

## DUODENAL DIAGNOSIS: X-RAY CONSIDERATIONS

### A TECHNIC FOR FLUOROSCOPY \*

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The estimation of gastro-intestinal pathology is being placed on a safer basis than subjective symptomatology. The stomach may be the barometer of digestive function but not so frequently the site of the pathologic conditions. Mayo<sup>1</sup> says that "the stomach has been credited with a host of diseases which it never possessed and has received an amount of treatment for supposititious conditions that is little credit to the medical profession. These mistakes have been due mainly to fundamental misconceptions of the function of the stomach, its relation to diseases in general and especially to those of the digestive tract. Mistakes in diagnosis are more often the result of lack of examination than a lack of knowledge. Prolonged laboratory examination and investigation has been productive of much harm. A scientific but deadly delay."

The primary etiological factor in duodenal ulcer is as obscure as that of gastric ulcer. Predisposing conditions and contributory causes depend on interference with normal function in the duodenum and are of wide latitude. Mechanical and chemical causes are dependent on the motility of the stomach and duodenum and on alterations in the pyloroduodenal anatomy. Most duodenal ulcers are found at that point which receives the impact of the acid chyme as it is ejected from the pylorus. The duodenal preference is an alkaline reaction, and the forcible mechanical contact of chemically disagreeable ejecta could do much to break down a normal or weakened resistance. The control of the pylorus is extremely delicate at the best. The rate of the pyloric outflow is governed by the rapidity with which the ejected acid chyme is neutralized by the alkalinity of the duodenal secretions. The presence of acid in the pyloric antrum promotes the opening of the pylorus, but the presence of this acid content in the duodenum immediately causes the pylorus to close. The pyloric function is more under the control of the duodenum than the stomach (Mayo).

The greater frequency of duodenal ulcer in men may be dependent on the fact that the first or ascending portion of the duodenum is higher in

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1. Mayo, W. J.: Diseases of the Stomach and Duodenum from a Surgical Standpoint, *St. Paul Med. Jour.*, 1911, xiii, 1; Ulcer of the Duodenum, *Jour. Am. Med. Assn.*, 1908, li, 556.

men than in women, so that the alkaline secretions do not reach or rise as high to neutralize the acid chyme with physiological rapidity. Duodenal ulcers usually occur above the bile-ducts, are single and on the upper circumference, and are more likely to involve the pylorus and stomach than to progress in the opposite direction.

The first or superior portion of the duodenum may be regarded as a physiological part of the stomach. The similarity in the symptoms of gastric and duodenal ulcers also warrants this view. Both Schwarz<sup>2</sup> and Holzkecht,<sup>3</sup> by the use of the fluoroscope and bismuth suspensions, noted that the food when ejected from the stomach remained for some little time in the superior or first part of the duodenal segment before advancing, at a comparatively rapid rate, through the remaining duodenal canal. Holzkecht calls this first duodenal segment the *Püfferraum* or teasing-room. By the fluoroscope he finds that this portion has no peristalsis normally. It acts like a storage-room for the chyme as it is ejected from the pylorus by the peristalsis of the antrum. It can hold quite an amount of chyme and does not rapidly pass this on unless its capacity is taxed, when it permits the surplus to be passed on in small coin-sized masses. These masses normally are not sharply defined by the fluoroscope but they may be distinguished as small masses, not nearly as large as the lumen of the duodenum, and they follow one another every few seconds, resting momentarily at intervals.

Considering that the first part of the duodenum has practically the same functions as the cardiac portion of the stomach, that of a reservoir, we may apply the principles of gastric fluoroscopy to duodenal diagnosis. It is easier to obtain fluoroscopic information regarding the late pathological changes produced by duodenal ulcerations, such as strictures and stenoses, dilatations, diverticula and hour-glass duodenums. In these late manifestations of pathology the bismuth suspensions cast characteristic shadows; the strictures and stenoses prevent the rapid or normal progress of the bismuth, and it dams up according to the degree of the stenosis or dilatation. If the dilatation is not dependent on a stenosis but merely is due to a lack of tonicity in the musculature, we would note a tardy progress of the bismuth through the dilated portions, and the distinct line or contracted area of a stenosis would be absent. In diverticula the pocket might become filled with the bismuth and so demonstrated as an abnormal shadow without the lumen of the duodenum but contiguous thereto. In all these late or chronic diseased conditions, it is not necessary but it is advantageous to employ special means of filling the duodenum with bismuth emulsions or suspensions. Bismuth and water pass rapidly through the pylorus of a fasting patient, and with

