The value of serial radiography in gastro-intestinal diagnosis / Lewis Gregory Cole.

This reprint is a resume of the more comprehensive article, "SERIAL RADIOGRAPHY OF THE STOMACH AND DUODENUM", referred to on page 1. A reprint of this will be sent to you upon application. Reference to these reprints will aid the practitioner to understand reports on radiographic findings of gastro-duodenal examinations.

5.

The Value of Serial Radiography in Gastro-Intestinal Diagnosis

LEWIS GREGORY COLE, M.D.
Radiologist to Cornell University Medical College
NEW YORK

Reprinted from The Journal of the American Medical Association
November 30, 1912, Vol. LIX, pp. 1947-1951

THE VALUE OF SERIAL RADIOGRAPHY IN GASTRO-INTESTINAL DIAGNOSIS*

LEWIS GREGORY COLE, M.D.
Radiologist to Cornell University Medical College
NEW YORK

This is essentially a summary of a series of three articles on the "Radiographic Diagnosis of Gastro-duodenal Lesions," the first two published respectively in the December, 1911, and the March, 1912, issues of the *Archives of Roentgen Ray*. The third will appear in an early issue of the same periodical.

Two or three radiographs are sufficient to determine the size, shape and position of the stomach. For the convenience of indexing, the different types may be grouped into four classes: (1) cow-horn, (2) text-book, (3) drain-trap, (4) fish-hook (Figs. 1, 2, 3, 4).

FIGS. 1-4.—TYPES OF STOMACHS

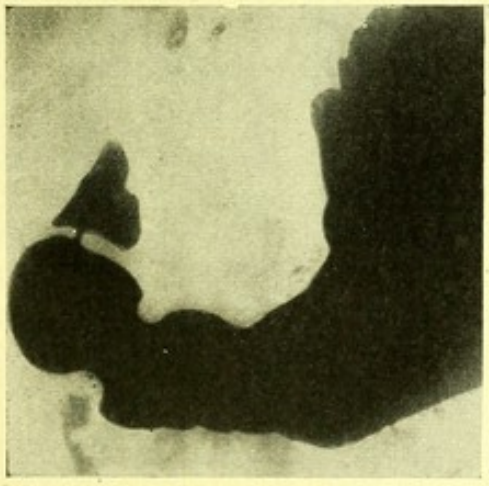

Fig. 1.—Cow-horn.

Fig. 2.—Text-book.

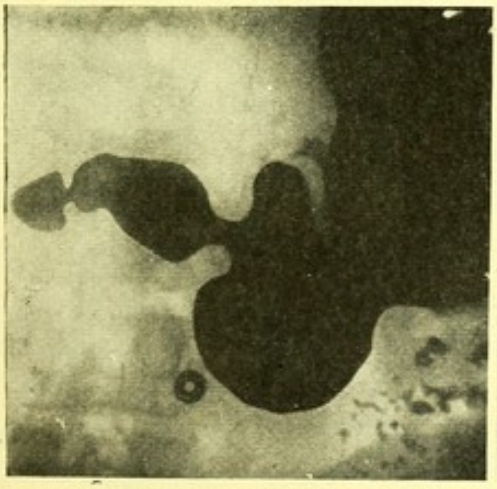

Fig. 3.—Drain-trap.

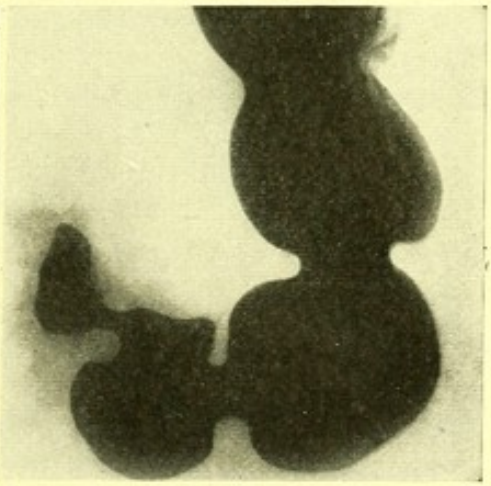

Fig. 4.—Fish-hook.

NOTE.—The contrast in Figures 1-6, 10, 11, 19, 22-26 is accenuated by a localized shading in the parts surrounding the stomach.

* Read in the Section on Practice of Medicine of the American Medical Association, at the Sixty-Third Annual Session, held at Atlantic City, June, 1912.

In cases of suspected pathologic conditions one is not justified in making a diagnosis unless serial radiography is employed. This term is applied to a series of from fourteen to twenty-four radiographs of various phases of different cycles, which, when assembled, may be studied individually and collectively, or reduced to a cinematographic size and projected on the screen, giving a graphic and fairly accurate representation of the gastric motor phenomena. The technic of this examination enables the operator to observe on a fluoroscopic screen grossly what is registered in detail on the plate.

This method of examination, illustrated in Figure 5, has demonstrated that the motor phenomena of the stomach are complex instead of simple. They constitute a cycle, similar to the heart action, composed of a systole (Phases 1 to 6), and a diastole (Phases 7 to 10), and the progression toward the pylorus of a series of peristaltic contractions. A cycle occurs about once in three seconds, and at the end of a cycle, a peristaltic contraction should have moved up to the position occupied by the preceding contraction at the end of the previous cycle. If a contraction progresses from its origin to its termination at the pylorus in a single cycle (Fig. 1), that stomach exhibits the one-cycle type of gastric peristalsis. If two cycles are required for it to progress from its origin to its termination, the peristalsis is of the two-cycle type (Fig. 2). If three or four cycles are required, it is of the three-cycle (Fig. 3) or four-cycle type (Fig. 4). The last two are the most common types. The gastric cycle is governed somewhat by respiration, perhaps through the vagus, which supplies impulse both to the diaphragm and to the stomach. This suggests a method by which gastric peristalsis may be stimulated.

