ate evacuation of the viscus. It would seem that bland and neutral urine should be better tolerated than the average acid normal urine, but I have made some very interesting observations on this point. In persons who are ingesting large quantities of pure spring water, which passes through the renal mechanism very rapidly, the bladder capacity is often immediately markedly decreased. This is due to the extreme rapidity with which the urine enters the bladder even though it be *per vias naturales*. I have noted this phenomenon so often that I feel sure of my ground. Irritable bladders can be, and often are, injuriously overworked in this way. When the hydrostatic method is employed without tube or catheter, the amount of force necessary to overcome sphincteric resistance foreordains a relatively powerful, bulky and swiftly-running current. This awakens bladder resentment both from stimulation of the urinary *besoin*, and surprising the bladder muscle, and speedy evacuation becomes necessary. This explains why so few accidents happen from hydrostatic expansion of the bladder. The bladder contracts and expels the fluid before hyperdistension occurs. This protective reflex is, however, not to be trusted too far. Its reliability presupposes a fairly sound and fairly elastic bladder wall. Caution is therefore necessary in aged subjects, whether the bladder is known to be extensively diseased or not.

There is no routine method for measuring bladder capacity which is applicable to all cases. Symptomatically, cases may be divided into those in which the abnormal calls to urinate are worse at night, and second, those in which the greatest frequency is during the waking hours. In the first class of cases the symptom-producing condition is almost entirely organic. In such cases the environment of daytime life is more or less distracting, and the calls to urinate are not so frequent as at night. In the second class there is a greater or less degree of neuropathic disturbance, existing either as a complication of actual organic disease and subordinate to it, or constituting—as it often does—the overshadowing element of the case. It is often difficult to draw the differential diagnostic lines, it is true; yet the cases in which it can be done are by no means infrequent. In cases with a decided neuropathic bias, the patient is unduly concerned about his bladder symptoms, and as a result of auto-suggestion the frequency of urinary desire is increased. Few realize how important the neuropathic side of urinary disturbances often is. A physician of my acquaintance who is the unfortunate possessor of an irritable bladder, tells me that his condition is almost unbearable when he happens to have in hand cases in which the disturbance of micturition is a strong factor.

Even in cases in which the condition is obviously organic there may be a neuropathic element, as a consequence of which micturition is most frequent in the daytime. In general, however, increased diurnal frequency means conditions in which movement and gravity enhance the local irritation. This is often found in *prostatiques*, vesical tumor and calculus. In general, frequent micturition due chiefly to inflammatory conditions is improved by rest, nocturnal or diurnal.

In cases of a purely nervous type, or in which the nervous element is a serious factor for consideration—cases distinguished clinically by lessened frequency of micturition at night—and in certain organic conditions in which rest is productive of similar improvement in symptoms, the capacity of the bladder can be gauged

by a method at once simple and efficient, a method which does not err by proving only the capacity of the bladder while in hyperdistension. The patient should be instructed to drink moderately of pure water during the evening, and, when aroused at night by a desire to micturate, to pass water on each occasion in a separate vessel. The greatest quantity obtained at any given micturition represents the maximum capacity of the bladder from a clinical standpoint. Cases in which the frequency of urination is aggravated at night, can not be gauged in this way, and mechanical means must necessarily be employed. The chief source of error here is: 1, hyperesthesia of the prostatic urethra and consequent exaltation of the urinary *besoin*; 2, too rapid distension of the bladder, producing "surprise" and peremptory muscular reflex in the bladder wall.

These sources of error being understood, the practical deductions are at once obvious. In the first place, general reflex excitability, if marked, should be guarded against by sedatives and antispasmodics. A hypodermic of morphia, 20 to 30 minutes before gauging the bladder capacity, is very useful. The local reflex irritability may be done away with by applications of eucain or cocain to the prostatic urethra. A small catheter should be used, save in the exceptional instances in which sphincteric resistance is easily overcome and the hydrostatic method without catheter can be used under relatively low pressure. Sterile water or normal salt solution is best for distending the bladder. Antiseptic solutions, as a rule, are too irritating, and defeat the very purpose for which they are used.

Whenever, in gauging bladder capacity, the urine returns at first with some degree of force, but loses this force as the test proceeds, it may be safely assumed that temporary distension atony has been produced and the operation, so far as gauging vesical capacity at that particular *séance* is concerned, is a failure, and the test will require repetition.

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PRIMARY SARCOMA OF THE ESOPHAGUS AND STOMACH.*

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PRIMARY SARCOMA OF THE ESOPHAGUS.

The fact that there are only eleven cases recorded in the literature shows that this affection is rare. Most of the cases have been regarded as pathological curiosities and were reported by the following authors: Chapman, 1877; Targett, 1889; Stephan, 1890; Shaw, 1891; Rolleston, 1893; Albrecht, 1895; Ogle, 1896; Livingood, 1898; Gastpar, 1900, and Stark, 2 cases, 1900. Besides these, Perry and Shaw, in an article on malignant tumors of the stomach, allude to two cases of sarcoma of the esophagus without, however, giving either clinical or pathologic data.

To the previously reported cases I am able to add another, that of a smooth muscle cell sarcoma of the lower end of the esophagus. The history is as follows: S. B., aged 51, was admitted to the Cleveland City Hospital service of Dr. Hoover, August, 1900, complaining of vomiting and difficulty in swallowing. He died a few weeks later of exhaustion.

* Read at the Fifty-second Annual Meeting of the American Medical Association in the Section on Pathology and Bacteriology, and approved for publication by the Executive Committee: Drs. A. Stengel, W. S. Hall and L. Hektoen.

Clinical Diagnosis: Carcinoma of the esophagus. Autopsy by Dr. Moore, resident pathologist.

Anatomical Diagnosis: Sarcoma of lower end of the esophagus, with metastasis in the cardiac end of the stomach, slight chronic interstitial nephritis, brown atrophy of the heart, emphysema and pigmentation of the lungs with broncho-pneumonia.

The body was 157 cm. long and markedly emaciated. The surface of the body was free from scars, abrasions and new growths. The superficial lymph glands were not enlarged. As the esophagus and stomach are the only organs showing lesions of present interest, the description of the other organs is omitted.

