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ROENTGENOLOGICAL APPEARANCE OF THE ABDOMEN IN ILEUS

L. JOHN DE ALBUQUERQUE, M.D.*

The diagnosis of obstruction of the small intestine is a very serious problem to the surgeon. Along with the details of the history and clinical findings, he will find that roentgenography can supply evidence which cannot be obtained in any other way: (a) the degree of bowel distention, (b) location of distended loops, (c) presence of air in the peritoneal cavity, and (d) site of obstruction.

In many instances, the radiologist who is not familiar with details of the history and clinical findings, will attempt to decide the presence of mechanical or paralytic (adynamic) ileus on the appearance of the X-rays alone. This practice should certainly be discouraged. On the other hand, the findings in the roentgenogram will prove extremely valuable to the surgeon when small bowel obstruction is suspected.

In acute obstruction of the small intestine which is certainly a surgical emergency, the patient may be too ill to be taken to the X-ray department. In such cases, the use of the mobile X-ray unit will make possible obtaining of radiograms quickly, through plain scout films of the abdomen showing the site of the obstruction, and this will cause no disturbance to the patient.

Scout films of the abdomen are obtained without contrast medium or preparation to the patient, and are usually taken in emergency cases, often at a bedside. Joseph Lavitin¹ found the scout film a significant aid in substantiating or establishing diagnosis in some conditions. In perforated ulcer, an antero-posterior view in lateral decubitus position with the left side down is desirable and may show free air in the abdomen, when the upright view fails. It is also much easier to take the film with the patient in the decubitus position when he is too ill to have a radiogram taken in the upright position. In non-opaque ureteral stones, the abdominal findings are important in the negative sense, in that no abnormal dilatation may be present. A stone on the right side may make differentiation between ureteral colic and appendicitis difficult. Such a stone may block the ureter and the characteristic signs of blood in the urine may be absent. An intravenous pyelogram may be made without disturbing the patient. If necessary, the films may be taken at bedside with a stationary grid. Spasm of the kidney pelvis may prevent excretion of the dye and density of the kidney on the side will appear increased.

During the first 24 to 48 hours after abdominal surgery, gas filled loops of bowel must not be interpreted as evidence of ileus. This has been observed to persist as long as two weeks.

In the normal subject, excluding infants and older patients, gas is not usually found in the small intestine, except for small quantities in the duodenum and

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occasionally in the terminal ileum. When the individual is unable to belch, he may swallow enough air to fill a number of loops of small intestine. However, the width of the lumen so outlined does not exceed 2.5 to 3.0 centimeters. Gas distended loops of small bowel with a fluid level are indicative of ileus (Fig. 1).



Fig. 1—47 year old white male admitted to the hospital with the complaint of abdominal distention following laminectomy done elsewhere six days previously.

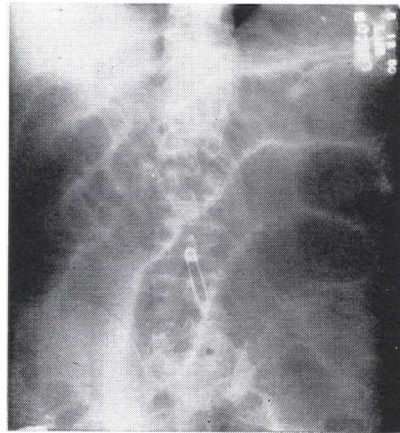


Fig. 2—60 year old male admitted to the hospital with the diagnoses of acute suppurative appendicitis. Operated upon, developed peritonitis post-operatively. The scout film of the abdomen shows both large and small bowel dilatation, and the "step-ladder effect" is noted in the small bowel pattern. Upright films showed presence of fluid levels in the loops of bowel.

In the erect position, fluid levels do not necessarily indicate intestinal obstruction, since they are commonly seen in the normal subject in the duodenal bulb, in duodenal and jejunal diverticula, in the flexures of the colon and in haustral pockets of the ascending and transverse colon when its contents are liquid.