2. Schwarz: Berl. klin. Wehnschr., 1908. No. 21; Abstr. in Fortschr. a. d. Geb. d. Röntgenstrahlen, 1908, xii, 435.

3. Holzkecht: Deutsch. Ztschr. f. Chir., 1911, cv, 54.

even a mild degree of pyloric spasticity or physiological closure of the pylorus, the suspension would fill up the duodenum before the duodenal pathology permitted the passing of such suspensions beyond. It is in the acute spasmodic functional disturbances of motility that the artificial filling of the duodenum is necessary.

This artificial filling may be accomplished by using a Gross duodenal tube, which is a small rubber tube tipped with a small ball. For this fluoroscopic examination it is necessary to substitute a lead ball for the aluminum one that Gross first devised, so as to obtain an image by the Roentgen ray. The patient swallows the ball and tube, it passes the pylorus and then the bismuth suspension is poured directly into the duodenum, as there are small holes for the exit of the fluid, just above the small ball.

Barclay<sup>4</sup> has frequently noted by ordinary fluoroscopy that a shadow which is separated from the pylorus persists beyond the pylorus and remains uninfluenced by the stomach peristalsis. There was usually a normal stomach shadow but a violent peristalsis. The pylorus opened more frequently and the gastric contents passed more rapidly, so that the stomach emptied itself in a short time, perhaps in one-half hour. Whenever he found this normal stomach shadow with excessive peristalsis passing the food rapidly, he considered it diagnostic of duodenal ulcer.

Distention changes in the duodenum and small intestines may be due to obstruction of the ileum. The obstruction of the ileum may be due to kinks produced by its mesenteric attachments, or to an anchored appendix, or to the weight of a loaded cecum which lessens the lumen of the ileum as it passes over the pelvic brim. Lane<sup>5</sup> has been unable to satisfy himself regarding the mechanism of this duodenal distention. At first he thought that the ileac obstruction dammed back the intestinal contents but that this could only be a reflex cause, as the jejunum emptied itself rapidly. Later he considered the distention secondary to the compression or obstruction of the third part of the duodenum by the strain exerted by the mesentery of the jejunum. Jordan<sup>6</sup> has always been able to demonstrate this duodenal distention in Lane's cases, by the fluoroscope and bismuth suspensions. The bismuth would advance normally to the third portion of the duodenum but here it halted, and only after four and nine hours was the obstruction seen to relax and eject some bismuth. During the time that the duodenum was filled, active and often violent peristalsis was seen in the walls of the duodenum. The stomach itself emptied normally, although usually it was dilated and elongated.

Lane and Jordan report four cases in which they demonstrated the distention of the duodenum by the fluoroscope and bismuth. They fre-

4. Barclay: *Arch. Roentgen Ray*, 1910, xv, 174.

5. Lane: *Surg., Gynec. and Obst.*, 1911, xii, 222.

6. Jordan: *Surg., Gynec. and Obst.*, 1911, xii, 226; quoted by Lane.

quently found duodenal ulcer associated in this class of cases. Operative interference disclosed usually a vertical downward pull on the commencement of the jejunum with a torsion which rendered evacuation of the duodenal contents difficult. The cecum was frequently found fixed by adhesions in the iliac fossa and the iliac obstruction was purely static, owing to resistance of the brim of the pelvis.

Holzkecht diagnosed five cases of duodenal stenosis by the fluoroscopic examination. The duodenum filled up behind the stenosis, so that the walls were in sharp contrast. The duration of the filling depends on the depth of the stenosis and the degree of the disproportion between the narrowness of the stenosis and the peristaltic strength of the stomach and duodenum, and on the mass of the ingesta in the duodenum. The duodenum, when filled behind a stenosis, exhibits worm-like convulsive contractions without visible effect on the mass, i. e., there is no outpouring through the stenosis. This peristalsis of the duodenum occurred at rhythmical intervals of about seven seconds and lasted about two or three seconds. Where there was a high degree of stenosis there appeared to be an atony of the dilated duodenal walls, probably owing to lack of compensation in the musculature. The degree of the stenosis was estimated by the length of time during which bismuth contents remained in the duodenum, which varied from a short time in spastic conditions to twenty-four hours in organic stenosis.