Esophagus: The organ is of normal size and appearance from its beginning to within 12 cm. of its cardiac end. At this point its wall is much thickened, and its mucous surface is the seat of irregular ulcers, covered with grayish necrotic material. The surface is irregular, but there are no polypoid masses projecting into the lumen. On section the wall is rather thicker than usual, firm and dense in consistency, and pale in color. The cardiac orifice of the stomach is narrowed, but admits the little finger with ease.

Stomach: The stomach is of ordinary size and appears normal throughout, except for the thickening of the cardiac orifice above described and for the presence near the latter of a nodular tumor, 7 cm. in its greatest diameter. On section this mass is seen to be beneath the mucosa. It is dense and firm and on section is glistening in appearance. Some of the lymph glands near the stomach are enlarged. There are no other metastases.

Microscopic Examination of Esophagus and Stomach: Sections made at various points through the wall of the esophagus, including the tumor, show in general the same appearances. The mucosa is fairly well preserved between the points of ulceration. In some places it is necrotic and contains numbers of bacilli, some of which are large and stout. In other places the mucosa is entirely replaced by a mass of fungoid tissue. It is composed of a fairly vascular fibrous tissue containing a number of larger and smaller areas of large spindle-shaped, large and small round, and many giant cells, which are supported by a variable amount of intercellular substance. There is no distinct alveolar structure, but a semblance of this occurs when masses of these cells occupy dilated vessels. The cells are often seen infiltrating the denser fibrous tissue. The nuclei of the tumor cells are large and vary much in shape, but are usually oval; they are often elongated, and even fusiform. They are usually vesicular and many of them contain fine chromatin granules. Some nuclei are dense and stain diffusely and deeply with hematoxylin and methylene blue. Some swollen nuclei contain small nucleoli. Nuclear figures are very numerous. The sarcomatous tissue is not diffuse, but, especially at the borders of the growth, occurs in patches. When, as is often the case, they occupy dilated lymph or blood vessels, the cells are usually large and often round, but even here long fusiform cells with long swollen vesicular nuclei are seen. In a few places the cells are arranged in concentric layers, and the cells of the inner layers are flattened and often show hyaline degeneration. The growth is best marked in the muscularis, all the coats of which are involved. (At the seat of the tumor only smooth muscle tissue is to be found.) In this tissue the most characteristic appearances of the growth are found. It consists of larger and smaller areas composed largely of long spindle-shaped cells with long swollen oval or fusiform nuclei. The cells and nuclei are often very large. The cells lie in parallel rows, usually separated by a small amount of intercellular tissue, which is, however, often absent or invisible. There is a striking resemblance between these cells and their nuclei and the muscle cells and nuclei of the neighboring tissue. The tumor cells nearest the muscle tissue very closely resemble those of the latter. They are narrower and have long oval or fusiform rather deeply staining nuclei. In most places it is easy to trace all gradations between the large tumor cells and the narrow muscle cells with thin deeply staining nuclei. The stages in the development of the muscle cells into tumor cells

is as follows: Along the advancing border of the growth the nuclei of some of the muscle cells swell and become more vesicular; later the nuclei become more swollen and develop fine chromatin growths. At the same time the cell body becomes thicker and its ends become somewhat rounded, and finally develops into a modified fusiform or even oval shape. Such cells can be found among unchanged muscle cells at quite a distance from the new growth. They are not infrequently found in isolated groups. In the sarcomatous tissue there are a number of large round cells with oval or round vesicular nuclei containing fine chromatin granules. Sections stained with Weigert's elastic tissue stain show little if any newly formed elastic tissue. As far as can be seen the fibrous tissue of the submucosa and of the muscularis plays no part in the tumor formation. Many of the larger sarcomatous areas show marked necrosis, with nuclear fragmentation. In the tumor tissue and at its border there are numerous polymorphonuclear eosinophiles. This tumor, then, is a mixed cell sarcoma apparently divided solely from the smooth muscle tissue of the esophagus.

Sections of the wall of the stomach made through the nodule show atrophy and superficial necrosis of the mucosa, which is entirely lost in places. In other places it is infiltrated with small round cells. The submucosa is in general free, but here and there shows the same round cell infiltration. The muscularis is the seat of an extensive invasion of a new growth in every way similar to that described in the esophagus. In most places the tumor cells are situated in dilated vessels. In some places the tumor tissue infiltrates the muscularis and a number of areas are to be seen in which the muscle cells take part in the tumor growth and show the same changes noted in the esophagus. In many of the muscle cells near the new growth there are large vacuoles.

Sections of the enlarged lymph glands show a new growth similar to that of the esophagus and stomach. There is, however, marked necrosis.

Revised Diagnosis: Primary myosarcoma of the esophagus, with metastases in the stomach and neighboring lymphatic glands.

Until Livingood's paper, in 1898, sarcoma of the esophagus was regarded as a pathologic curiosity and, on account of its rarity, of no special clinical importance. Livingood analyzed the cases reported to the date of his article and added a well-studied case with a full clinical history. He concludes that there is clinically no essential difference between sarcoma and carcinoma of the esophagus. He further notes that the advance of sarcomatous tumors of the esophagus is more rapid than carcinoma, being fatal within nine months from the first symptoms; that widespread metastases and the location of metastases are as uncommon and indefinite as in carcinoma, and finally, that the mode of termination is the same in both. Livingood found eleven cases of carcinoma and one case of sarcoma of the esophagus in one thousand consecutive autopsies. He suggests that the apparent rarity of sarcoma is due to a lack of careful histological study of esophageal tumors.

Stark, in the most recent and complete article on esophageal sarcoma, reports two cases and analyzes the clinical symptoms of the affection. In regard to the differential diagnosis between sarcoma and carcinoma of the esophagus, he states that age has little influence if the case of Stephan (a 4-year-old child) is excepted, but that in an individual under 25 years of age sarcoma is much more probable than carcinoma. He thinks that the most important symptom is pain, which in carcinoma may be lacking for months, and when it does occur is rarely of the intense stabbing character observed in sarcoma; the pain in carcinoma is usually most marked after eating, and in sarcoma while fasting, especially at night. He further states that the pain in sarcoma is

back between the shoulder blades, which is uncommon in carcinoma. He also points out that the duration of the disease is shorter in sarcoma; in one of his cases death occurred in ten weeks after the first symptoms of dyspepsia.