That portion of the gastro-intestinal tract previously known as the first portion of the duodenum has the embryologic, physiologic and surgical characteristics of the stomach, rather than of the small intestine. The important part that its radiologic appearance plays in the diagnosis of gastric, duodenal and gall-bladder lesions justifies its being dignified by a name, and the manner in which it sits up on the pylorus so closely resembles a cap that this name immediately presented itself. Radiologically this cap appears to be a continuation of the stomach, and resembles the pars pylorica in size and shape (Figs. 6 to 10). It should be symmetrical, although its shape varies with the gastric cycle and the posture of the patient. The cap surmounts the pylorus, being separated from it by a space of about three-sixteenths of an inch, which indicates the normal pyloric sphincter. The gastric and duodenal surfaces of

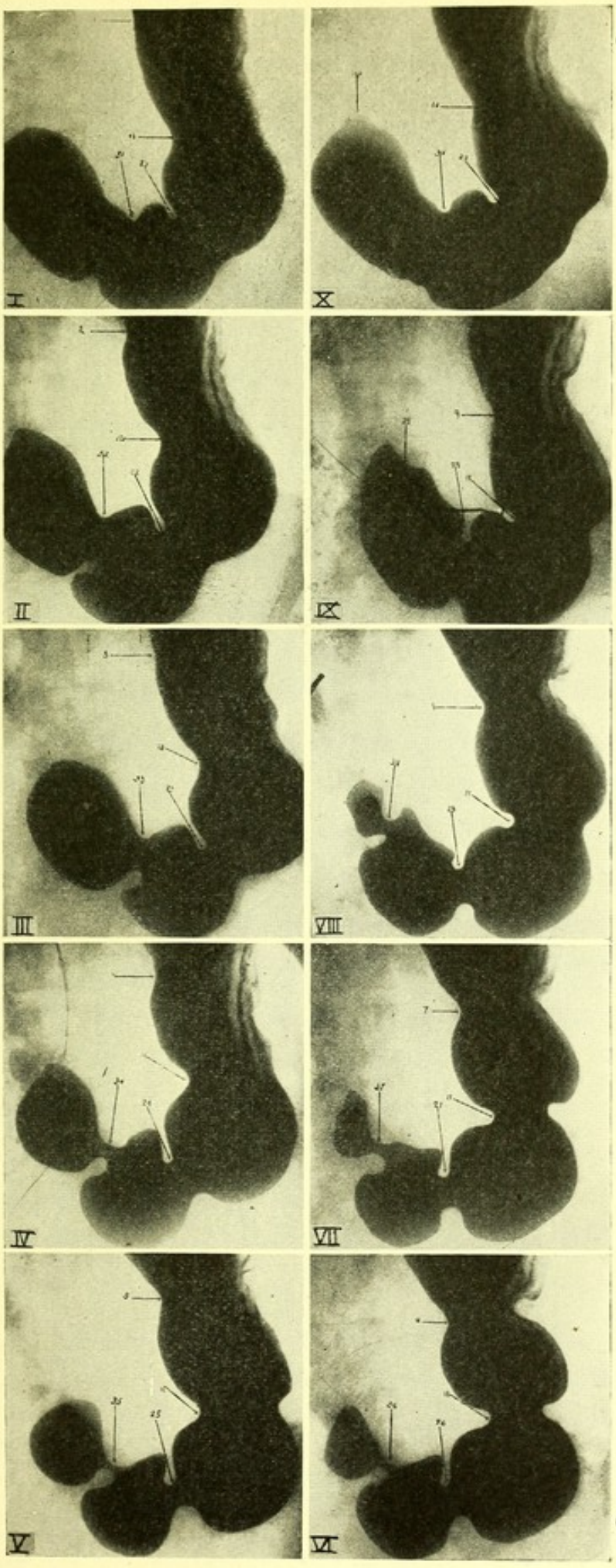

Fig. 5.—Serial radiographs showing diastole (Phases 7-10) and systole (Phases 1-6) and the progression toward the pylorus of a four-cycle type of gastric peristalsis.

FIGS. 6 TO 10.—VARIOUS TYPES OF CAPS

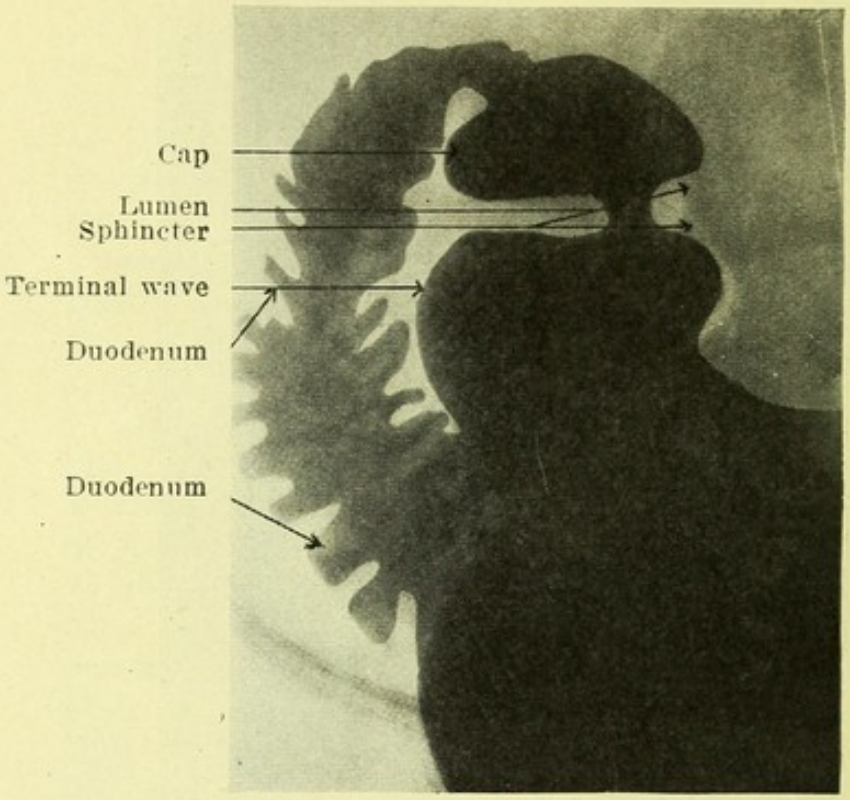

Fig. 6.

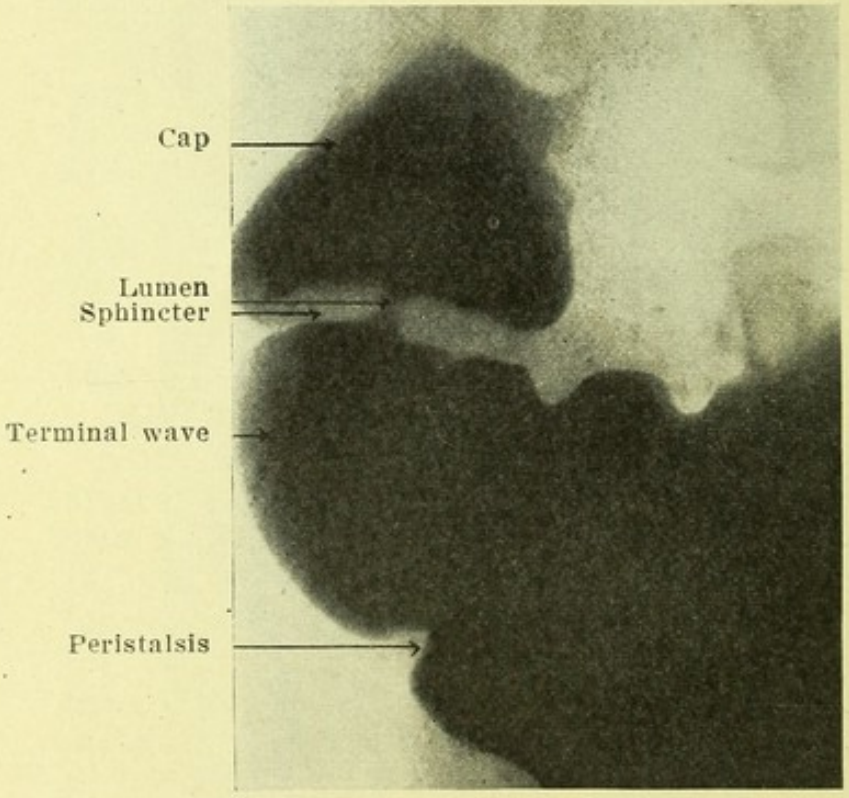

Fig. 7.

