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INTERPRETATION OF ROENTGEN-RAY FINDINGS IN THE DIAGNOSIS OF PEPTIC ULCER

SOME DIFFICULTIES *

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One of the most important advances in the diagnosis of gastro-intestinal lesions has been the development and application of roentgenographic methods in this field. As is likely to occur when any method is devised which demonstrates new objective signs of disease, certain findings obtained by roentgen-ray studies create new diagnostic problems. Most important of the problems is the significance of roentgen-ray findings and their relative value, to those obtained by other procedures, in the diagnosis of gastric and duodenal lesions. These have been discussed in former communications.¹ Our purpose in this paper is to present some of the difficulties and errors into which roentgen-ray findings may lead in relation to the diagnosis of peptic ulcer.

Temporary muscle spasm occasionally produces distortion in the outline of the duodenum or stomach like that produced by an ulcer. An example of this condition is pictured in Figures 1 and 2. In this case the deformity pictured was present throughout one examination but absent in another made two weeks later, although the symptoms remained unchanged. When such deformities occur in cases in which the clinical findings are not those usual for peptic ulcer, the roentgen-ray studies should be repeated at a later date. At the second examination, especially if atropin has been given to the physiologic limit, the deformity usually will have disappeared. If this precaution is not taken, one may be forced erroneously to consider the presence of organic disease where it does not actually exist. This is illustrated in Case 1:

CASE 1.—Diagnosis, *gastric neurosis*.—F. R. G., white man, aged 32, salesman, with unimportant family and past medical histories, from February to November, 1914, had had attacks of slight dizziness with some nausea and occasionally vomiting, but no hematemesis, or bloody or tarry stools. The attacks recurred every two or three weeks and lasted for about half a day. In November, 1914, severe epigastric burn-

ing from two to three hours after meals began; this symptom persisted for two weeks. The patient was then placed on a diet by a New York physician, which was followed for several months with finally complete relief from symptoms. The patient remained well until the present illness, October, 1919. About the first of that month the onset of mild burning in the epigastrium, from two to three hours after meals, began. The symptoms gradually increased in severity until at the end of three weeks the patient sought medical advice. The appetite was good. There had been no vomiting. The bowels were constipated. There had been no loss in weight.

Physical examination was essentially negative.

Roentgen Report: The stomach was normal in position and tone. Its outlines were regular. There was active peristalsis, and the pyloric sphincter closed normally. There was constantly present a definite irregularity of the lesser curvature side of the first portion of the duodenum. Otherwise the duodenum appeared normal.

Interpretation: The findings are those usual in ulcer of the first portion of the duodenum.

Roentgen-ray studies were repeated in two days and again one month later. On both occasions the duodenum filled normally and its outline was regular.

Clinical Pathology: Gastric analysis was not made. The stools gave a negative benzidin test for blood. The usual examinations of the urine and blood were negative. The Wassermann reaction in the blood serum was negative.

Progress: Treated on the basis of a neurosis, without special dietary measures, the patient became free from all symptoms within one week. During this period he carried on business as usual. He remained well, while under observation, for the ensuing three months.

This case shows the value of cooperation between the roentgenographer and the clinician. The clinical history was not typical of ulcer, yet the first roentgen-ray findings were characteristic of that condition. The discrepancy led to a repetition of the roentgenographic examination. The result was such as to show that the first findings were transient, probably the result of temporary muscle spasm and not due to an ulcer.

There is a type of case in which a persistent duodenal deformity, resembling that due to ulcer, exists and yet is probably due to some cause other than ulcer, such as adhesions, congenital or acquired. Case 2 furnishes an example of this:

CASE 2.—Diagnosis, *duodenal ulcer*.—J. J. C., Med. No. 11061, white man, aged 47, expressman, admitted to the Peter Bent Brigham Hospital, May 12, 1919, and discharged, May 15, 1919, complained of distress in the abdomen. The past medical history was essentially unimportant. Gastric symptoms began seven years prior to admission. The symptoms had occurred in periodic attacks, usually at intervals of about every two months and persisting for from one to six weeks. The interval between the last two attacks had been one year. The last attack began three weeks before admission, and was of the same character as the preceding ones.

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1. McClure, C. W.: Certain Diagnostic Aspects of Medico-surgical Diseases of the Gastro-Intestinal Tract, Boston M. & S. J. **181**: 399 (Sept. 25) 1919. McClure, C. W., and Reynolds, Lawrence: Gastric and Duodenal Ulcer: Typical and Atypical Forms: The Relative Value of Diagnostic Procedures, *ibid.*, to be published.

