulness is always smaller than the tumor.

Percussion is valuable in demonstrating the absence of areas of dulness normally present. Disappearance or reduction of the hepatic and splenic dulness is often of the highest diagnostic value. Disappearance of the posterior renal dulness is less so.

In isolated cases auscultatory percussion gives valuable results.

(D) Auscultation. Almost no results are obtained by this method. Peritoneal friction, either localized or diffuse, is sometimes heard. Arterial and venous tones and murmurs are common and usually of but little significance.

(E) Exploratory Puncture is often of the very greatest value, especially in determining the nature of the tumor. The details will be given later.

(F) Exploratory Laparotomy. In certain cases a complete diagnosis—*i.e.*, one which localizes the tumor and determines its nature—is impossible even after the most careful examination. In such cases an exploratory laparotomy is often justifiable, providing it can be made by a competent surgeon under favorable circumstances. Unless the patient presents some obvious contraindication to the operation, it can be done with almost no danger and often gives information which leads to definite curative treatment.

II. and III. The *chemical* and *microscopical methods* of examination can be more profitably discussed in the special paragraphs referring to the different organs.

Before taking up the various diseases of the abdominal organs leading to tumor formation, it should be expressly and emphatically stated that any examination of an abdominal tumor which omits a complete and careful examination of the entire body is criminally incomplete. Abdominal tumors are often merely symptoms of diseases of organs remote from the abdomen, and such primary disease can be discovered only by a complete examination of the body.

ENLARGEMENTS OF THE ABDOMEN AS A WHOLE.—This may occur as the result of accumulations of gas or fluid in the peritoneal cavity, from large amounts of gas in the intestines, from deposits of fat in the abdominal walls, omentum, and mesentery, and in rare instances from very large tumors.

Ascites.—This is the only common cause for extreme enlargements of the abdomen. The abdomen is enlarged in all diameters, but when the cavity is not completely filled, as is ordinarily true, the horizontal diameter when the patient is in the dorsal decubitus will be found considerably greater than the perpendicular diameter. The flanks are bulging while the umbilical region is flattened. The skin is often tense and shining, and under it can be seen the overdistended veins. Such veins are present in all well-marked cases of ascites irrespective of its cause, but are usually better marked in cases due to atrophic cirrhosis of the liver than in others. The umbilicus is flattened out or even bulging. Sometimes when the patient changes position, one sees the fluid changing position also, and one is reminded of the appearance of an incompletely filled sack when it is shaken.

On palpation the fluid waves can be felt when the hand is placed flat on one side of the abdomen and the other side is percussed gently. If one lays the hand lightly over the region of the abdomen which percussion shows to be tympanitic and at the same time percusses the flank, the fluid will flap up and strike the hand, *i.e.*, the fluctuation is felt over the tympanitic area.

Percussion shows dulness over the dependent portions of the abdomen, but usually about the umbilicus one finds an area of tympany. The borders of this area are not regular, but wavy. If one outlines this area very carefully he will find that though the borders are wavy, they are at all points in the same horizontal plane. When the position of the patient is changed, the level of the fluid changes very promptly to correspond to the altered position. When the amount of the fluid is very great, the entire abdomen will be dull on percussion, even at the highest level.

Auscultation yields no results, except in cases to be stated later.

Such free fluids in the abdomen are usually transudates, but they may be exudates, and the first question is to determine which. Usually this can be done with a great degree of certainty even without actual examination of the fluid. If the patient has a perfectly manifest disease of the heart, kidney, or liver, the fluid is very probably a transudate. If there is fluid in the subcutaneous tissues and the other serous sacs also, this probability becomes a certainty.

If doubt remains, enough fluid must be withdrawn to ascertain its character. In these cases it is best to remove at first only sufficient for examination, for when the fluid is chylous it is best not to withdraw it except upon the most urgent indications. A transudate is a clear, straw-colored fluid, of low specific gravity, less than 1.015, containing a small amount of albumin up to two per cent. and showing almost no cellular elements. An exudate may be equally clear, but is usually cloudy from cells and fibrin. The specific gravity is above 1.015, usually considerably above. The amount of albumin is higher, over four per cent. The cellular elements vary greatly in number and in character, but are always more abundant than in the transudate.