A critical study of the twelve recorded cases (including my case) of sarcoma of the esophagus brings out the following information:

Age.—Youngest, 4 years (lympho-sarcoma, Stephan); 25 years, one case; 38 years, one case; 41 years, one case, 45 years, one case; 50 to 55 years, five cases, and 60 to 70 years, two cases. (The cases of Perry and Shaw are mentioned without clinical or pathological data and are, therefore, useless for generalization.)

Situation of the Tumor.—Lower part of the esophagus, 9 cases; upper part, 2 cases; not mentioned in 1 case.

Morphology of the Tumors.—Pedunculated or polypoid in 3 cases (Ogle, Albrecht and Stephan); diffuse tumor formation with polypoid or nodular excrescences in 2 cases (Livingood and Gastpar); tumor mass completely surrounding the lumen in 5 cases (Rolleston, Gastpar, Stark—2 cases—and Howard); not mentioned in 3 cases. More or less obstruction occurred in nearly all cases; in some stenosis was complete. Ulceration of the mucosa and of the growths occurred in 7 cases. Perforation of the esophagus occurred in 4 cases; into the trachea twice. (Shaw and Livingood); and with pleurisy and lung inflammation twice (Rolleston and Stark).

Histologic Characters of the Tumors.—Lympho-sarcoma, 1 case (Stephan); round cell sarcoma, 4 cases (Shaw, Stark, Stark, Rolleston); pure spindle cell, 2 cases (Ogle and Livingood); oval and spindle cell, 2 cases (Chapman and Targett); alveolar, 1 case (Albrecht). Large mixed cell, 1 case (Gastpar); muscle cell, 1 case (Howard).

Metastases were noted in 5 cases; in the neighboring lymph glands, stomach, intestines, kidneys, adrenals, lungs, liver, brain, etc., in 1 case (Stark); in the peripancreatic lymph glands, the iliac bone and neighboring muscles, the temporal bone and muscle, 1 case (Rolleston); in the neighboring lymph glands and kidneys, 1 case (Shaw); in the stomach and gastro-hepatic lymph glands, 1 case (Howard); and in the liver, 1 case (Stark).

In one of Stark's cases the stomach contents were acid in reaction, without, however, the presence of free HCl.

In 4 cases, no clinical diagnosis was made; in 3 cases it was carcinoma, in 3 esophageal tumor; in one case periostitis of the spinal vertebrae with extension to the esophagus, with perigastritis; in 1 case there were no clinical symptoms referable to the esophagus. In this case—Albrecht's—the patient died of croupous pneumonia and at autopsy, a pedunculated alveolar sarcoma was found in the esophagus.

Conclusions.—Analysis of the twelve recorded cases of sarcoma of the esophagus shows the following: 1. The disease is more common in males than in females, and at the period of life during which carcinoma most frequently occurs. It may, however, unlike carcinoma, occur in early life—between 4 and 25 years. 2. Nine of the twelve cases involved the lower half of the organ. 3. While the tumors usually nearly surround the lumen, in three cases they formed pedunculated or polypoid masses projecting into the lumen. 4. Symptoms of esophageal obstruction occurred in eleven of twelve cases. 5. There was perforation with involvement of the respiratory organs in four cases. 6. All the varieties of sarcoma except angio-sarcoma have been found, the round cell variety standing first in frequency—one-fourth of the cases. 7. Metastases occur rather frequently (five out of twelve cases), and in two cases were widespread. 8. The clinical diagnosis of esophageal sarcoma has not been made and there are no certain and constant diagnostic points between sarcoma and carcinoma of this organ, the clinical symptoms being neces-

sarily very much the same and dependent upon the same conditions—obstruction and cachexia—in the two diseases. 9. As pointed out by both Livingood and Stark, sarcoma runs a more rapid course, and a fatal issue is to be looked for earlier than in carcinoma. The greater size of the sarcomatous growths is probably responsible for this. 10. The differences in the character, distribution, and period, of the pain in the two affections described by Stark, are not mentioned by other observers. It would prove a matter of considerable importance if his experience is confirmed.

PRIMARY SARCOMA OF THE STOMACH.

A case of sarcoma of the stomach was recognized and reported as early as 1847 by Bruch, and Virchow described three cases in 1865. Although a considerable number of cases were reported chiefly as pathologic curiosities, it was not until the classical article of Schlesinger, in 1897, that the subject assumed clinical importance. This author reported three personally observed cases and collected 33 others from the literature. In 1898 Brooks reported a case and analyzed 15 others which he collected from the literature. In the past six years several cases have been reported by surgeons—Hartley, Baldy, Capello, Cantwell and others—who have removed gastric sarcomata at operation. The best of the recent articles on gastric sarcoma is that of Dock, in 1900, who reported a carefully studied case, and collected 13 additional cases from the literature, which, added to the cases collected by Schlesinger, brought the total number of known cases up to 50.

In a careful search of the literature I have been able to add 7 cases to these, which, together with the 4 cases reported in this article, increase the total number of cases to 61. I have taken considerable pains to criticize the accuracy of the diagnosis in the cases collected from the literature and have excluded all those in which there was any apparent doubt in regard to the correctness of the diagnosis of sarcoma. As several of the reported cases have been found by accident in articles under other titles, I am led to believe that this list does not include all the recorded cases. All who write on the subject must acknowledge a debt to Krüger, Schlesinger and Dock. The disease is ignored in most of the textbooks on diagnosis, diseases of the stomach and pathology.

CASE 1.—Diffuse round cell sarcoma with atrophy and constriction of the stomach.

Female, aged 65 years, a patient of Dr. J. H. Lowman, to whom I am indebted for the clinical history, complained of nausea and vomiting for over a year before her death, which occurred Jan. 12, 1896. She was weak and emaciated, but was able to walk about the room three days before her death. No mass could be palpated in the abdomen.

Clinical Diagnosis: Carcinoma of the stomach.

Autopsy: The body was that of a woman of ordinary size, and was poorly nourished. The abdomen was distended. The skin showed no scars, abrasions or new growths. The pericardium, heart, aorta and large vessels showed no abnormalities. The esophagus was normal.