Dull, aching distress in the epigastrium occurred at variable periods of the day or night, and without relation to food except for a tendency to appear just before meals. The distress was partially relieved by food and to a greater extent by soda. Belching of considerable amounts of gas was a prominent symptom. The appetite was usually good. There

Fig. 1 (E. W., O. P. D. 60463).—Antral incisura, due to temporary muscle spasm, in a case of gastric neurosis.

had been no vomiting, no hematemesis, no jaundice, and no bloody or tarry stools. The bowels were regular. The patient was usually able to trace a connection between gastric symptoms and emotional stress, such as worry over business affairs.

Roentgen Report 14735 (Fig. 3): The stomach was normal in position, outline and tone. It was freely movable, and hyperperistalsis was present. The pyloric sphincter showed no abnormalities. The outline of the first portion of the duodenum was persistently irregular. The ileum was normal in position, freely movable, and contained the entire six-hour barium meal. At the twenty-four hour observation, the head of the barium column had reached the rectum. The cecum and the colon were normal. The appendix was not seen. A second roentgen-ray examination, one week later, gave the same findings.

Interpretation: The findings are those of either peri-duodenal adhesions or duodenal ulcer.

Clinical Pathologic Findings: The fasting stomach contents contained free hydrochloric acid, 15, and total acidity, 26. The guaiac test for occult blood was negative. After an Ewald test breakfast, free hydrochloric acid was 3 and total acidity 30.

The stools showed no occult blood. The Wassermann reaction in the blood serum was negative. The examinations of the blood and urine were negative.

Progress: The patient was in the hospital three days. During this period he was given the usual hospital soft diet and was free from all symptoms. After leaving the hospital he took a short vacation and then returned to work. In a letter, four months later, he stated that he had been free from all gastric symptoms since leaving the hospital.

That this case was one of duodenal ulcer cannot be denied, but the rapid recovery makes the correctness of that diagnosis problematic. This is emphasized by the failure to demonstrate at operation the presence of an ulcer in a case (Case 6, M. M. Mc., Med. No. 10448) reported elsewhere,² in which the clinical and

roentgenographic findings were almost identical with those in the case just described.

Such cases as these demand intensive study and long observation. The patient's reaction to medical treatment is a practical guide to follow. It has been thought that rest in bed, combined with dietary measures, is indicated in all cases in which there is considerable evidence of the presence of ulcer, such as existed in the case just reported. That this line of therapy will often produce quick results is shown by the results obtained in this case. However, there are patients on whom exclusion from business works a great hardship. Since the correctness of the diagnosis of ulcer is somewhat questionable in such cases, it seems justifiable to try ambulatory treatment provided the patient is kept under close observation. That such a course is not only justifiable, in selected cases, but that good results may be obtained is illustrated by Case 3:

CASE 3.—Diagnosis, *gastric ulcer*.—F. E. M., Med. No. 8260, white man, aged 21, student, admitted to the Peter Bent Brigham Hospital, May 6, 1918, and discharged May 25, 1918, whose family history was unimportant, since early childhood had lunched between meals because of hunger; also, the bowels had been more or less constipated, frequently requiring the employment of cathartics. During the twelfth year of age there had been frequent nausea and vomiting immediately after breakfast. The patient was slightly under weight.

The present illness had begun one year prior to admission to the hospital. The predominating symptom was dull pain, occurring from two to three hours after eating, accompanied by belching. The pain was always in the umbilical region. It was relieved by taking hot water, soda or food. There was no night pain. The pain persisted for three months and then disappeared. It reappeared four weeks prior to admission, and was of the same character as during the first attack.

Fig. 2 (E. W., O. P. D. 60463).—Normal outline of antrum disclosed when stomach was roentgenographed two weeks later.

The physical examination was essentially negative.

Roentgen Report: There was a moderate six-hour barium residue. There was a deep incisura in the prepyloric region. The incisura extended from the greater curvature, and divided the stomach almost into two cavities. The incisura was present throughout the fluoroscopic examination, and was seen on the plates. No irregularities in the stomach

2. Footnote 1, second reference.

outlines were made out. The duodenum could not be more than partially filled.

Interpretation: The findings are due to muscle spasm, and suggest gastric and duodenal ulcer.