The rather rare cases of adipose and chylous ascites show a turbid, milky fluid, very different from the ordinary ascitic fluid. The adipose ascites is usually of high specific gravity, for it is merely an altered exudate, contains a good deal of fat which is in both large and fine droplets, and is free from sugar. The chylous ascites contains fat, but only in fine droplets; sugar is present in most, but not in all cases; the specific gravity is low.

When it is settled that the enlargement of the abdomen is due to free fluid, and the nature of the fluid, whether exudate or transudate, has been discovered, it yet remains to determine the cause of the trouble. Large peritoneal transudates may come from a disease of heart, kidney, or liver. If due to heart or kidney, the ascites is usually a part of an anasarca; if due to the liver, the ascites exists alone or preceded the œdema elsewhere by days or weeks. A well-marked collateral circulation on the abdomen and an enlarged spleen speak for a primary hepatic process, but it may be necessary to withdraw the fluid before the spleen can be palpated.

Large exudates in the abdomen are almost always due either to tuberculosis or to carcinoma. The physical signs often differ somewhat from those of the transudate, because as a rule the fluid is not perfectly free and for this reason does not change its level so promptly as does the transudate, and oftentimes certain portions of the intestines become adherent to the abdominal wall, so that tympany is found even over the most dependent part of the abdomen. The clinical differentiation of tuberculous from carcinomatous peritonitis is often very difficult. If the patient is too young for carcinoma or there is a manifest carcinoma or tuberculosis of some organ, then it is easy; but there are many times when it is difficult. The positive reaction to the Koch tuberculin speaks for tuberculosis, a leucocytosis speaks for cancer, but these

two sometimes contradict each other. The development of cachexia speaks for cancer. In doubtful cases the patient should be laparotomized for purposes of diagnosis and treatment, if the latter is found possible.

There have been numerous instances of confusion of ovarian cysts with free fluid in the abdomen, both transudates and exudates. There is little excuse for this error unless the ovarian cyst is so large as to fill completely the abdomen. Here attention to the history, which in these cases runs back for years, together with the absence of any demonstrable cause for free fluid, will usually enable one to make the diagnosis. As a further aid one may make an exploratory puncture. The fluid of ovarian cysts presents characteristics to be described in a later paragraph.

Sometimes great dilatation of the stomach has been mistaken for ascites, the air and fluid in the stomach giving the same physical signs as free fluid in the abdominal cavity. The history of this condition differs from that of the ascites. In cases of any doubt, the stomach tube, by withdrawing any fluid in the stomach, will enable one to make the diagnosis with certainty.

Collections of gas in the free peritoneal cavity often cause a very considerable increase in the size of the abdomen, but percussion and the tympany thus developed clearly prove the nature of the enlargement. Whether the gas is in the intestines or in the peritoneal cavity is often difficult to decide when both are possible, as after trauma or in the course of some ulcerative process in the gastro-intestinal tract. Here the progressive decrease in the size of a liver dulness, known from former examinations to be present, speaks for gas in the peritoneal cavity. It is usually associated with shock and symptoms of peritonitis.

Enlargement of the abdomen from fat is common, and is readily recognized, as a rule. We sometimes see lipomata of the mesentery or omentum, which present themselves as tumors of the abdomen and are really such, but it is not to these which we refer. Careful examination of this very common condition will protect one from error.

TUMORS OF THE LIVER.

The pathological processes causing enlargement of the liver may be well placed in two groups, according as the enlargement is diffuse or circumscribed. It must, however, be stated that this division, like most other divisions in medicine, is not at all sharply marked, for most of the pathological processes may occur in either group. For example, amyloid infiltration usually causes a diffuse enlargement of the liver, but may cause sharply circumscribed masses; while, on the other hand, carcinoma usually causes localized masses, but may cause diffuse enlargements.

Diffuse enlargements of the liver, no matter what the cause, bring about no change in the general shape; the liver is, so to speak, merely magnified. The borders lose their normal sharpness and become rounded and thickened. The notch in the anterior border for the gall bladder is retained. The consistency of the liver is often altered, usually becoming firmer, but sometimes it feels softer. The surface may be perfectly smooth or slightly granular, depending upon the pathological process in play. A granular surface may be simulated by the presence in the subcutaneous tissues of partially atrophied adipose tissue, but under such circumstances the granules can be felt all over the abdomen, and they feel more superficial than granules in the liver.