the sphincter should be clear-cut and smooth, and its lumen about one-eighth inch in diameter, and centrally located. In cases of adhesions in this quadrant of the abdomen, from gastric or duodenal ulcers, or from gall-bladder infection, with or without calculi, the cap is usually the first to suffer limitation in its normal dilatation.

Various Types of Caps

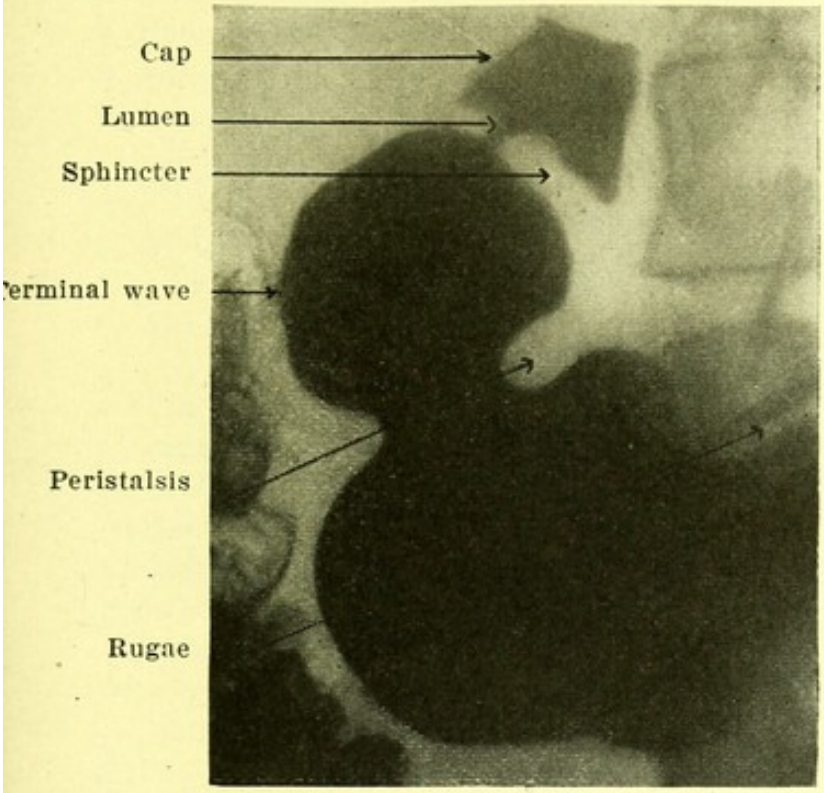

Fig. 8.

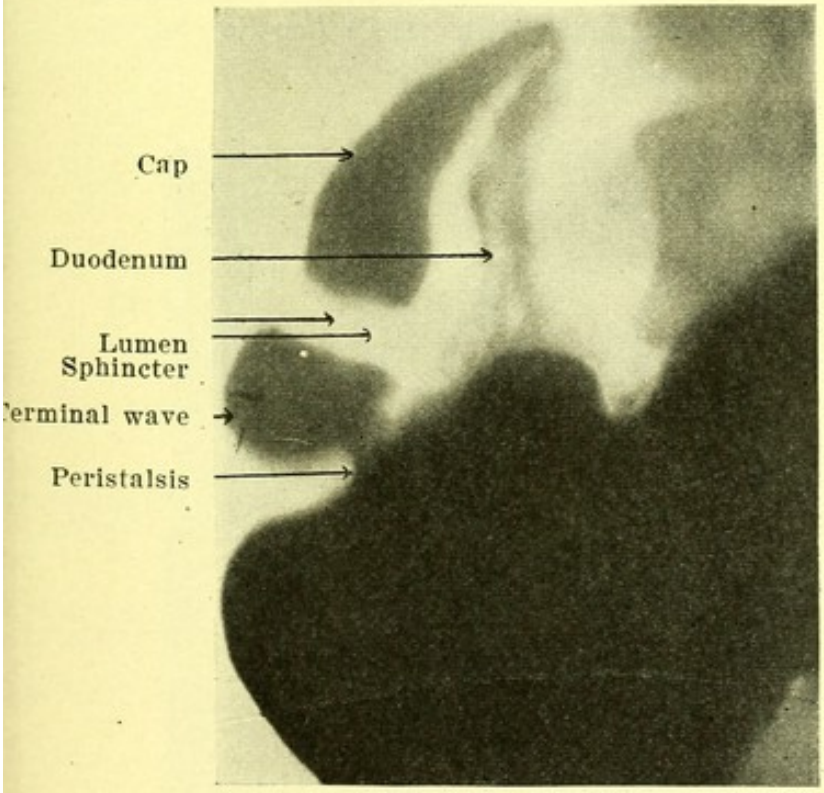

Fig. 9.