Crane<sup>7</sup> recently called attention to the possibility of outlining the head of the pancreas, or estimating its size by plotting the curve of duodenum as the duodenum encircles the head of the pancreas.

#### AUTHOR'S TECHNIC

The method of introduction of the Gross duodenal tube has been described fully by Gross.<sup>8</sup> Briefly, the small tube with a lead ball at the end is swallowed about fifteen minutes after the patient has taken a glass of milk. The patient takes an easy position recumbent on the right side with the hips elevated. After about one-half to one hour the patient is fluoroscoped to see if the ball has passed the pylorus. A small amount of bismuth and water may be given (not through the tube). If the tube is in the duodenum it will appear independent of this bismuth stomach shadow. When it is determined that the lead ball at the end of the tube has passed the pylorus and is in the duodenum, a suspension of bismuth in water (one-half ounce of bismuth oxychlorid to 6 ounces of water) is funneled into the tube, and thus it reaches the duodenum independent of pyloric activity.

7. Crane: *Tr. Am. Roentgen Ray Soc.*, 1910, Reference from *Am. Quart. Röntgenol.*, 1910, ii, 269.

8. Gross: *Duodenal Ulcer*, *Jour. Am. Med. Assn.*, 1910, liv, 1365.

The patient, just previous to the injection of the bismuth suspension through the tube, is placed on the simple apparatus illustrated in Figure 1. The patient is brought to a horizontal position on the right side, as in Figure 2, just before the suspension is introduced, so that the duodeno-

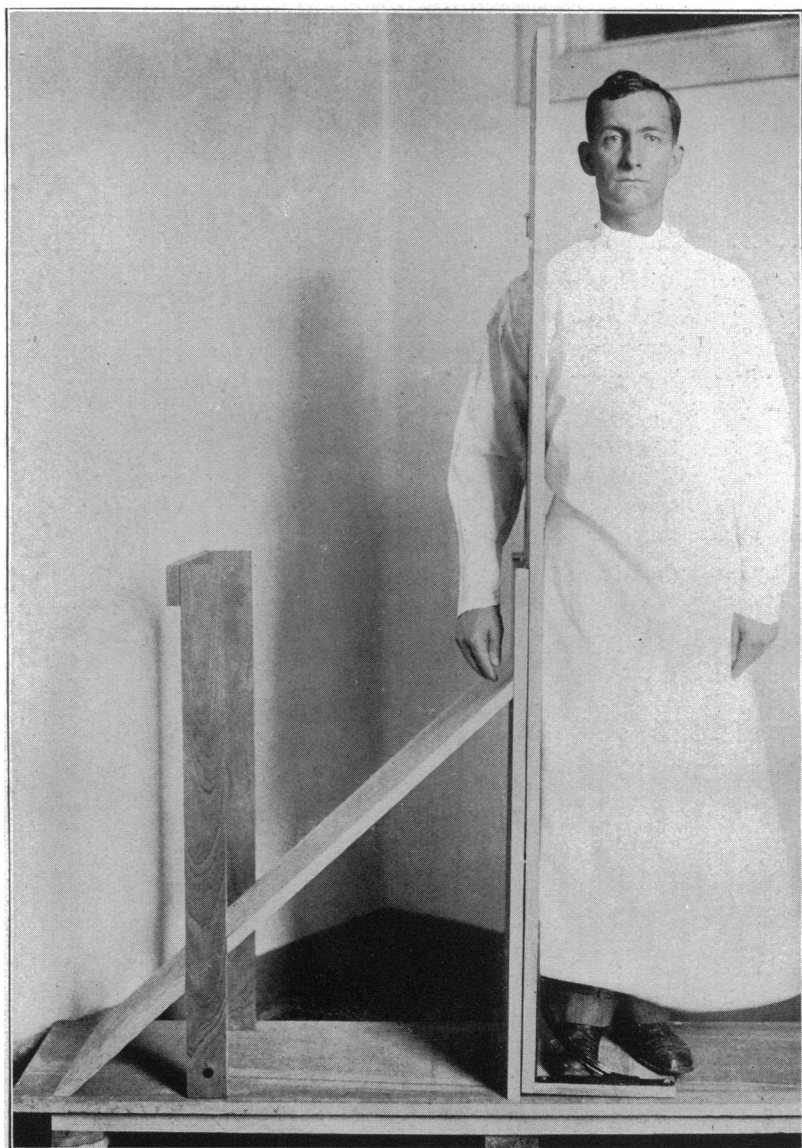


Fig. 1.—Apparatus for use in fluoroscopy.