Stomach: The stomach occupied its usual position. It was very small, being about one-fourth its ordinary size. On external examination it was everywhere hard, firm and inelastic. Midway between the cardia and pelvis the organ was markedly constricted, roughly resembling an hour-glass in shape. On section its wall was everywhere greatly thickened, being from 1 to 3 or 4 cm. in thickness. At the point of constriction the lumen was 3 cm. in diameter. The mucosa, which was of a brownish-red color, was unbroken. The thickening of the stomach wall was due to the presence of a dense and firm grayish-white tissue, which had a rather homogeneous

appearance. This tissue apparently did not encroach upon the mucosa, but involved the submucosa and muscularis, both of which coats were extensively infiltrated. The gastro-hepatic, mesenteric and retro-peritoneal lymph glands were enlarged and had the same appearance as the growth in the wall of the stomach.

The other organs showed nothing of present interest.

Sections of the stomach made of various portions showed in some places disintegration of the mucosa. In some places it had entirely disappeared. In all the sections examined, the submucosa was transformed into a fibro-cellular tissue composed of newly-formed fibrous tissue containing variable numbers of small round and oval cells. The cells showed no special arrangement, but often occurred in groups and masses and were always supported by fibrous tissue or by a fibrillar intercellular substance. The individual cells varied from 8 to 15 mikron in diameter. They had a single round or oval nucleus which usually stained deeply and uniformly with hematoxylin. Some cells had paler nuclei. The cell bodies were usually round or slightly oval. A few spindle-shaped cells were seen. In all sections the muscularis was markedly invaded, in many places diffusely. All grades of invasion of this coat occurred from small islands of tumor cells to complete transformation into tumor tissue. The muscle tissue was pushed aside and infiltrated by the new growth. There was no evidence of proliferation of the muscle cells, which, so far as could be determined, played no part in the tumor formation. The origin of the tumor from the fibrous tissue of the submucosa was clear. A few blood vessels were found in the new growth. In no places was invasion of blood vessels made out. The amount of fibrous tissue present in some parts of the tumor warrants the term fibro-sarcoma. Sections of the lymph glands showed a growth in all respects similar to that of the stomach.

Anatomic Diagnosis: Small round and oval cell sarcoma of the stomach, primary in the submucosa, and infiltrating the muscularis. Constriction producing hour-glass shape of the stomach. Secondary sarcomatosis of the gastro-hepatic mesenteric and retro-peritoneal lymph glands. Anemia.

CASE 2.—Mixed cell sarcoma of the stomach with abscess formation in the tumor, with metastases in the neighboring lymph glands.

R. F., female, aged 46 years, was admitted to the Lakeside Hospital, Sept. 7, 1898, service of Dr. Dudley P. Allen (Dr. Nevison acting), complaining of anorexia, headache, pain, swelling in the region of the spleen. There was no vomiting and no pain in the epigastric region. A large mass could be felt in the region of the spleen. Examination was otherwise negative. The urine contained a trace of albumin but no casts. The red blood cells were normal in number and appearance. A considerable leucocytosis was noted.

Clinical Diagnosis: Tumor of the spleen. The patient died 12 days after admission. Autopsy a few hours after death.

Anatomic Diagnosis: Primary mixed cell sarcoma of the stomach with abscess formation and peritonitis. No metastases. Edema and congestion of the lungs. Adenoma of the duodenum. Streptococcus pyogenes and staphylococcus pyogenes aureus, and a short liquefying bacillus in the peritoneal exudate and abscess of the tumor of the stomach.

The body was 172 cm. long. The general nutrition was good. There were no scars, wounds or growths upon the surface of the body. There was bilateral enlargement of the thyroid. The chest was well shaped, the pleuræ negative; the lungs showed congestion, edema and emphysema, but were free from tumors. The pericardium, heart and aorta are without present interest. The abdomen was distended and very tympanitic. The abdominal wall contained a thick layer of fat; the muscles were pale. The parietal peritoneum was covered with a thin fibrino-purulent exudation. The coils of the intestine were bound together by recent fibrous adhesions, containing larger and smaller collections of creamy pus. The liver projected 4 cm. below the costal border in the mammary line. The under surface was adherent to the stomach, and the colon. The stomach was intimately bound to the surrounding

structures, and was displaced downwards towards the left, so that its posterior surface lay over the left kidney. Its anterior wall was of ordinary size and appearance. The posterior wall was thickened. On the right side there was a ragged opening, 8x4 cm., between the peritoneal cavity and with a large cystic area in the posterior wall of the stomach.

Stomach: On removal and section the stomach contained foul-smelling yellowish material. The cubic capacity of the organ was reduced, while its bulk was markedly increased. The anterior wall was normal in appearance. Near the lesser curvature, and affecting nearly the whole of the posterior wall, there was a tumor mass 20x16 cm. which varied from 0.5 to 8 cm. in thickness. Near the lesser curvature there was a fungus-like mass, 6x8 cm. in breadth and length, which protruded into the lumen of the stomach. This protuberance was irregular in outline and ulcerated, and covered with a foul-smelling yellowish pus. The tumor did not extend to or involve the pylorus, which was quite soft. The tumor lay beneath the mucosa everywhere except at the ulcerated area. At the cardiac end of the tumor there was a cyst 7x4 cm., and at the pyloric end a similar cyst 6x5 cm.; between these there was a larger cyst, communicating with the other two. These cysts contained fluid and necrotic material. The larger cyst communicated with the peritoneal cavity. The tumor varied very much in thickness, the cyst walls being from 1 to 3 cm. thick. The tumor involved the submucosa and invaded the muscularis and mucosa irregularly. On section it varied much in consistency, in some places it was soft, while in others it was dense and firm. On the right side of the stomach near the tail of the pancreas, there was a nodular mass, apparently an enlarged lymph gland, measuring 8x4 cm., which on section had the same appearance as the growth in the stomach, and contained a cyst 3x2 cm. in size. The neighboring lymph glands were swollen. The posterior wall of the stomach was bound to the pancreas, which was not, however, invaded by the tumor. The duodenum was markedly congested; 8 cm. below the pylorus there was a small nodule, 1.5 cm. in diameter, situated in the submucosa. The rest of the intestines showed nothing abnormal. The other organs showed nothing of present interest.