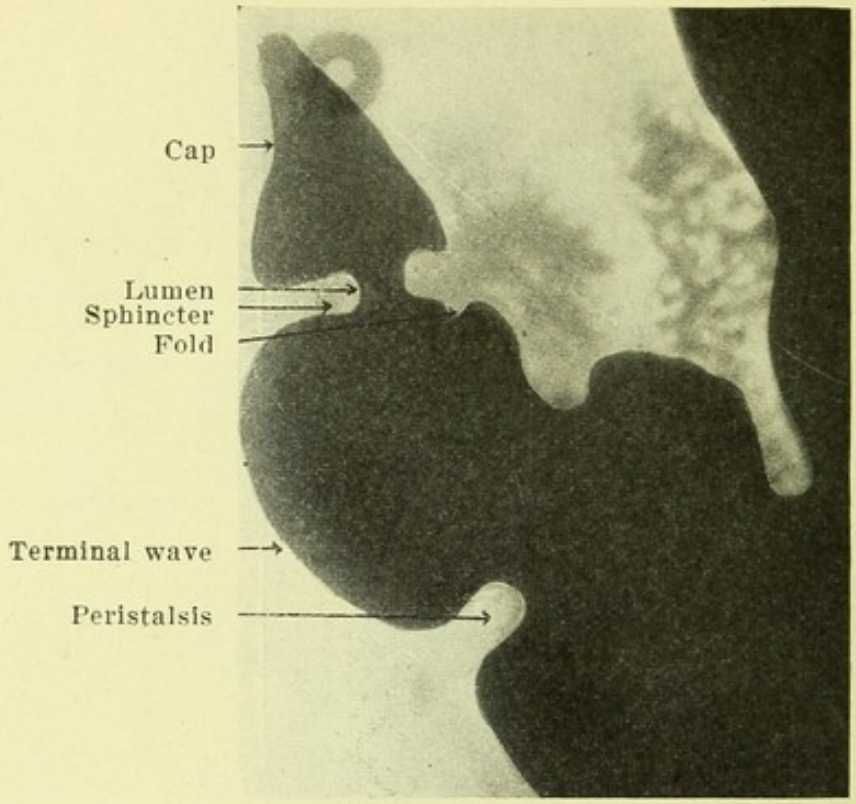

Fig. 10.

To determine the lumen of the second and third portions of the duodenum *artificial dilatation of the duodenum* may be accomplished by passing a pyloric dilator (Einhorn) into the jejunum. This, when inflated, acts as a temporary obstruction. The bismuth and buttermilk then passes through the sphincter, dilating the second and third portions of the duodenum (Fig. 11).

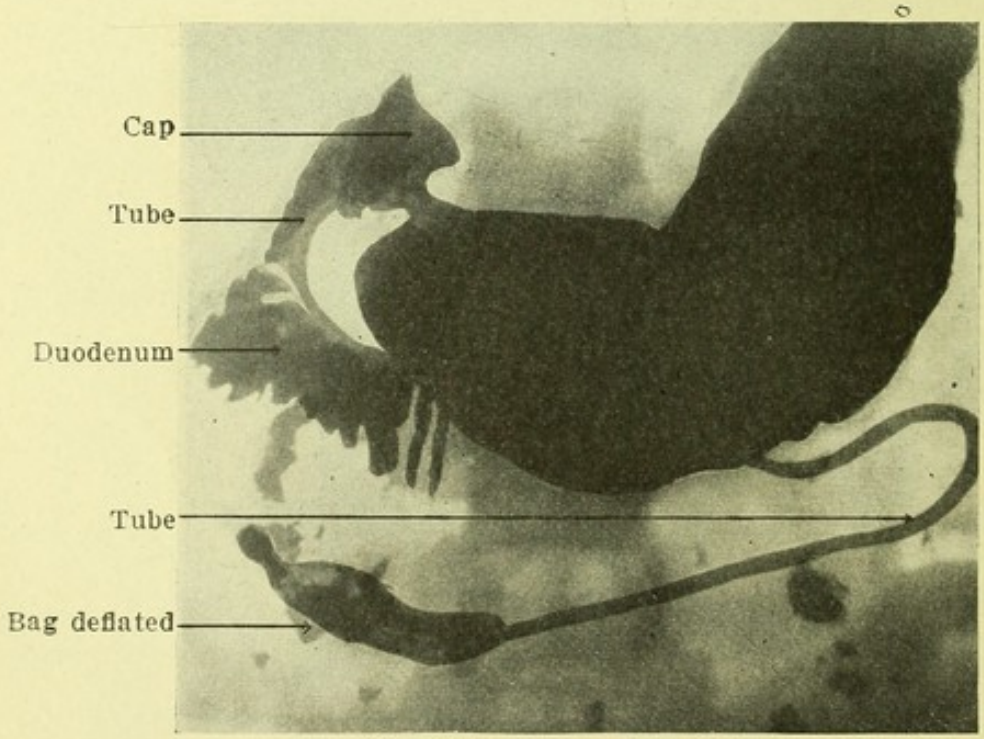

Fig. 11.—Artificial duodenal dilatation.

The gastric and duodenal lesions that may be recognized by the use of serial radiography are:

1. Carcinoma (Figs. 12, 13, 14).
2. Hour-glass contraction (Fig. 15).
3. Adhesions from gastric or duodenal ulcers (Figs. 18 and 19, respectively), or gall-bladder infection, with calculi (Fig. 20), or without calculi (Fig. 21).
4. Dilatation of the pars pylorica from obstruction (Fig. 24).
5. Atonic dilatation (Fig. 25) with or without prolapse of the pylorus.
6. Atrophic contraction (Fig. 26).

The following radiographic findings are characteristic of carcinoma: The lumen of the stomach is encroached on by a nodular growth in the wall of the viscus, with islands or projections into the normal tissue, giving the appearance of finger-prints (Figs. 12 and 14). The growth may progress in the form of a cone (Figs. 12 and 13), terminating at its apex in a small constricted lumen, which may be filled with bismuth or entirely obliterated, or the line of invasion may have a worm-caten appearance with overhanging edges. The area of constriction is constant in size, shape and position, and devoid of peristaltic contractions or rugæ, although it may be filled and emptied during each cycle by the peristalsis of the normal portion.

FIGS. 12-14.—CARCINOMAS

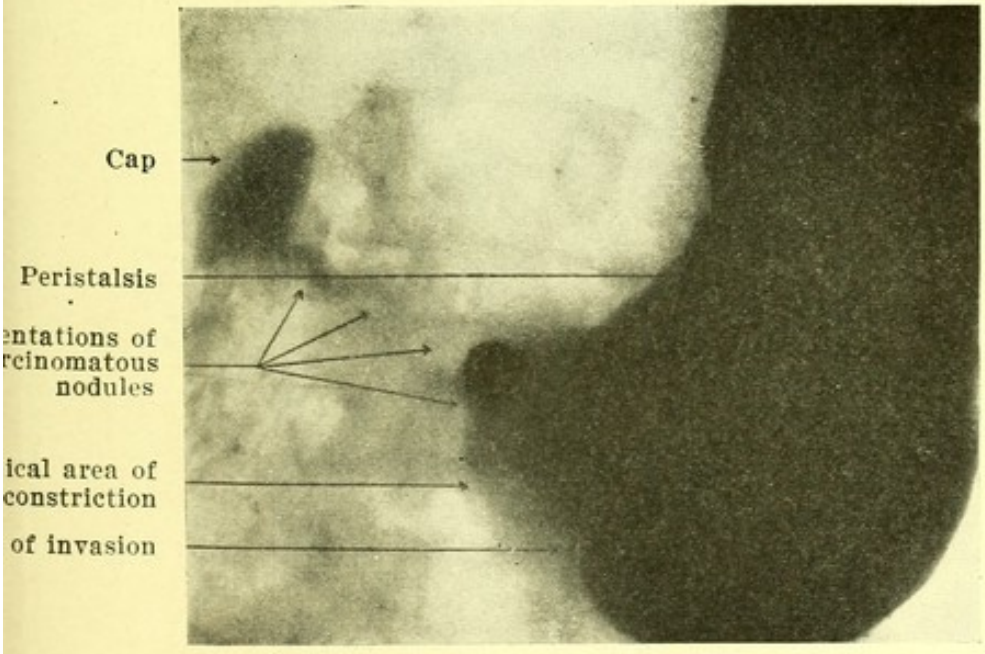

Fig. 12.—Extensive carcinoma.