Clinical Pathology: Twenty-six c.c. of fasting gastric contents were obtained, and they contained some food

Fig. 3 (Case 2).—Irregularity in outline of duodenum.

residue. The benzidin test for blood was negative. After an Ewald test breakfast, free hydrochloric acid was 3 and total acidity 24. The stools contained no occult blood. The usual examinations of the blood and urine were negative. The Wassermann test in the blood serum was negative.

Progress: After admission to the hospital, the patient was placed on a Sippy diet. Within seventeen days he was able to take a general diet without producing symptoms. The patient remained free from symptoms until April, 1919. At this time there appeared fairly severe epigastric pain every few days about two hours after meals. This condition continued for three months; then the epigastric pain became more or less constant. It remained of fairly severe intensity. This condition continued for two weeks. Then the patient went into the mountains on a vacation. There he tramped and ate liberally of a general diet. In spite of this he quickly became free from all symptoms and remained so until December, 1919. There then appeared either fairly sharp pain or marked discomfort in the epigastrium two hours after food. The pain or discomfort was relieved by soda or food. There was occasional vomiting and some belching of gas. Roentgenographic studies were made at this time. The stomach was found to be markedly atonic and contained a medium sized six-hour residue. Aside from these findings, the gastro-intestinal tract presented no abnormalities. It was now learned that the patient was subjected to much nervous strain and that he had been so prior to the onset of his trouble in 1918. He was told that, although he probably had a gastric ulcer, his symptoms might all be due to a neurosis. He was given treatment for gastric neurosis and was instructed to eat liberally of a bland diet for two weeks, after which time he was placed on a general diet. Within a few days after beginning treatment the patient became free from symptoms and remained so one month later.

Two other cases were observed in which the symptoms were those of peptic ulcer, but the roentgen-ray findings revealed only gastroparesis and atony. As in the case just reported, these two patients became free from symptoms under treatment for neurosis. Whether

or not these three cases were peptic ulcer could be determined only by operative methods. The subsequent courses of these cases and of Case 2 were like those of gastric neuroses. In all four cases the basis for a neurosis was present. On the other hand, the histories and roentgen-ray findings suggest the diagnosis of ulcer in two of the cases. The diagnosis in these cases must be left an open question in the absence of surgical exploration. But, as regards treatment, unless such cases quickly respond to other forms of therapy, it would be best to institute a medical regimen for peptic ulcer.

Roentgenographic findings may be very atypical and assist materially in the making of an incorrect diagnosis. Case 4 illustrates such an instance:

CASE 4.—Preoperative diagnosis, *malignancy superimposed on an old ulcer*; postoperative, *gastric ulcer and benign pyloric stenosis*.—J. C. B., Med. No. 11906, white man, aged 78, retired, admitted to the Peter Bent Brigham Hospital, Sept. 26, 1919, and transferred to the surgical service, October 14, entered the hospital complaining of "stomach trouble." The past medical history was unimportant. The symptoms consisted of anorexia, belching, and occasionally epigastric distress occurring from three to four hours after meals. The epigastric distress was temporarily relieved by soda or food. These symptoms had persisted with remissions and exacerbations for a period of six years. There had been no vomiting and no bloody or tarry stools. During the eight months preceding admission, distress from three to four hours after meals, flatulence and belching had been present continuously. There had been nausea occasionally, but no vomiting. During the latter three months of the present illness the patient had lost 35 pounds in weight.

Physical Examination: Other than the evidence of considerable loss in weight, the physical examination was essentially negative.

Roentgen Report 16090: Two fluoroscopic examinations were made. The stomach was dilated and atonic. Peristalsis on one examination was practically absent, while in the second it was vigorous and of the obstructive type. There was a constant filling defect in the region of the antrum, the margins of which appeared irregular in outline. The sphinc-

Fig. 4 (Case 4).—Appearance of stomach in a case that proved to be gastric ulcer and benign pyloric stenosis.

ter was not seen. Virtually the entire six-hour barium meal was in the stomach, and at the twenty-four observation the stomach was still outlined by barium.

Interpretation: The findings are those of a carcinoma involving the sphincter and causing pyloric obstruction.

Clinical Pathology: The fasting stomach contents contained remnants of food eaten fourteen hours previously.