jejunal junction will be at the highest point and the duodenum will have the position of an upright U. We are accustomed to use this simple apparatus with a Beclere fluoroscopic stand.

This method of filling the duodenum lends itself to the estimation of duodenal pathologic conditions, especially in cases in which there is a stenosis or interference with the peristalsis. It will usually be found that a peristaltic wave will not pass over an erosion or ulcerated area of the duodenum; rather will it incite a spastic contraction at the site of the ulcer. For outlining the head of the pancreas this method of filling the duodenum would be quite useful, as the bismuth-filled duodenum encircles the head of the pancreas.

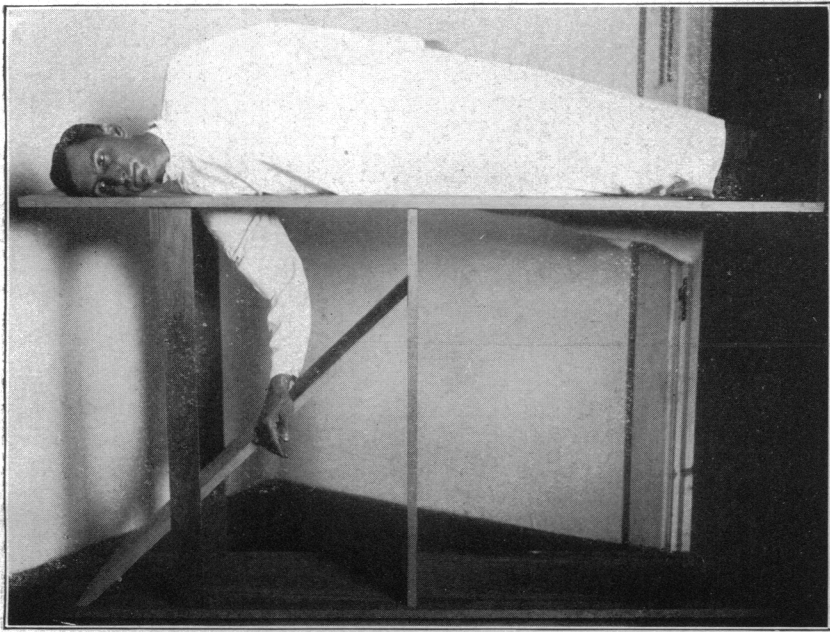


Fig. 2.—Patient in second position on apparatus.

#### CONCLUSIONS

We have been able to estimate a mechanical diagnosis of duodenal ulcer on the following: When a bismuth-and-water suspension is swallowed by a fasting patient, it readily passes the pylorus into the duodenum (because the acid stomach content is not taken up as when food is offered the stomach, neither is there a closure of pylorus as when a food bolus is swallowed). The stomach appears normal after the ingestion of a bismuth meal (2 ounces of bismuth oxychlorid to 13 ounces of porridge of one of the prepared wheat breakfast-foods), but there is a vigorous peristalsis and a rapid emptying of the stomach in as short a time as one-half hour and at least in two hours. The duodenum seems to be sluggish and casts a shadow for a longer interval than usual, but the food

rapidly traverses the remaining portion of the small intestines. By this method of filling the duodenum, as described above, the duodenum may present an hour-glass contraction at the site of the ulcer. Usually the duodenum is sluggish and does not exhibit any pronounced peristalsis. When the duodenum is filled and pressure is made at the outer curve of the duodenum as shown by the shadow, the patient usually experiences some pain or discomfort. We place the greatest weight on the rapid emptying of a stomach that exhibits the usual normal J-shaped shadow and a vigorous peristalsis.

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