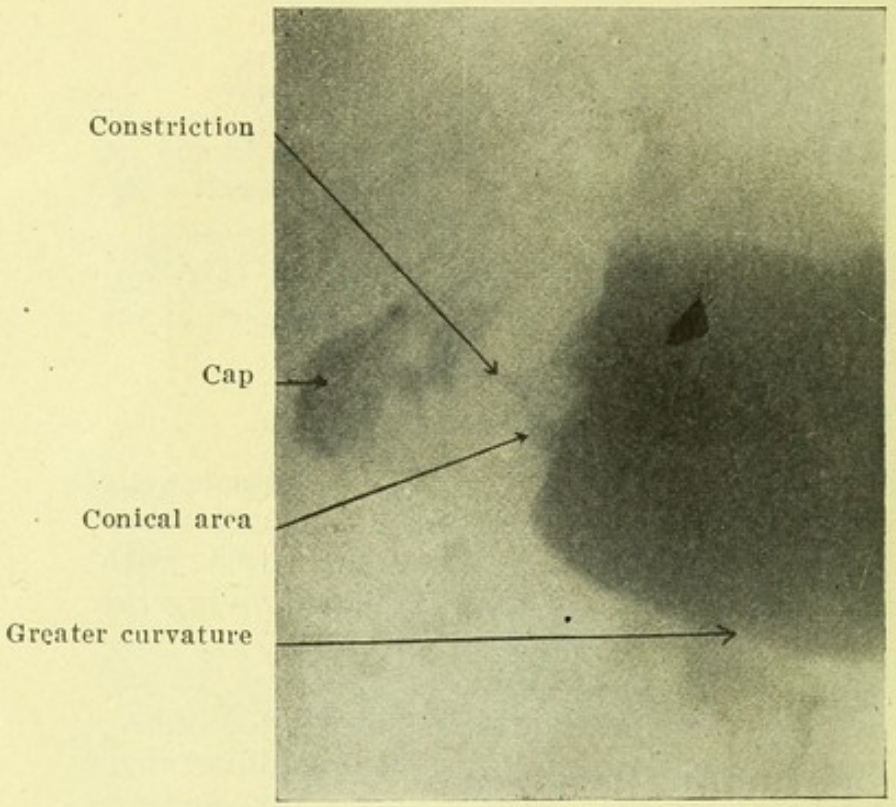

Fig. 13.—Annular growth.

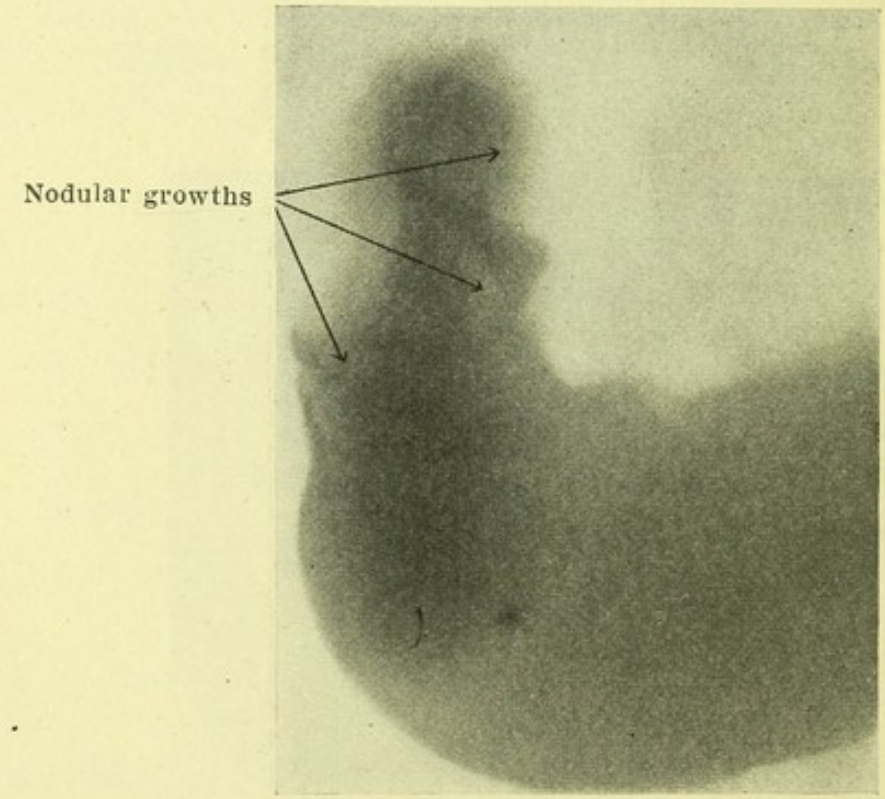

Fig. 14.—Carcinoma.

The characteristics of hour-glass constriction of the stomach are illustrated in Figure 15. The constriction is narrow, having the appearance of a ring with clear-cut edges. It resembles a peristaltic contraction, except

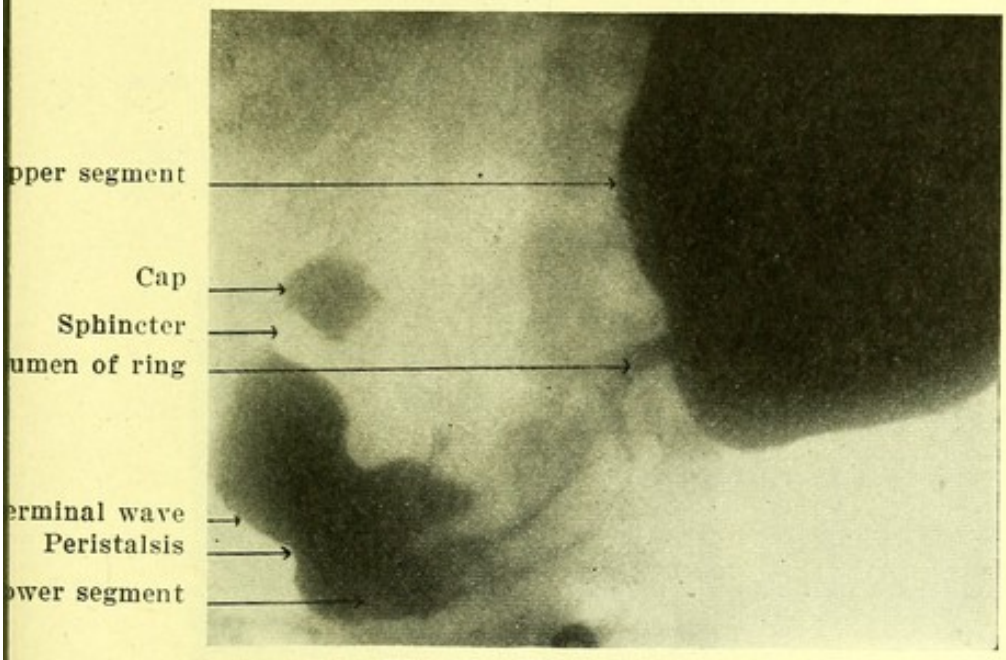

Fig. 15.—Hour-glass stomach.