Diffuse enlargements of the liver generally take place downward rather than upward. Percussion shows that the upper border of the liver occupies its normal position; presents its normal shape, that of a straight line perpendicular to the surface on which the patient is lying; and shows only a slightly decreased respiratory mobility.

Passive Congestion of the Liver.—This is the commonest example of a diffusely enlarged liver, and inasmuch as the subjective symptoms from which the patient suffers

may be, and often are, entirely limited to the hepatic region, the tumor of the liver is often mistaken for some primary condition, while in reality it is not primary but always a mere symptom of some disease causing obstruction to the venous circulation at a point above the juncture of the hepatic veins with the inferior vena cava.

The subjective symptoms are pain, fulness, tension, and weight in the right hypochondriac region, either constant or intermittent. These symptoms may, and often do, overshadow all other symptoms of the primary disease. Examination shows a uniformly enlarged liver, reaching usually only a few centimetres below the costal arch, but sometimes extending to or beyond the umbilicus. The surface is smooth, the borders are regular but rounded. Usually, but by no means always, the liver is tender. Percussion shows a regular upper border with normal respiratory motility.

The patients often show a moderate degree of jaundice, usually both conjunctival and cutaneous. The jaundice is practically never intense unless there is some complication. This jaundice is apt to still further strengthen the idea that the patient has a primary disease of the liver. Examination of the abdomen shows an absence of ascites and no enlargement of the spleen. Occasionally both these are found, but in these cases the symptoms of cardiac insufficiency are so marked that only the most careless can mistake them.

Examination of the chest will in most instances show that the primary disease is oftenest a disease of the heart, endoperi- or myocardial. The cardiac insufficiency may, however, be secondary to some disease of the lungs or pleura, oftenest an emphysema or an obliterative pleuritis.

All patients who present an enlarged liver, especially when the liver is painful or tender, should be examined for some disease of the heart, lungs, or pleura as a possible cause for a passive congestion; and if such disease is found, the liver should be regarded as a fiver of passive congestion; and this diagnosis should be given up only on the strongest evidence pointing to some other disease causing diffuse enlargement of the liver.

Passive congestion of the liver is liable to rapid fluctuations, so that marked changes in the size of the liver can occur in the course of a few days or even hours. Such fluctuations do not, however, always occur, and the enlargement may remain stationary over weeks and months.

Active Congestion of the Liver.—This occurs in a variety of conditions, but is usually of so slight a degree as to pass unrecognized, or if found, is so minimal or so manifestly of secondary importance as to attract little attention. It occurs in a variety of infectious diseases, the most important examples being scarlet fever, smallpox, the various forms of sepsis, typhoid fever, and malaria. Malaria, especially the estivo-autumnal malaria, may cause a marked and persistent enlargement of the liver which may be difficult to diagnose. Such cases may present an icteric discoloration of the skin, with marked enlargement of the spleen, thus closely resembling the hypertrophic cirrhosis of the liver, a disease which often gives rise to an intermittent fever resembling the fever of malaria. The differentiation between the two is made by an examination of the blood for the Plasmodium malariæ. Malarial enlargements of the liver may persist after the plasmodium has disappeared from the blood, in which case attention must be paid to a history of prolonged and irregular malarial fever.

A variety of poisonings, especially those by phosphorus and arsenic, may cause acute congestive enlargement of the liver.

Biliary obstruction due to obstruction of the common duct, when continued for any length of time, often causes a marked enlargement of the liver. The enlargement is perfectly uniform and is accompanied by pain and tenderness. The jaundice is intense and progressive. The stools are usually acholic. The constitutional and other symptoms present are due in part to the jaundice and in part to the cause of the obstruction. The only disease of the liver liable to be confused with the swelling due to biliary retention is the hypertrophic cirrhosis, for both

present a uniform enlargement of the liver plus jaundice, and both may be accompanied by fever. There are these points of difference: the hypertrophic cirrhosis is accompanied by a splenic tumor; the jaundice is usually not complete, *i.e.*, the stools still contain bile; and pain and tenderness are absent as a rule. With biliary retention there is no splenic tumor, the stools contain no bile, and there are also present the symptoms of the primary condition causing the obstruction, such as gall stones, acute catarrhal jaundice, a tumor at the porta, etc.; ascites is more common than with hypertrophic cirrhosis.