In the presence of obstruction the gut is distended, the arrangement of the plicae are characteristic and the fluid levels are longer than in the incidental types mentioned above.²

The dictionaries have defined intestinal obstruction as being synonymous to ileus and vice-versa, when actually they are physiologically distinct from one another. Ileus may be defined as a dilatation of the small intestine, or a portion thereof, associated with an accumulation of gas and fluid and with other disturbances in physiology. Obstruction is any localized condition acting as a barrier, or preventing mechanically, the free passage of intestinal contents. Obstruction, usually designated as chronic obstruction, may exist without ileus but ileus often results from obstruction, and is often referred to as acute obstruction. It seems desirable to bear in mind this distinction in terms in order to avoid confusing the two conditions.³

In a review of the physiologic disturbances consequent upon ileus, Ochsner (1937)⁴ pointed out that distending the intestinal wall results in increased secre-

tion, diminished absorption, and failure to transport intestinal contents from higher to lower levels. The pressure in the wall of the bowel rises and is much higher in the upper than in the lower part of the intestines. The normal function of the duodenum is largely secretory while that of the ileum is largely absorptive, and it has been found that the duodenum secretes fluid five to ten times as rapidly as the ileum. The blood supply of the wall varies in different portions of the intestine. In the upper part the blood vessels enter the wall close to the mesenteric attachment and pass around the circumference deep in the muscle or submucosa. In the ileum, the vessels run part way around just beneath the serosa, sending small branches into the muscle, and then plunge into the wall. Distention of the upper intestine, therefore, compresses the intramural arteries and veins much more than in the lower intestine. Sufficient stretching may obliterate the lumen of the vessels. Storck and Ochsner (1936)⁵ summarize the mechanism of interference with intestinal movements by distention as follows: (a) in the early stages it causes fatigue through stretching of the muscles; (b) in the intermediate stages, it causes interference with the blood supply to the muscles, resulting in anoxemia to the bowel; (c) in the terminal stages, it causes actual necrosis of the musculature.

It appears worthy of emphasis that mechanical obstructions must be differentiated from paralytic ileus in cases of distention of the small bowel, because if the diagnosis is not made early by proper roentgenogram studies of the abdomen before the clinical evidence becomes clear, and treatment not started, such obstructions may prove fatal.

Ileus in the early stages may have the appearance of only one hairpin loop, of gas containing intestine, and can be diagnosed long before any clinical evidence becomes clear. As time goes on additional loops become distended, lying side by side producing the so-called "step-ladder effect" (Fig. 2).

The diagnosis of ileus by the demonstration of gas distended loops of small intestine on roentgen films has been done for many years. Hibbard and Swenson showed in dogs that gas in the small intestine can be demonstrated in three to three and one-half hours and that fluid levels appear six to seven hours after an obstruction of the small intestine is produced. The higher the obstruction, the sooner the phenomena developed.³

It may be possible to determine to a certain degree the level of gas distended loops by observing the appearance of the mucosal contours visible in the gas shadow. In the high jejunum cross striations can be observed in the shadow (Fig. 2).

In the lower jejunum and upper part of the ileum, these striations become less marked. Lower in the ileum no cross striations can be seen and the margins of the intestine outlined by gas are smooth (Fig. 4).

Consequently, if one observes a smooth loop of intestine the obstruction is probably in the ileum.

The colon when distended by gas presents itself with widely spaced markings, as observed in Fig. 6.

Occasionally, it may become difficult to differentiate distended colon from distended jejunum, but the position of the dilated loop of bowel in the film will aid in distinguishing these portions of intestine (Fig. 3).

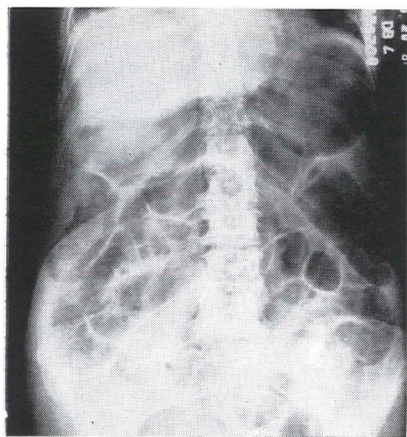


Fig. 3—White, female admitted to the hospital with the diagnosis of obstructive jaundice. Liver biopsy (needle) done 15 days after admission. The following two days the patient began vomiting, complained of pain on the right side of the abdomen which was distended and tympanic. Scout film of the abdomen showed generalized dilatation of the colon and small bowel. The small bowel assumed a so-called "step-ladder pattern." On lateral decubitus projection multiple fluid levels were observed in what appeared to be large and small bowel.