that it does not relax during diastole. The upper segment is large in proportion to the lower one, which corresponds in size and shape to a normal empty stomach. A deep crease or spasmodic contraction in the greater curvature near the spleen so closely resembles an hour-glass constriction that at least two series of radiograms must be made with the patient in various postures before one is justified in making a diagnosis of hour-glass stomach.

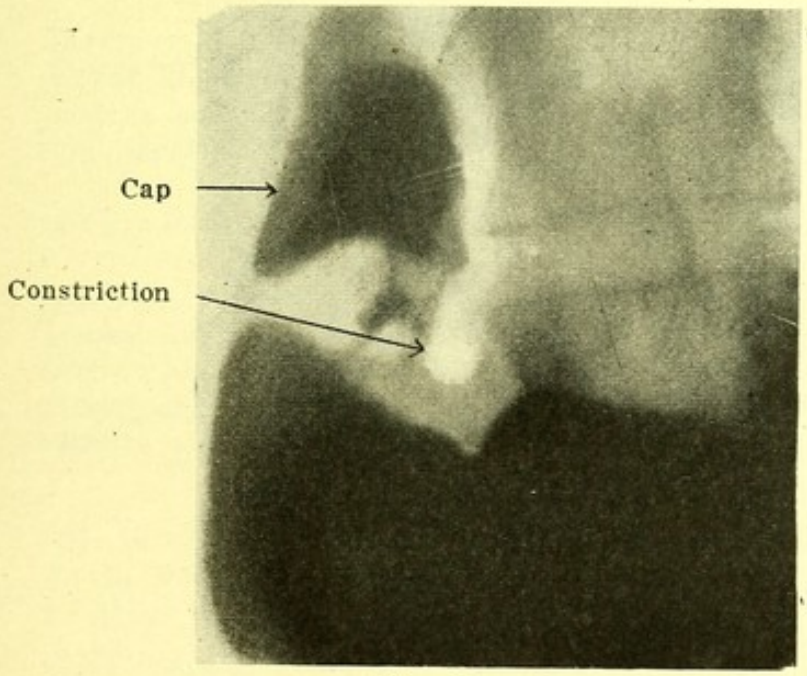

Fig. 16.—Adhesions.

Adhesions involving the pylorus and duodenum indicate, in a large percentage of cases, the presence of an ulcer of the stomach or duodenum, or gall-bladder infection, with or without calculi. The radiographic indications of adhesions are illustrated in Figures 16, 17, 18, 19, 20, 21, 22 and 23.

1. The lumen of the affected area varies in diameter but does not dilate to its normal size.
2. The rugæ in the affected area show with unusual distinctness, having a crinkled appearance, and usually run obliquely or transversely.

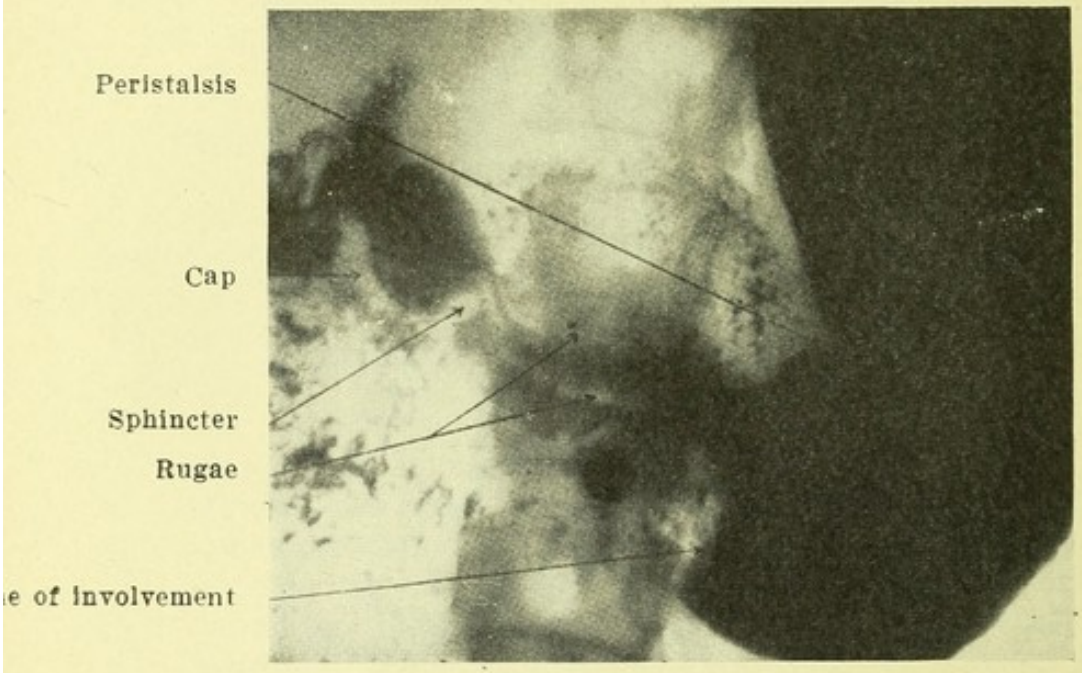

Fig. 17.—Extensive adhesions.

3. The peristaltic contractions are clear-cut in the normal portion, but cease or are distorted when they reach the adhesions.
4. The cap is constricted, asymmetrical, displaced or absent.
5. The sphincter is not clear-cut and well-defined, and is much wider than it should be, either on one surface, forming a wedge-shaped area, or on both surfaces, giving an annular appearance.
6. The second and third portions of the duodenum are angular or contracted.
7. The stomach may be bound to an adjacent viscus, and conform in shape to the lines of the liver, gall-bladder or colon. At the point of adhesions on the lesser curvature peristalsis ceases, and the contraction on the greater curvature becomes deeper, compensating for its absence on the lesser curvature.