Sections of the stomach made at a distance from the tumor showed nothing abnormal. Sections from various portions of the tumor all showed much the same structure, the tissue being composed of rather large round, oval and spindle-shaped cells of the connective-tissue type, and with relatively large nuclei. The cells were not arranged in alveoli, but a supporting connective-tissue could be made out. In some places, especially at the borders, the tumor was fibro-cellular, while in others it was markedly cellular in structure. Larger and smaller areas of necrosis were found. Sections taken from the margins of the cysts showed marked necrosis, with nuclear fragmentation. In this material there were large and small clumps of large bacilli. In a few places there was an intimate relation between the tumor cells and the adventitia of arteries and veins, suggestive of the vascular origin of the former. These areas were always isolated. In other places, at a considerable distance from the main tumor, there were small irregular islands of typical sarcoma tissue and apparently springing from the connective tissue of the submucosa. The tumor was situated in the submucosa and invaded the muscularis and the mucosa in only a few places. Its origin was without doubt in the submucosa. Sections of the smaller tumor showed the same structure met with in the larger. No trace of lymphatic tissue, however, remained. There was markedly little inflammatory reaction about and in the tumors of the stomach; no groups of tumor cells were found in either blood or lymph vessels. Some of the veins, however, contained recent thrombi.

Sections of the small tumor situated in the submucosa of the duodenum showed a typical adenoma, composed of a large number of glands divided into lobules by connective tissue bands. The glands were lined with a single row of epithelial cells, which were columnar in some and cuboidal in other glands. The cytoplasm of these cells was finely granular and stained poorly; the nuclei were vesicular and placed at the base of the cells, where the latter were supported by a delicate membrana

propria. The epithelial cells formed a single row in the glands and never broke through the membrana propria. No ducts were to be found. The tumor lay almost entirely in the submucosa, but in some places had pushed through the muscularis mucosæ and encroached upon the mucosa, which was normal in appearance. Sections of the tumor of the thyroid showed a papillary adenoma. The other organs are without present interest.

CASE 3.—Sarcoma of the pylorus. G. H., white, a laborer, aged 48 years, was admitted to St. Alexis' Hospital, service of Dr. Cogan, Oct. 26, 1900, complaining of vomiting and weakness. His family history was negative. The patient stated that he had always enjoyed good health until December, 1899, when his appetite failed and he began to lose weight. In October, 1900, he had to give up work on account of weakness and discomfort in his stomach. At this time he began to vomit after each meal. After admission to the hospital he vomited almost continuously until his death, which occurred on November 3. No food could be retained by the stomach.

Examination of the chest was negative. No tumor could be felt in the abdomen. On testing the stomach contents the acidity was normal. Motility and absorption were both diminished. The red blood cells numbered 1,000,000 per cubic millimeter. The leucocytes were not increased.

Anatomic Diagnosis: Sarcoma of the pylorus and neighboring portion of the stomach. Broncho-pneumonia of both lungs. Chronic adhesive pleuritis. Anemia.

The body was poorly nourished. Rigor mortis was present. The other organs showed nothing of present interest; only the description of the stomach is taken from the autopsy protocol.

Stomach: This was somewhat dilated. On opening the organ the pylorus and the wall of the stomach on all sides for a distance of 10 cm. from the pylorus, were found to be thickened. The mucosa was unbroken. The gastric wall at the pylorus measured from 1 to 2 cm. in thickness. The tumor on section was at nearly every point beneath the mucosa, and its chief seat was the submucosa, but in many places it could be traced into the muscularis. The tumor was homogeneous in appearance and firm in consistency. The lymph glands in the neighborhood of the stomach were not enlarged. No metastases were found in any organ.

In sections made from various portions of the tumor the mucosa was atrophied, the tubules having been compressed and the interglandular stroma replaced by fibrous tissue containing round, oval or fusiform cells. The muscularis mucosæ was absent in many places. The submucosa was everywhere thickened, due to a new growth of fibrous tissue, containing a varying number of fusiform, round and oval cells, supported by a variable amount of intercellular substance. At many places this tissue extended into the muscularis. In some places the sarcomatous tissue was markedly fibrous. Throughout the tumor the capillaries were numerous. In many places the lymph vessels were dilated and contained tumor cells. In some places the endothelial cells of the lymphatics showed marked proliferation and nearly filled the lumina of these vessels. In some lymphatics the lining cells had assumed a cuboidal shape and the structure had the appearance of a tubular gland. The new growth in some places invaded the nerves and even the serosa. There was no peritonitis.

CASE 4.—A saloonkeeper, aged 39 years, married and a moderate drinker, suffered with occasional attacks of indigestion and discomfort in the epigastrium for a year before consulting Dr. Robert H. Sunkle, to whose kindness I am indebted for the history and autopsy in this case. When first seen by Dr. Sunkle, the man complained of pain in the abdomen, loss of weight, strength and appetite. The liver was greatly and uniformly enlarged, but no nodules were palpated. No tumor could be made out in connection with the stomach. The heart and lungs were negative. There was occasional vomiting, but no special pain referable to the stomach.

A few days before death, which occurred one month after Dr. Sunkle first saw the case, dulness was made out in the flanks. Dr. Sunkle's diagnosis was hypertrophic cirrhosis of the liver, in which he was upheld by Dr. Sihler, who saw the case in con-

sultation. Later the possibility of carcinoma of the liver was considered.

The autopsy was made by Dr. Sunkle, who brought the organs to my laboratory for examination.

Anatomic Diagnosis: Primary angio-sarcoma of the lesser curvature of the stomach, with metastases in the neighboring lymph glands and in the liver.

As the stomach and liver were the only organs showing changes of present interest, a description of the other organs is omitted.

Stomach: The organ was of ordinary size. The lesser curvature was thickened. On section, the cardiac and pyloric ends were normal, as were the greater curvature and the anterior and posterior walls. The mucosa was somewhat thickened. The whole length of the lesser curvature was thickened and from it a mass of tissue protruded into the cavity of the organ. The mass was from 1.5 to 2 cm. in thickness and 4x5 cm. in outline. The surface was irregularly ulcerated and it was difficult to make out the mucosa. On section the mucosa was soft, readily lacked the pearly translucency of carcinoma. The growth extended through the coats of the stomach, and included and surrounded several enlarged lymph glands, which were virtually involved in the growth. On section these glands were soft and had the same appearance as the gastric tumor. The peritoneal cavity contained a considerable amount of clear fluid. There was no peritonitis. The liver was markedly enlarged, its edges rounded, the capsule mottled red and yellow. Scattered over the surface, but lying well beneath the capsule, there were a number of soft yellowish areas. On section both the right and left lobes of the organ were the seat of numerous grayish-yellow areas of soft consistency, sharply marked off from the surrounding liver tissue, and varying from 0.5 to 3 or 4 cm. in diameter. Many of the large branches of the portal vein were occluded by grayish-yellow masses, which were here and there mixed with blood and coagula. Portal vessels could be traced into many of the larger masses, which often contained central hemorrhagic areas. The liver tissue between the masses was congested and in places compressed. The external surface of the gall bladder showed a small nodule similar to those found in the liver. The gall bladder and bile ducts on section were normal. The mesenteric glands and other organs were free from metastases.