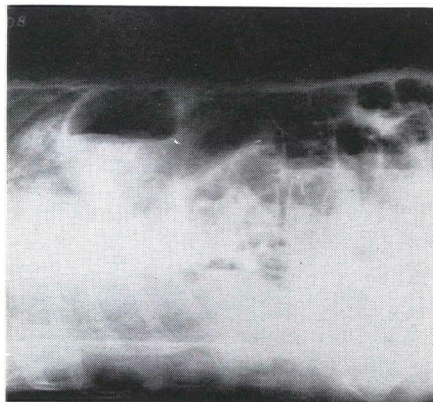


Fig. 4—Same patient described in Fig. 3, on lateral decubitus projection. Note multiple fluid levels seen in what appears to be large and small bowel.

CLASSIFICATION—Ileus may be classified as mechanical, paralytic or adynamic and mixed.

Mechanical Ileus—Mechanical ileus often results from simple occlusion within the bowel, such as a tumor. It may result from simple occlusion from without—adhesions, inflammation, infiltration, or enlarged viscera. Or it may result from incarceration, as observed with adhesions, internal hernia and strangulation. Finally, volvulus is seen in the film as a dilated gas-filled loop of bowel rising out of the pelvis and lying in the middle of the abdomen. This condition can be differentiated roentgenologically from the slowly developing obstruction of the sigmoid due to carcinoma. The distended colon due to gradual obstruction of the sigmoid lies in the usual position and can be traced from the point of obstruction to the cecum. Differentiation of these two conditions is very important to the surgeon.¹

Ileus may occur proximal to an obstruction when the bowel is no longer able to advance its contents past the critical point, probably initiated by fatigue of the muscle and localized distention, which begins near the obstruction and extends proximally until other portions of the gastro-intestinal tract are involved. Occasionally, the bowel is able to re-establish compensation without mechanical

relief of the obstruction, and is manifested clinically by repeated attacks of abdominal pain and distention with spontaneous relief. The approximate level of the obstruction can be determined by the appearance of the gas distended loops of bowel, as described previously. This has proved of great assistance to the surgeon in planning his operation. The signs presented in a scout film of the abdomen in mechanical ileus are:

- (a) hoop shaped gas filled loops of intestine;
- (b) fluid levels in motion;
- (c) no tumor shadow visible;
- (d) little or no gas in colon;
- (e) exudate difficult to see;
- (f) free diaphragm;
- (g) little deformity of adjacent structures;
- (h) epiperitoneal fat line not obscured in early films (Fig. 4);
- (i) narrowed space between the loops.

Paralytic Ileus—Paralytic or adynamic ileus results from some influence external to the intestine itself which interferes with its physiologic efficiency and starts a train of events similar to those associated with mechanical ileus.³ The most frequent cause is peritonitis, but other causes such as trauma—injury to the spine, post-operative infections, infections in the lungs and hemorrhage may initiate the train of events. It is important to obtain chest films in cases of abnormal findings in scout films of the abdomen, or try to include the diaphragms in these for subdiaphragmatic free air. Paralytic ileus also results from a disturbance in the circulation of blood in the intestinal wall due to mesenteric vascular occlusion. The differential diagnosis of this from other conditions causing ileus is of great importance and cannot be made from the appearance of the gas shadows on the roentgenogram.³ Mesenteric vascular occlusion should receive surgical treatment with the least possible delay. This diagnosis is suggested: (a) by a sudden onset of abdominal pain which persists between cramping attacks characteristic of mechanical ileus; (b) by localized tenderness or a palpable tender mass; (c) by fever and leucocytosis. The most important sign is the persistent pain.

Spontaneous paralytic ileus in previously healthy persons is a well known condition in Mysore State, South India, but has received little, if any, recognition elsewhere. W. B. Roantree⁵ reports on 33 cases of this rapidly developing paralysis of the small bowel seen during 1936-48. Abdominal X-rays show obstruction with gas and fluid levels. The stepladder arrangement may be found as early as four hours after onset of illness. This early evidence of obstruction speaks against mechanical obstruction, as does the usual absence of increased peristalsis noted in these patients. Pain is usually less severe than in intestinal strangulation, tachycardia and leucocytosis are not seen, and there is no abdominal mass.