A small localized constriction in the body of the stomach or pars pylorica, having the appearance of an embryonic hour-glass contraction, associated with a distortion of the rugæ, suggests an ulcer of the stomach, old or new.

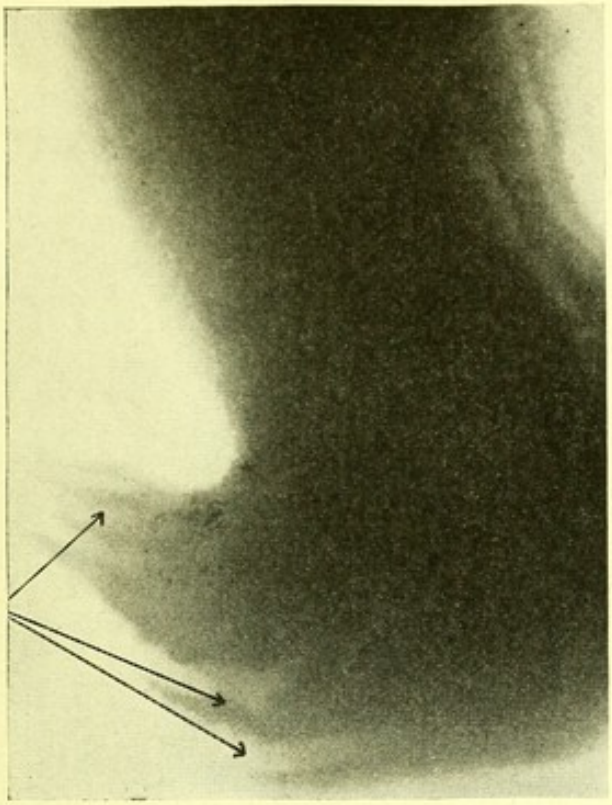

Fig. 18.—Adhesions from gastric ulcer.

If the cap is contracted and worm-eaten, but not drawn to the right, and the duodenal surface of the sphincter is irregular, duodenal ulcer should be considered.

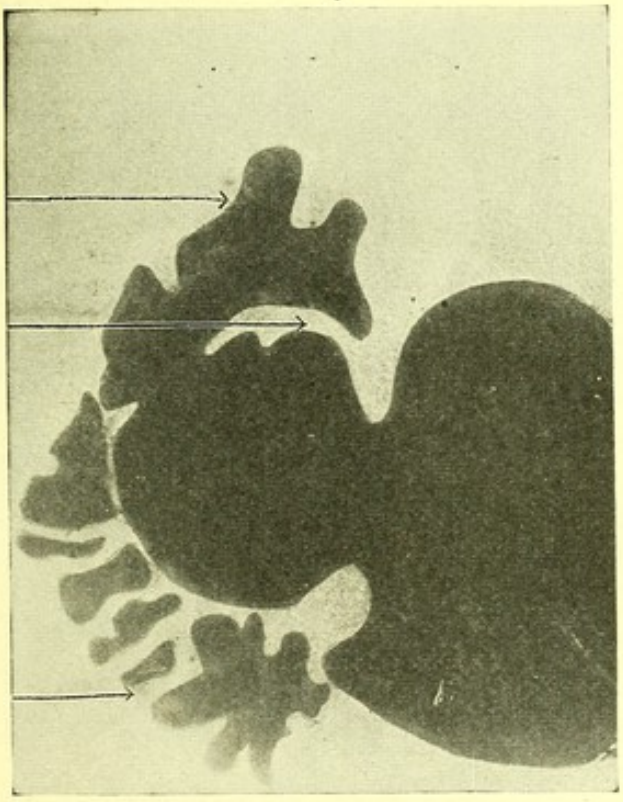

Fig. 19.—Duodenal ulcer.

Extensive adhesions, involving the right side of the pars pylorica, drawing that portion of the stomach to the right and straightening out the greater curvature, the cap being of normal dimensions, but angulated, and the sphincter being normal, suggest gall-bladder infection, with or without calculi.

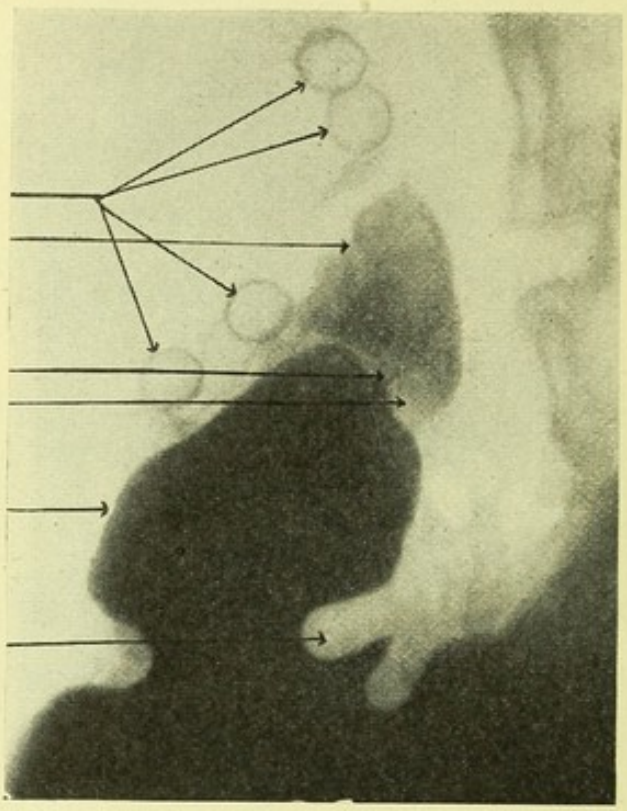

Fig. 20.—Gall-stones.

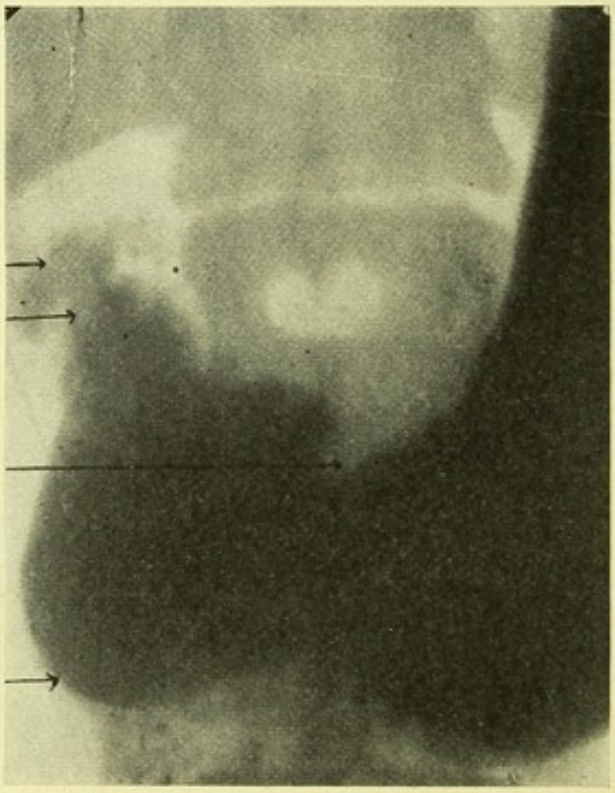

Fig. 21.—Adhesions from gall-bladder infection.