Hypertrophic Cirrhosis of the Liver.—This gives rise to a universal enlargement of the liver, exactly resembling the enlargements just considered, so far as the shape of the swelling is concerned. The enlargement is in general greater, and the size is of no value in the differentiation. There is usually no pain or tenderness, merely an uncomfortable sense of weight and fulness. The patient usually gives a history of one or more attacks of jaundice, brought on by slight indiscretions in diet or occurring spontaneously. Each succeeding attack is longer, and the intervals between the attacks become progressively shorter. Usually these cases appear for treatment because of a jaundice, the intensity of which varies greatly, but in general is not so intense in this disease as in others to be mentioned later. The stools are not acholic as a rule, although they are often lighter colored than normal, and in some instances are completely acholic.

Examination shows an enlarged liver and practically always an enlarged spleen. This enlargement of the spleen is very constant and is often extreme, so that the spleen reaches a hand-breadth or more below the costal arch. The spleen, like the liver, is not tender and, like it, feels hard and dense. Inasmuch as this form of cirrhosis respects the portal veins, there are no signs of passive congestion of the abdominal viscera. There are no evidences of a collateral circulation. Ascites does not appear until the terminal stage.

Hypertrophic cirrhosis is sometimes accompanied by irregular fever or by fever regularly intermittent, and under such circumstances may require differentiation from malaria and from infections of the bile tracts. The history of previous attacks of malaria or of residence in malarious regions is important. The blood should be examined for the Plasmodium malariæ. In these cases the demonstration of the malarial organism often requires repeated examination of the blood, and, in case of repeated failure, an exploring needle should be put in the liver or spleen and the blood thus obtained examined. The plasmodia are often found in the blood of these organs when they cannot be found in the circulating blood.

Infections of the bile tracts, even when acute, may resemble the hypertrophic cirrhosis by causing marked enlargement of the liver, with jaundice and splenic tumor. The liver is, however, often tender, and the enlargement may be irregular; the spleen often feels soft, the fever is usually more marked, the chills are more prominent. An examination of the blood will in many cases show a leucocytosis and sometimes bacteria. The difficulty of differentiation is still further increased by the fact that many patients with hypertrophic cirrhosis suffer during the later stages from infections of the biliary tracts.

Syphilis of the liver occurs in various forms, but we are concerned only with those forms which lead to enlargement of the liver. Either the acquired or the hereditary variety of syphilis may cause an increase in the size of the liver, though they do so by different processes.

Tertiary syphilis, the stage in which the liver is oftenest enlarged, leads to the development of gummata in varying number and arrangements. These gummata, undergoing absorption, lead to gross irregularities in the configuration of the liver. Much liver tissue is destroyed, and the remaining portions undergoing hypertrophy to counterbalance the loss, still further increase the deformity. The symptoms resulting from gummata in the liver are very variable, as may be readily imagined when one recalls that there may be any number of gummata in

the liver, and that they may be located about the porta or be scattered more or less indifferently through the liver.

The marked peculiarity of this form of syphilitic liver is its moderate increase in size plus the very gross and irregular lobulations. The constitutional symptoms may be marked or slight, but there are usually some gastro-intestinal symptoms. Ascites is rare and usually does not appear until late. When present, it may be moderate or excessive, and it is liable to marked spontaneous variation in amount. It reappears rapidly if withdrawn by paracentesis.

There is not usually any subcutaneous, abdominal, collateral circulation.

Jaundice is exceptional. Splenic tumor is common.

The diagnosis is based mainly upon the irregular liver, residua or a history of syphilis, which was either not treated at all or treated but imperfectly.