Roentgenologically the findings in paralytic ileus may be described as:

- (a) meteorism with fluid levels in small bowel and colon, gas in rectum;

- (b) signs of inhibition, decreased motor activity;
- (c) free peritoneal fluid;
- (d) blurring of flank stripe;
- (e) inhibition of diaphragmatic excursions;
- (f) secondary changes in lung bases, thus the importance of obtaining chest films in these cases; also, for free air under the diaphragms.
- (g) epiperitoneal fat line obscured by edema. This is a very important sign when present. If present we may be fairly sure of our diagnosis (Fig. 5).

Mixed Ileus—This usually is a paralytic type followed by a mechanical ileus.

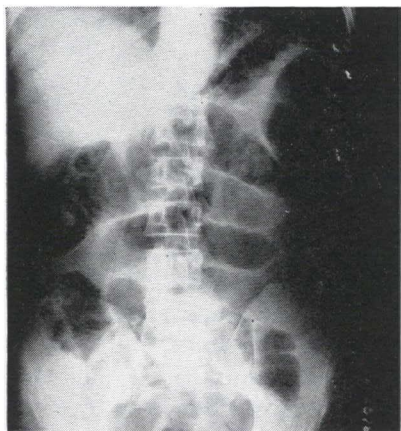


Fig. 5—44 year old colored male admitted to the hospital with acute appendicitis, developed abdominal distention post-operatively. Scout film of the abdomen shows many dilated loops of lower jejunum and possibly upper ileum. Silent abdomen. Note obscured epiperitoneal fat line and presence of exsudate.

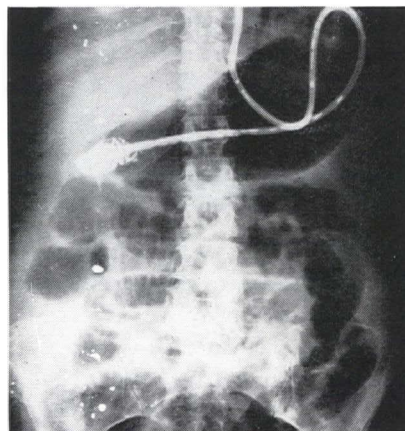


Fig. 6—There is an intestinal drainage tube coiled in the stomach with the mercury filled bag lying just proximal to the pylorus. Below this are several dilated loops of jejunum, actually the dilation goes down as far as the upper ileum. There is a small amount of gas in the colon, but the colon here is not a pattern of obstruction. Clinical findings with scout films of the abdomen suggest paralytic type of ileus.

DIFFERENTIAL DIAGNOSIS—It may be very difficult to differentiate roentgenologically mechanical from paralytic ileus. The clinical history is very important to help in evaluating the case. Haworth and Garland (1940)⁶ have pointed out that in the late stages of mechanical ileus, the differential diagnosis from the paralytic type is usually very difficult because by that time gas begins to accumulate in the large intestine. The properitoneal fat line (of diminished density), visible along the flank, becomes partially obscured by edema in the presence of peritonitis, but they have found it also obscured in the late stages of mechanical ileus.

Generally, gas is not observed in the large bowel in mechanical ileus except in very small amounts in adults, whereas in paralytic ileus gas can be observed in considerable amount in the colon, rectum and stomach (Fig. 6). Fluid may also be observed in the colon. In paralytic ileus, there is inhibition of the bowel, and

fluid levels may be observed at the same height⁷. (Fig. 1). Changes in the lung bases are also more common in adynamic ileus, and there may be free sub-diaphragmatic air.

In paralytic ileus with free fluid in the abdomen, the X-ray has a characteristic appearance when taken with the patient in the upright position. The gas distended coils rise to the upper part of the abdomen, while the lower abdomen appears opaque as a result of the effusion (Fig. 1).

Extreme meteorism dominates the picture in paralytic ileus.

There are occasions in which differential diagnosis between mechanical, spastic and inhibitive (paralytic) ileus may be difficult or impossible to make. The consideration which causes the clinician the greatest concern is whether a strangulating mechanical obstruction may be present. Wangensteen⁸ has encountered this dilemma many times, once in a severe post-operative wound infection which gave very few local signs.

SUMMARY

The scout film of the abdomen is a practicable and valuable diagnostic procedure, as an aide to the diagnosis of ileus.

In suspected small bowel obstruction the diagnosis should be made early by proper roentgenogram studies of the abdomen before the clinical evidence becomes clear, because if treatment is not started such obstructions may prove fatal to the patient.

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