Histologic Examination: Stomach. In sections of the gastric wall made at a distance from the tumor, there was disintegration of the superficial layer of the mucosa. In sections cut through the tumor at various places the mucosa showed disintegration to a varying depth. In some sections the deeper layers of the mucosa were invaded by tumor tissue which compressed and replaced the tubules and interglandular tissue. The submucosa was markedly thickened, due to the presence of large areas of tumor tissue which was diffuse in some places and in others sharply circumscribed. This latter appearance was usually due to the extension of tumor tissue into large and small veins. The tumor evidently had its origin in the submucosa and varied in structure considerably. In many places the structure was typical of a mixed cell sarcoma, being composed of large and small round and oval cells, large spindle-shaped and numerous giant cells, and a variable amount of intercellular tissue, which was conspicuous in some places and scanty in others. In general, the tumor was very cellular. In all parts of the growth, capillaries, most of which contained blood, were numerous. In most places the relation of the tumor cells to the capillaries was intimate, viz., masses of round, oval, flattened and often fusiform cells surrounded blood capillaries, and were placed directly in relation with their walls. In some places, especially in the metastases in the liver, tumor cells were arranged in a regular row about a small lumen, in such a manner as to resemble a cross-section of a tubule. Blood cells and granular material were present in some of these spaces. In still other places the tumor cells were arranged in large alveoli, supported by a variable amount of intercellular tissue and capillaries. The muscularis was only slightly invaded, and the mucosa was markedly invaded in places. The invasion of the large and small veins of the sub-

mucosa was marked. Most of these vessels in the tumor area were completely occluded by tumor tissue, similar to that above described. The tumor cells varied much in size and shape. Their nuclei were large, round or oval, some staining densely, while in others fine chromatin masses could be made out. In many nuclei there was a rather large oval or round hyaline body, which stained pink with eosin. Nuclear figures were common. The giant cells had very large single nuclei. Many of the tumor cells showed marked fatty degeneration. The growths in the lymph glands and the liver were identical with that of the stomach. The relation of the tumor cells to the capillaries was especially well marked in the liver metastases. Some of the branches of the portal vein contained both tumor cells and fibrinous thrombi. Many were completely occluded. In many places the new growth in the liver had passed through the veins and was infiltrating the liver tissue. In sections some distance from metastases, there was marked necrosis of the central portions of the liver lobules with hemorrhage. There could be no doubt in regard to the sarcomatous nature of the neoplasm, which evidently sprung from the blood vessels of the submucosa of the stomach.

Frequency.—The disease is certainly rare, but probably occurs more commonly than is generally supposed. There can be no doubt but that in the absence of routine microscopic examination of tumors found at operation and autopsy, many cases must have been mistaken for carcinoma, which, indeed, was the clinical diagnosis in a considerable number of the recorded cases. So far there are sixty-one known cases. Next to carcinoma it is certainly the most common tumor of the stomach.

Etiology.—Of the 61 cases 30 occurred in females, 25 in males and in 6 the sex was not mentioned. In regard to age the youngest reported case occurred in a girl $3\frac{1}{2}$ years old (Findlayson's lympho-sarcoma). The age was reported in 52 cases and the ages were as follows: It was from 15 to 20 years in 6 cases; 20 to 30 in 9 cases; 30 to 40 in 7 cases; 40 to 50 in 10 cases; 50 to 60 in 10 cases; 60 to 70 in 5 cases; 78 in 2 cases, and given as "old age" in 2 cases. Nothing is known of the primary cause of the disease. In Brooks' case the tumor started in an old bullet wound of the stomach.

Seats of Tumors.—Heretofore on account of the meager data at hand little attempt has been made to establish the principal seats of sarcoma of the stomach. Schlesinger and Dock concluded that any portion of the gastric wall might be affected. The former states that the greater curvature is the most common seat, especially of the nodular form, while lympho-sarcomata are apt to be diffuse. Dock calls attention to their origin at the pylorus and in the posterior wall in some of the recently reported cases.

Analysis of the 61 cases shows that the growth was diffuse in 13, of which 4 were lympho, 5 round cell, 1 fibro and 1 spindle-cell sarcoma. In 8 cases the growth was limited to the pylorus, in 6 cases the pylorus and the lower half of the stomach were involved, in 1 the pylorus and the upper part of the duodenum, and in 1 the pylorus and the greater curvature; the pylorus was involved in a total of 16 cases. The tumors were primary in the greater curvature in 7 cases, and involved the greater curvature with the posterior wall in 1 case, with the lesser curvature and posterior wall in 2 cases, and with the anterior wall in 1 case, making the total involvement of the greater curvature 11 cases. The lesser curvature alone was involved in 5 cases, with the cardia in 3 cases, with the posterior wall in 1 case and with the posterior wall and greater curvature in 1 case. The posterior wall alone was affected in 6 cases, and with the anterior wall in 1 case. The cardia was involved in only 3 cases, and always with the

lesser curvature. The anterior wall was never involved alone, but was affected with the posterior wall in 1 case, and the greater curvature in another.

It is seen from the above that the growth involved the pyloric end in a total of 16 cases, the cardiac end in 2 cases, the intermediate portions in 27, while it was said to be diffuse in 13 cases. The seat of the growth was not mentioned in 5 cases. The stomach and whole gastrointestinal track were involved in 1 case of lympho-sarcoma.

Pyloric stenosis was noted in only 5 cases, but probably occurred more frequently, for the reports are meager in many instances.

Size of Tumors.—They were stated to have been the size of a pigeon's egg in 1 case, a man's fist in 2 cases, an orange in 1 case, a child's head in 5 cases, and a man's head in 6 cases. The tumors extended below the umbilicus in 8 cases.