Free hydrochloric acid was 10, and total acidity, 43. After an Ewald test breakfast the gastric contents contained, free hydrochloric acid, 40 and total acidity, 60. The benzidin test for occult blood was negative. Hemoglobin was 80 per cent. and the white cells 8,000 per cubic millimeter. The

Fig. 5 (J. S., Med. No. 12180).—Stomach in a case of duodenal ulcer. Arrow points to the duodenum which, together with the region of the pyloric sphincter, was pulled upward by a congenital band of adhesions.

Wassermann reaction in the blood serum was negative. The urine contained no pathologic elements.

Surgical Note: The preoperative diagnosis in this case was malignancy superimposed on an old ulcer. At operation the pylorus was found to be obstructed by a mass of scar tissue resulting from an old ulcer, and no evidences of malignancy were found.

In this case both clinical and roentgen-ray findings were distinctly those of carcinoma, yet the case was one of ulcer. This case illustrates that even the most typical roentgen-ray findings do not necessarily make a correct diagnosis. A correct preoperative diagnosis does not seem to have been possible. The roentgen-ray findings are portrayed in Figure 4.

In a case of pyloric ulcer (Case 2, J. S., Med. No. 12180), reported in a previous communication,² the pylorus and duodenum were adherent to the gallbladder by a congenital band of tissue. In the roentgenogram the deformity produced obscured that due to the ulcer and gave the appearance of the presence of an extra-gastric process, such as a tumor mass or adhesions. The condition found is presented in Figure 5. The symptoms present in the case were those typical of gallbladder disease, and the roentgen-ray findings seemed to confirm that diagnosis. In this case the roentgen-ray findings led away from, rather than toward, a correct diagnosis.

There is a gastric roentgen-ray finding of which three examples have been observed. The finding consists of an area on the lesser curvature over which peristaltic waves do not pass (Fig. 5). No irregularity in the outline of the stomach exists. Case 5 is an example of such a case:

CASE 5.—Diagnosis, *gastric ulcer*.—P. J. B., Med. No. 10993, white man, aged 46, watchman, a year and a half before, following a fall, had symptoms similar to the present attack,

during which 15 pounds in weight were lost. The present illness began seven weeks prior to admission to the Peter Bent Brigham Hospital, and again followed mild trauma. The symptoms had consisted of burning epigastric pain coming on about half an hour after meals. Occasionally nausea had been present, but no vomiting. The patient had lost 12 pounds in weight during the present illness. The physical examination was essentially negative except for some tenderness in the midepigastrium.

Roentgen Report 14697: The stomach was normal in position, tone and outline, and was freely movable. The peristalsis was irregular and sluggish; at times three waves were visible. There was a small six-hour residue. On the lesser curvature, proximal to the antrum, there was an area in which no peristalsis occurred, although peristaltic waves were seen to pass over the greater curvature opposite this area. The same phenomena were noted on a second examination one week later. There was no irregularity in outline of the stomach. A good sphincter and first portion of the duodenum was seen. At the six-hour observation, the ileum contained the entire barium meal. The cecum was not seen.

The laboratory findings in the blood, urine and stools were negative. The fasting gastric contents were 34 c.c. in amount and showed no free hydrochloric acid. The contents removed after a test breakfast contained: free hydrochloric acid, 30, and total acidity, 45. There was no occult blood. The Wassermann reaction in the blood serum was negative.

Progress: The patient was under observation in the hospital for two weeks. During this period he was on a general diet. He complained of more or less constant, dull epigastric pain.

Whether or not this case was one of ulcer was not determined, although the history and roentgen-ray findings make the accuracy of such a diagnosis probable. In a second case with identical roentgen-ray findings there was a history of dyspeptic symptoms, like those usual for a gastric neurosis of several years' duration. In a third case the symptoms were those of ulcer, and a gastric ulcer in the antral region was found at operation.

Cases such as the one reported above demand continued, careful study and observation. The character of the treatment will depend on the medical and financial conditions of each patient. Ambulatory treatment

Fig. 6 (Case 5).—Tracing of stomach made with the aid of the fluoroscope. Arrow points to the region on the lesser curvature over which no peristaltic waves were seen to pass.

may be tried first, as was done in Case 3. If this fails, then rest treatment and finally a medical regimen for ulcer should be instituted.

SUMMARY AND COMMENT

The findings in the cases reported demonstrate that:

1. Cases occur in which either the presence of an ulcer is not diagnosed, or in which the presence or

absence of an ulcer cannot be definitely determined except by exploratory operation.

2. It is necessary to interpret roentgen-ray findings in relation to the data obtained by careful and thorough clinical studies.