Hereditary syphilis may affect the liver in a variety of ways, but in contrast to the effects of acquired syphilis it is much more often a diffuse instead of a circumscribed process. The changes in the liver may be apparent at birth, or appear during early childhood, or be delayed until adolescence. The earlier they appear the more easily the nature of the process is recognized, for in the young other processes in the liver are rare as compared with syphilis. The symptoms are often indefinite. The children are poorly nourished weaklings, suffering from gastro-intestinal disturbances, often rachitic. The spleen is usually enlarged; ascites is not uncommon, but icterus is the exception. The manifestations of syphilis on the skin and mucous membranes are often minimal. The diagnosis is based mainly upon the recognition of the opportunity for the existence of hereditary syphilis; in other words, the diagnosis is based upon an examination of the parents.

Fatty Liver.—There are a considerable number of pathological conditions in which the liver is enlarged from the presence of fat, either deposited or formed *in situ.* Such a liver is enlarged, usually, only to a moderate degree; retains its shape; is not tender or painful. It does not cause jaundice or ascites, or lead to the development of a collateral circulation.

The recognition of the nature of the process causing the enlargement of the liver rests on a recognition of the cause for fatty degeneration or infiltration. The commoner causes are over-eating and the excessive use of alcohol, especially when combined with insufficient exercise. Enlargement of the liver is frequently found in alcoholics without the pathological process in play being manifest. The liver will be found enlarged, the patient suffering from moderate gastro-intestinal symptoms, and examination fails to show any change in the other organs. In such cases it is impossible to decide whether the patient has a fatty liver, a congested liver from the gastro-intestinal irritation, or a beginning hypertrophic or atrophic cirrhosis. Any of these conditions will disappear if the alcoholic abuses are stopped. If this is not done, a few years will settle the question. If the spleen is found enlarged the condition is probably one of cirrhosis.

Diseases which interfere with oxidation, either by reduction of the hemoglobin or by reduction of the breathing surface of the lungs, often cause a fatty liver. Thus fatty livers are seen in many cases of primary anæmia—in chlorosis, for example—and in many cases of pulmonary tuberculosis. It occurs also in cases of other exhausting diseases, such as prolonged suppuration, chronic dysentery, pernicious anæmia. A variety of toxic bodies, notably phosphorus, arsenic, and antimony, cause fatty liver.

Amyloid Liver.—The diagnosis of this condition rests upon two factors: the recognition of a sufficient cause for the amyloid, and the recognition of amyloid changes in other organs. The liver is enlarged, often enormously so, and the enlargement is usually generalized, but exceptionally the deposits of amyloid are localized, forming large and sharply circumscribed tumors. The surface of the liver is smooth and regular. It feels firm and dense, and is not tender or painful. Jaundice does not

occur, and ascites when present develops late and is the ascites of cachexia, preceded by œdema of the extremities. The amyloid process does not often reach a high degree in one organ before it begins in other organs also. For this reason we do not find the amyloid liver without similar changes in spleen, kidney, and intestines. The spleen is enlarged; the urine is abundant and contains considerable albumin with granular and waxy casts; and there are often gastro-intestinal disturbances, especially a diarrhœa due to the amyloid changes in the intestines.

The cause of the amyloid may lie in any chronic infectious disease, oftenest chronic suppuration of the extremities and joints and pulmonary tuberculosis. It occurs also in syphilis, chronic malaria, chronic dysentery, and sometimes in the later stages of carcinoma and other malignant tumors.

Amyloid changes must most often be distinguished from the fatty liver seen in many of these conditions because of the common etiology, and from hypertrophic cirrhosis because of coincident changes in spleen and gastro-intestinal tract. The fatty liver in general feels softer than the amyloid liver, and, what is more important, is not accompanied by enlargement of the spleen, albuminuria, and diarrhœa.

The hypertrophic cirrhosis, while presenting an enlarged spleen and gastro-intestinal symptoms, is associated with recurring attacks of jaundice, something never seen as the result of amyloid, and the causal conditions for amyloid are absent.

Résumé of the Uniform Enlargements of the Liver.

Passive Congestion.—Liver enlarged, painful, tender, liable to sudden variations in size; spleen not enlarged; jaundice moderate or absent and altered in tint by the usually accompanying cyanosis; ascites, if present, preceded by œdema of the feet; examination of thorax will show cause for passive congestion.