General Appearances.—They were said to have been nodular in 27 instances, and in some of these, notably in 2 cases, the tumors formed polypoid masses projecting into the lumen of the stomach. Tumors projected into the peritoneal cavity in 8 cases. In some of the latter cases the base of the tumor was narrow. The new growths showed ulceration in 10 cases, with perforation of the gastric wall in 2 cases.

In many instances, the exact number of which could not be determined, the growth developed beneath the mucosa, which was intact. The growth usually started in the submucosa, and the muscularis was commonly involved. The tumors occasionally had their origin in the muscularis, and cases of myosarcoma was recorded.

The tumors varied much in consistency, from soft, spongy, fungoid masses to firm, fibrous growths, and had the general macroscopic characters of sarcoma of other organs. They differed from carcinoma in their situation, being usually beneath the mucosa and often not involving the latter, and also in their nodular character, comparative dryness and homogeneous appearance on section. In many cases the diagnosis was not made until microscopic examination. This was, no doubt, often due to lack of care in the macroscopic examination. Cystic degeneration of the tumors occurred in 6 cases, hyaline degeneration in 1, calcification in 3, myxomatous degeneration in 2, and suppuration in 1. The stomach is stated to have been decreased in size in 2 cases, and in 1 case, the second reported in this paper, it was constricted in the middle and resembled an hour glass in shape. In a few cases, dilatation of the stomach is mentioned, but this seems to be much less common and not so marked as in carcinoma. It will be noted that the pyloric end of the stomach was involved in only 16 out of 61 cases—26.23 per cent.—and that pyloric stenosis was noted in only 5 cases—8.19 per cent. The stomach was bound to the right lobe of the liver in one case and the spleen in another.

Involvement of Other Glands.—Metastases occurred in 24 cases—40 per cent.—a smaller proportion than in carcinoma. The gastro-hepatic lymph glands were involved alone in 2 and with other organs in 5 cases; the mesenteric glands in 6 cases, never alone; the retroperitoneal glands alone in 1 case and with other organs in another. The omentum was invaded in 2 cases, the liver in only 7 cases, the spleen in 4, the kidneys in 2, the ovaries in 3, the peritoneum in 2, and the intestines, pancreas, thyroid, right adrenal, and testis each in 1 case. In our Case 4 there was extensive sarcomatous

embolism of the branches of the portal vein, with multiple large metastases of the liver.

Histologic Classification.—The growths were classified as round cell in 16 cases, spindle cell in 8, mixed cell in 4, as lympho-sarcoma in 15, myosarcoma in 4, fibro-sarcoma in 3, angio-sarcoma in 3, and endothelial (lymph) sarcoma in 1. The histologic diagnosis was not given in 7 cases. In Case 4 of our series giant cells were numerous.

Clinical Symptoms.—Reigel states that there is no clinical difference between sarcoma and carcinoma of the stomach, and that hematemesis and cachexia are common to both. Schlesinger found that examination of the stomach contents (7 cases reported by Hammerslog, Maass, Dreger, Fleiner and Schlesinger) showed nothing essentially different from that of gastric carcinoma. Dock, who has presented the most carefully studied case, made a diagnosis of dilatation from a tumor at the pylorus, probably the scar of an old ulcer, but also thought of carcinoma and sarcoma, "but the features of the case were not considered to admit a differential diagnosis."

According to Reigel the clinical course runs from a few months to three years, on an average of from 1 to 1½ years. In several cases death occurred within from four to six months from the onset of nausea and vomiting and epigastric pain. Many cases run their course without symptoms until near the end. Case 4 illustrates this point. In some cases there were no clinical symptoms referable to the stomach. In Hartley's case there was coffee-ground vomit and dyspepsia five years before the case came under observation. There was no recurrence and except for symptoms of indigestion, fair health was enjoyed for four years, when coffee-like material was vomited on five successive mornings.

Analysis of the cases shows that the duration of the illness was mentioned in only 16 cases as follows: Six weeks, 1 case; 3 months, 1 case; 5 months, 1 case; 7 months, 1 case; 9 months, 1 case; 1 year, 4 cases; 2 years, 1 case; 3 years, 1 case; several years, 1 case; 5 years, 1 case. Vomiting was recorded in 18 cases, in 4 of which the vomitus was bloody. Loss of appetite was recorded in 5 cases, but was probably a common symptom. Diarrhea was a marked symptom in 2 cases, but constipation seems to have been of frequent occurrence. Pain in the gastric region was complained of in 6 cases; pain in the abdomen was noted in 9 cases, in 3 of which it dated for 2 years.

Tumors were palpated in the gastric region in 10 cases, in the splenic region in 6, and in the lower abdomen in 13 cases. In Case 4 the liver was enormously enlarged with no symptoms suggestive of disease of the stomach. Emaciation was noted in 13 cases.

The condition was mistaken for pseudo-leukemia in 1 case, and for pernicious anemia in 1 case; ascites occurred once and jaundice twice. Dock found that the blood in the cases of gastric sarcoma previously reported showed a decrease in the hemoglobin and in the number of red blood cells, and usually leucocytosis.

Diagnosis.—A diagnosis was either not made or not mentioned in 38 cases. In 5 cases a diagnosis of gastric carcinoma is recorded; in 8 cases the diagnosis was "malignant tumor" of the stomach, while a positive diagnosis of sarcoma of the stomach was made in 3 cases, one each by Schlesinger, Reigel and Westphalen. In the latter's case the diagnosis was made on the microscopic appearances of a bit of tissue obtained on washing the stomach. In Reigel's case a large sarcomatous nodule

was vomited. A probable diagnosis of an old scar of the pylorus was made in one case by Dock. The diagnosis was tumor of the spleen, tumor of the omentum, tumor of the left hypochondrium, cystic tumor of the abdomen, ovarian cyst and pseudo-leukemia, each in one case. In Case 4 the diagnosis was hypertrophic cirrhosis of the liver. Little mention is made of differential diagnosis in the literature, and Dock undoubtedly states the case correctly when he says, that so far as the earlier stages are concerned we have no specific symptoms of sarcoma of the stomach and even when a tumor is present (palpable) it can not be differentiated from cancer (carcinoma). As previously pointed out, analysis of the gastric contents has hitherto been of no aid in differential diagnosis between gastric sarcoma and carcinoma.