3. In certain cases roentgen-ray findings are more confusing than helpful in diagnosis.

It is obviously necessary for the internist to become familiar with roentgen-ray findings. But he can scarcely hope to become as adept as the expert roentgenographer, for roentgenology is specialized work requiring much knowledge, large experience and great skill on the part of the physician engaged in it. The best results are obtained by the proper cooperation of clinician and roentgenographer. The proper cooperation consists:

1. On the part of the roentgenographer, in the accurate description of roentgen-ray findings present, portrayal of the most probable conditions which they represent, and the exclusion of artefacts.

2. On the part of the clinician, in the integration of roentgen-ray findings into symptomatology and diagnosis.

THE USE OF BEEF-BONE SCREWS IN FRACTURES AND BONE TRANSPLANTATION

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In recent years, bone grafting has become established in surgical practice as firmly as the more simple operation of skin grafting, and, as in the latter, it has been found that the autogenous graft is the best. Practically all failures can definitely be attributed to technical errors, such as too small a graft, infection, inadequate fixed bony approximation of the graft to fragments, and poor postoperative fixation of the part. I have found beef-bone screws to be a great aid in attaining this fixed approximation of the graft to the bone, and I believe that they would be employed more if their uses and methods of preparation were more generally known. I am well aware of the fact that a few surgeons have used them, but I present this article on their preparation and use believing that it may be of interest to others.

There can be no doubt that, from a purely theoretical point of view, screws made from the bone of the patient, such as the bone pegs advocated by Albee, would be better than beef-bone screws. The theory when put into practice, however, has so many objections, such as the difficulty of making the screws or pegs properly, and the extra amount of bone used, that I have come to the conclusion that the beef-bone screws are to be preferred. The question of whether the beef bone is suitable for a graft does not enter into this discussion, for all that is demanded of the screws is that they provide fixation of the autogenous graft to the fragments. They are usually absorbed completely within from six months to a year.

We know that the bone transplant must be held firmly in position and have broad contact with the bone to which it is to be grafted. While in theory an inlay graft is best and occasionally it is possible to obtain a perfectly fitting inlay by the use of the double bladed circular saws, in actual practice this is not easy. If the blades of the twin saw are out of line there

will be a considerable discrepancy in the size of the graft and the slot. It is necessary to employ some means of securing the graft to prevent it from moving. Kangaroo tendon or catgut sutures thrown about the fragments and the graft are not satisfactory. Beef-bone screws properly placed are well-nigh ideal for the purpose.

PREPARATION OF SCREWS

Fresh beef bone is obtained usually from the tibia, the joint ends are sawed off, and the shaft is boiled for one and one-half hours to remove the tissue and the marrow. The shaft is sawed into pieces $3\frac{3}{4}$, $2\frac{3}{8}$ and $1\frac{1}{4}$ inches long for the large, medium and small size of screws, respectively. The medium sized screw is of aid in many situations, and many more of these are used than of either the large or the small screws. The sizes used by us are standard, and in mechanical terms the large screws are known as $\frac{5}{16}$ by 18, the medium size as 10 by 24, and the small as 6 by 32. The lengths

Fig. 1.—Piece of beef-bone with strips, blanks and screws: A, medium sized screw, 10 by 24; B, large sized screw, $\frac{5}{16}$ by 18.

adopted are arbitrary and may be varied to suit the needs of the case. The pieces are sawed lengthwise into strips; their width varies according to the diameter of the screw to be made. The strips are roughly sized in the vise by filing, and are then turned to the proper size, pointed, and the head rounded in the lathe. These finished blanks are placed, for one-half hour, in petrolatum brought to the melting point in a double boiler, in order to replace to some extent the natural oils removed by the boiling. This renders the bone a little less brittle and less likely to crumble when being threaded. The heat must not be extreme or the bone will be overheated and rendered almost chalky.

The blanks are placed in the lathe and threaded by using a standard machine screw die. Petrolatum is freely used on the die while the threads are being cut. The large blank is threaded with a standard $\frac{5}{16}$ inch by 18 die. The head is $\frac{5}{16}$ inch long and is flattened on two sides to $\frac{1}{4}$ inch in thickness to fit a special wrench. The large screw when finished is ordinarily $3\frac{1}{2}$ inches long, but this may be varied. The medium sized blank is finished into a screw $\frac{19}{100}$ inch in diameter and $2\frac{1}{4}$ inches in length (Fig. 1). A little more care is necessary in putting the threads on this size than on the large screw, and