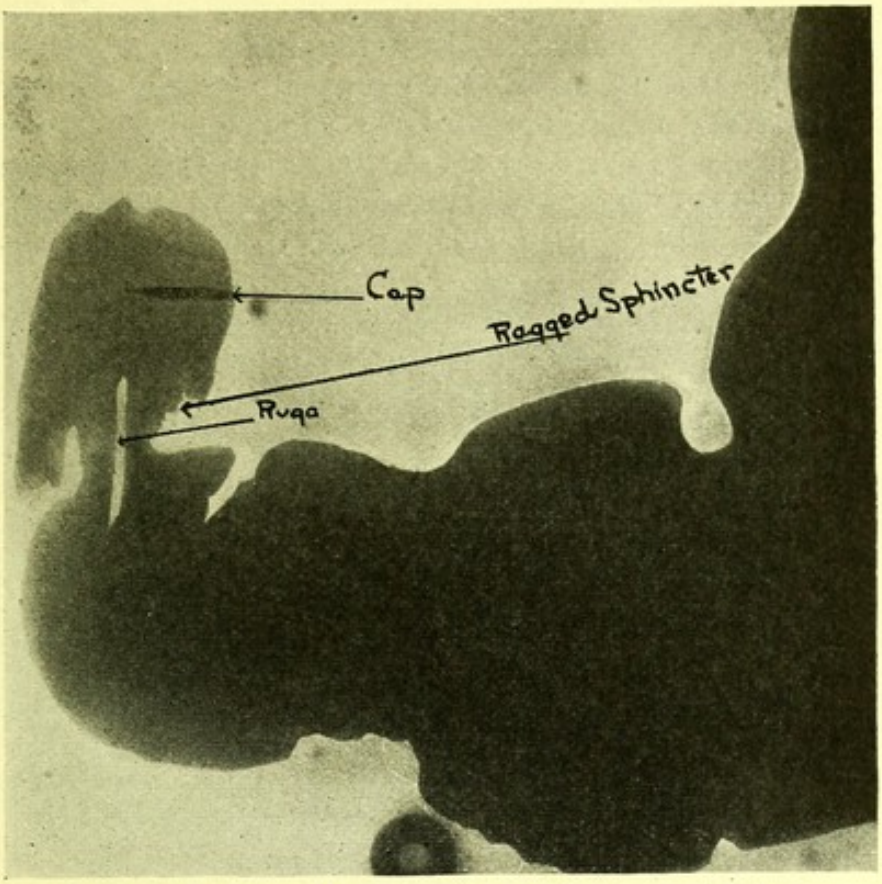

Fig. 22.—Progressive adhesions. First examination.

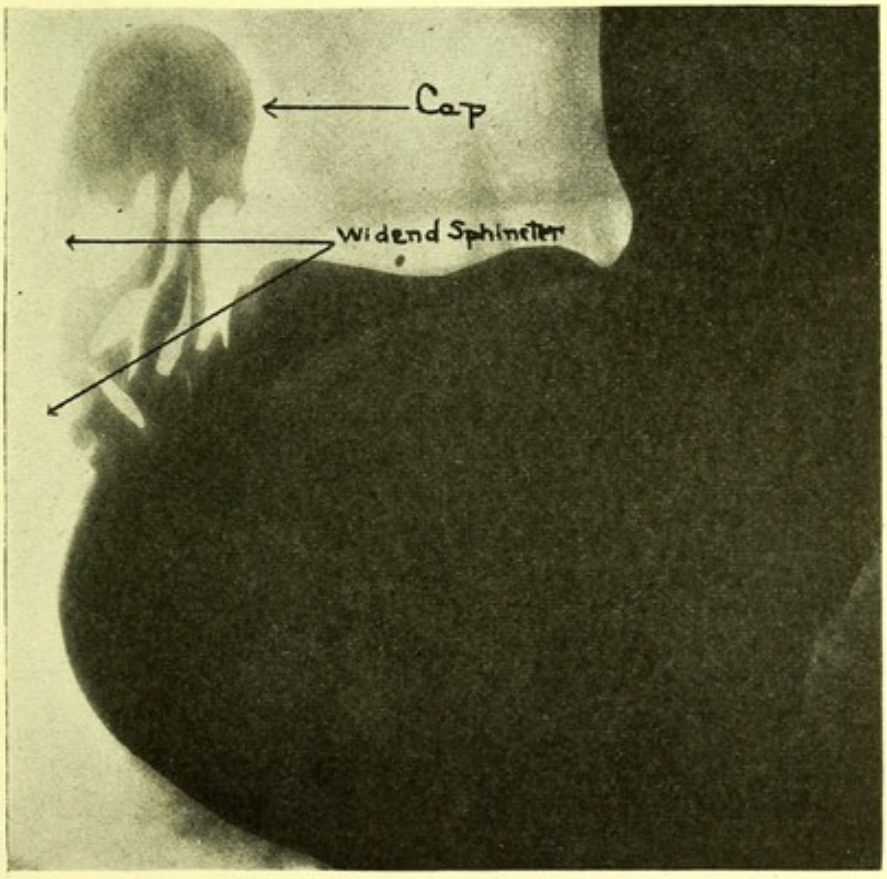

Fig. 23.—Progressive adhesions. Second examination, one year later.

wide, showing a lack of pliability of the gastric wall. This condition is most frequently found in patients having an alcoholic history, or those showing a tendency to sclerotic changes in other organs.

SUMMARY

1. The types of stomachs may be divided into four classes to facilitate indexing.

2. The motor phenomena of the stomach are complex, showing a gastric cycle, consisting of a systole and diastole, and the progression toward the pylorus of peristaltic contractions.

3. The appearance of the cap (first portion of the duodenum) is a vital factor in gastroduodenal diagnosis.

4. The second and third portions of the duodenum may be artificially dilated.

5. The lesions which can be diagnosed by serial radiography include carcinoma, hour-glass constriction, adhesions from gastric ulcer, duodenal ulcer, and gall-bladder infection, with or without calculi, dilatation from obstruction or atony, and atrophic contraction.

6. The radiologist can recognize and differentiate between these conditions with about the same degree of certainty as can the surgeon at an exploratory operation without the microscopic examination of the specimen.

103 Park Avenue.