Biliary Retention.—Liver enlarged, painful, tender; spleen not enlarged; jaundice intense and the stools acholic; may or may not be fever; ascites present or absent; symptoms of the condition causing obstruction, such as gall stone, catarrhal inflammation, or tumor, present.

Hypertrophic or Biliary Cirrhosis.—Liver enlarged, not tender or painful; spleen enlarged; jaundice actually present or found one or more times in history; ascites only in terminal stage.

Syphilis of the Liver.—Acquired: enlargement general, but grossly irregular; may be pain and tenderness; jaundice and ascites usually absent; spleen not enlarged; history and residua of syphilis. Hereditary: enlargement uniform, without pain or tenderness; jaundice and ascites usually absent; spleen enlarged; other marks of hereditary syphilis and existence of syphilis in the parents.

Fatty Liver.—Liver large, smooth, soft; spleen not enlarged; no jaundice or ascites; presence of cause, as general lipomatosis, alcoholism, anæmia, etc.

Amyloid Liver.—Liver enlarged, smooth, firm, not tender or painful; spleen enlarged; jaundice and ascites absent; diarrhœa and albuminuria present; the presence of a cause for amyloid, as prolonged suppuration, tuberculosis, syphilis, etc.

This practically completes the list of processes causing diffuse enlargements of the liver, except the enlargements seen in leukæmia and pseudo-leukæmia. These will be considered in the paragraphs upon tumors of the spleen.

Localized Enlargements of the Liver.

Of the processes which cause circumscribed enlargements of the liver, there are three which far exceed all others in importance. These are the abscess, the cancer, and the hydatid cyst. Any one of these, however, may cause diffuse enlargements, just as most of the processes usually causing diffuse enlargements may at times cause circumscribed tumors.

Cancer of the Liver.—While other neoplasms occur in the liver, the cancer is so much more common than all others combined that it alone will be considered. Cancer

Abscess of the Liver.—The pyogenic organisms, streptococci, staphylococci, pneumococci, bacillus coli, amœba, etc., may reach the liver through any of its five sets of vessels, but oftenest through the portal vein, the biliary ducts, or the hepatic artery. Infections through the hepatic artery are usually part of a general septicopyæmia which so overshadows the infection of the liver that the latter has only a pathological interest.

Most often the organism enters through the portal vein. The infection atrium in the intestines is furnished oftenest by dysenteric ulcers, and for this reason abscesses of the liver are commonest in Southern countries, where dysentery is commonest. In the temperate zones the primary disease most common is appendicitis, but ulcerative processes anywhere along the intestinal tract, especially along the large intestine, may cause infection through the portal vein.

Bacteria may enter the liver from the bile ducts either directly from ulcerations of the ducts, excited by gall stones or other causes, by extension up along the bile ducts, or by entering the vessels of the bile ducts and thence reaching the portal vein.

The symptoms are both constitutional and local. The patients are often emaciated, cachectic, with yellow-colored skin (not often, however, due to jaundice), and marked anæmia, usually accompanied by leucocytosis. Fever occurs in most cases, at least at some time during the course of the disease, and may be continuous, intermittent, remittent, or hectic in type. Chills may or may not be present.

Locally, there is pain, usually preceded by a sense of weight and fulness. The exact location of the pain varies with the site of the abscess—oftenest in the right hypochondriac region. It varies greatly in character as it does in intensity, but in general is more severe if the abscess is located near the surface of the liver. Radiation of the pain to the right shoulder is quite common.

Examination of the liver shows it to be enlarged, and the general tendency is for the liver to enlarge upward instead of downward. The border between the liver and lung is no longer a straight line, but one curving upward to a varying degree. The respiratory excursion of this line is retained, unless there is an old pleuritis with adhesions complicating the hepatic condition. If the abscess is located in the left lobe of the liver there may be marked dislocation of the heart.

If the abscess points toward the skin there may be localized bulging of the abdominal wall with œdema of the skin.

Jaundice is rare with liver abscesses, as is also the ascites. When the latter is found, it may be due to pressure on the portal vein, or to the general cachexia, and be merely a part of a general anasarca.

The spleen is not enlarged with the chronic abscess unless it has become amyloid.