Analysis of the 61 cases at our disposal brings out several points which may be of assistance in a differential diagnosis between sarcoma and carcinoma after the presence of a gastric tumor is established. In the first place age has an important bearing. It was shown to be as follows: One case of lympho-sarcoma of the stomach occurred in a girl 3½ years old; 7 were below 20 years; 23, or 37.7 per cent., were below 40, and only one-third of the cases occurred between 40 and 60 years, the most common period for the occurrence of carcinoma of the stomach.

In 16 cases, or 26.23 per cent., the tumors were situated at the pyloric end, causing pyloric stenosis in only 5 cases. In but 3 cases was the cardia involved. In the other 41 cases the tumors were seated between the pylorus and cardia, without involving either. These facts are not, however, of as much assistance as they seem at first glance, for it is chiefly in the cases in which the ends of the organ are involved, that symptoms of gastric tumor occur. The growth was diffused over the surface of the organ in 13 cases. Accurate figures could not be obtained, but it is clear from reading the reports of the recorded cases that dilatation of the stomach is much less common in sarcoma than in carcinoma of the stomach. In several cases the stomach was decreased in size. Gastric sarcoma was mistaken for tumor of the spleen or splenic region in 3 cases, and this is very natural in a case of large tumor mass of the greater curvature without gastric symptoms; see our Case 2.

The size of the tumor is a point of considerable diagnostic importance. In 6 cases the tumor was the size of a man's and in 5 of a child's head; in 3 cases they weighed from 10 to 12 pounds, projecting into the peritoneal cavity in 8 cases, and below the umbilicus in 9 cases. One case was operated on for tumor of the omentum, and another for ovarian cyst.

Although many cases run a short course, in a few instances gastric symptoms extended over a period of from two to five years. As previously pointed out, many cases run their course without symptoms until near the end, and frequently there are no symptoms referable to the stomach. The appetite and the gastric functions may continue to the end.

Treatment.—It is of interest to know that eleven cases have been operated on, with four deaths. In one case, that of Mintz', the patient recovered from a gastro-enterostomy, but died later from the tumor. A portion of the tumor was excised in two cases—Baldy and Dreger. In one case pus was evacuated from a gastric sarcoma with a fatal termination. In six cases the tumors were removed. In Capello's case, a woman 54 years old, a large cystic sarcoma of the stomach, the size of a man's head, mistaken for an ovarian cyst, was successfully re-

moved. The patient was in good health two years later. In a woman 52 years of age, Cantwell found a spindle cell sarcoma weighing 12 pounds, growing from the posterior wall of the stomach over a surface of five inches square. The tumor was successfully removed, but a secondary growth was discovered six months later. A successful operation for the removal of sarcoma of the stomach is credited to Billroth. In Dock's case, a man of 55 years, Nancrede successfully removed about one-third the long axis of the stomach and 2 cm. of the duodenum for a lympho-sarcoma, measuring 6 by 4 cm. The patient was well and had gained thirty pounds two months later. Hartley's case was even more remarkable. A woman 54 years of age, five years before coming under observation, vomited coffee-ground-like material, but had no other symptoms. There was no recurrence, and for four years she was in fair health, except for symptoms of indigestion which did not interfere with work. A year before applying for treatment she vomited coffee-ground-like material for five successive mornings. Pain in the back was a marked symptom. On physical examination a large, hard, elastic tumor was felt in the left lumbar and umbilical regions. At operation a large pedunculated tumor was removed from the posterior wall of the stomach. Schapf resected the entire stomach, the seat of a large lympho-sarcoma, in a woman, who gained flesh and was apparently well one year after operation.

Conclusions.—1. Gastric sarcoma is more common than is generally supposed, at least 61 cases being recorded. Careful routine microscopic examination of all gastric tumors met with at autopsy and operation will probably show a marked increase in the occurrence of these tumors. 2. The two sexes are affected in about equal proportions, as against five males to four females for carcinoma; 37.7 per cent. of the cases occurred below the fortieth year, and 11.44 per cent. (7 cases) below the twentieth year. 3. The pyloric end was involved in only 26.23 per cent. of the cases, as against 60 per cent. for carcinoma (Welch), and caused stenosis in only 8.19 per cent. of the entire number of cases. Diffuse growths occurred in 21.31 per cent., while the cardia was involved in only 4.9 per cent. The posterior wall and greater curvature are commonly involved. 4. Gastric sarcoma may reach a large size, that of a child's or man's head, and may project as large masses into the lumen of the stomach or into the peritoneal cavity, extending below the umbilicus—13.1 per cent. Such tumors have been mistaken for tumors of the spleen, omentum and ovaries, and may be pedunculated and readily removed. 5. Gastric sarcomata commonly start in the submucosa or muscularis and are less apt to ulcerate and cause hemorrhage than carcinomata. 6. All the histologic varieties of sarcoma have been found in the stomach. 7. While most of the cases in which the duration of the illness was mentioned ran an acute course, the average duration of life is probably from nine to ten months, while in one case it was three and in another five years. 8. Metastasis is not as frequent as in carcinoma, but may be widespread. The liver was invaded in only seven cases—11.47 per cent.—in striking contrast to gastric carcinoma, which, according to Welch's statistics, invaded this organ in 30 per cent. of cases. 9. There are no distinctive clinical symptoms or physical signs of sarcoma of the stomach, but a positive diagnosis has been made in three cases from microscopic examination of material obtained from the stomach. 10. In cases of large tumors connected with the stomach, especially

when they project to or below the umbilicus, a diagnosis of sarcoma of the stomach is warranted. A tumor of the stomach in an individual under 20 years of age is almost certainly sarcoma. In our series 37.7 per cent. of the cases were under 40, while in Osler's 150 cases of carcinoma of the stomach only 15.3 per cent. were under this age. 11. Operation should be as successful in sarcoma as in carcinoma of the stomach.

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The Fifth International Congress of Gynecology and Obstetrics.—This congress will convene at Rome, September 15 to 21, 1902. Professor Mangiagalli will preside over the section of gynecology and Professor Morisani over the obstetric section. The committee of organization is composed of Professors Pasquali, of Rome, Pestalozzi, of Florence, and La Torre, of Rome, treasurer. The fee is 25 francs.