Exploratory puncture will often settle any doubts as to the nature of the process, but one must remember that there are some dangers in making the puncture. The greatest danger is that of infecting the peritoneal or pleural cavity on withdrawing the needle from the abscess cavity.

The diagnosis will often be cleared by the rupture of the abscess into some organ, as the lungs, stomach, or intestine, and the escape of the pus outward.

The diagnosis of the solitary abscess of the liver is based mainly upon the symptoms of sepsis, with local pain and tenderness, with physical signs of a localized enlargement of the liver, with history of dysentery, appendicitis, hemorrhoids, or gall-stones. The diagnosis is certain when pus is obtained by aspirations.

When the abscess is very large and the enlargement of the liver mainly or solely upward, the condition may be mistaken for pleurisy; but attention to the history of the case, and especially to the respiratory motility of the upper border of the dulness, will settle the question.

may occur primarily in the liver, but this is decidedly exceptional while secondary cancer of the liver is comparatively frequent. The cancer is oftenest primary in some organ in connection with the portal system—the stomach, rectum, pancreas, uterus—but the primary tumor may be anywhere. The secondary tumor or tumors may far exceed the primary in size.

Examination shows the liver enlarged, often to an extreme degree, and in suitable cases the liver can be seen to enlarge from day to day. The enlargement may be nearly uniform, but in most cases it is plain that the enlargement is irregular. Sometimes the prominences in the liver can be seen and their respiratory motility followed by the eye. More often they can be felt as round, usually firm, hard prominences, sometimes distinctly umbilicated on the surface. They may be tender. Sometimes the peritoneal covering is inflamed and the resulting friction can be palpated. Percussion shows the irregular enlargement of the liver, and here also especial attention should be paid to the upper border of both the superficial and deep hepatic dulness.

In addition to these symptoms due to the presence of the tumor we may find symptoms due to the pressure which the tumors may exert upon neighboring organs. Thus the common bile duct may be obstructed and icterus result. The icterus tends to become rapidly and steadily worse.

The spleen is found enlarged in about ten per cent. of the cases.

Ascites is not uncommon and may be due to compression of the portal vein, to an accompanying carcinomatous peritonitis, or to the general exhaustion. The ascites is often sufficiently marked to entirely mask the tumors in the liver, which can be discovered only after the removal of the fluid, which may be either serous or hemorrhagic. The patients with cancer of the liver show a progressing secondary anæmia with leucocytosis, together with a rapidly developing cachexia, accompanied usually by considerable pain in the right side. There are no febrile symptoms unless caused by some complication.

Having found a tumor of the liver, a circumscribed enlargement which, from the general condition and age of the patient, and from the absence of symptoms of abscess or echinococcus cyst, seems to be a cancer, one should search for the site of the primary tumor, paying especial attention to symptoms pointing to disease of the stomach, pancreas, rectum, uterus, or to any of the other common sites for carcinoma, as the breast, etc. Even in the absence of such symptoms it is probable that the cancer of the liver is secondary.

Echinococcus Cysts.—Many cases cause no symptoms whatsoever and are therefore unrecognized until the cysts reach considerable size, and even then may be purely accidental findings. When small they cause no functional disturbances unless located at the porta or superficially, where they may excite a painful perihepatitis. Usually the first thing to attract attention is a palpable tumor or symptoms resulting from pressure upon some organ.

Hydatid cysts enlarging downward are much more easily palpated than those enlarging upward. The cyst is round, firm, elastic, sometimes fluctuating, although in many cases, when the tension of the walls is great, there is none. The size of the tumor varies over a wide range, but may be so large as to extend even into the pelvis or far upward into the thorax.

Percussion shows the tumor to be dull, and in a certain number of cases gives the so-called hydatid thrill, which is probably a fluctuation phenomenon in which the individual waves are very short because of the tension of the fluid, the elasticity of the walls, and the homogeneity of the cyst contents. The phenomenon is not found in all cases of hydatid cyst and is not absolutely peculiar to it, for it is found with other forms of cyst when the peculiar physical conditions are present.

Percussion is especially valuable when the cyst enlarges upward into the thorax. It enables us to determine the upper border of the cyst. The upper hepatic border is no longer straight, but presents a bulging up-