

Spontaneous Pneumoperitoneum: A Roentgenologic Sign Found in the Supine Position¹

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THE IMPORTANCE of the roentgen examination in the diagnosis of perforations of the hollow viscera has been repeatedly stressed and evaluated. In all cases in which a rupture of the stomach, small bowel, or colon, whether of spontaneous or traumatic origin, is suspected, the diagnosis can be made relatively certain by means of roentgen study. The roentgen findings depend upon the occurrence of a spontaneous pneumoperitoneum, gas from the gastro-intestinal tract escaping into the free peritoneal cavity. In all the literature on this subject it has been stressed that it is necessary to have the patient in the upright position in order that the gas may rise to the upper portion of the abdomen, coming to lie just inferior to the diaphragm. Thus the shadow of the gas can be made out by contrast with the diaphragm above and the denser shadows of the solid viscera below. When the upright position is impossible, it has been suggested that films might be made in the left lateral decubitus position, a postero-anterior exposure being undertaken, so that the gas will rise under the lateral abdominal wall and again manifest itself by contrast with the surrounding tissues.

In a series of cases of perforation of the colon from various causes we have observed another roentgen sign of pneumoperitoneum which is particularly valuable because it is manifested in the ordinary scout roentgenograms of the abdomen made with the patient in the supine position. Essentially, this finding consists in the ability to visualize, on the film, the outer as well as the inner wall of the bowel.

It is curious that in the extensive literature on artificial pneumoperitoneum there

is no specific mention of this finding, although it has undoubtedly been observed repeatedly. It appears to occur only in those cases in which relatively large quantities of gas and some fluid have entered the peritoneal cavity. Under such circumstances there is a sufficient quantity of contrast medium present to separate the individual loops of bowel from each other. The loops themselves are usually greatly distended with gas because of the peritonitis which is present. As a result, it is possible to observe both the contour of the inner wall of the bowel and of the outer, the thickness of the wall itself being quite apparent. In the ordinary case of ileus it is relatively easy to observe the inner wall of the bowel because of the contrast between it and the gas which distends the bowel. Likewise the thickness of the bowel wall can be approximately ascertained because, with two loops of bowel lying in close juxtaposition to each other, the gas filling each loop delineates its wall; thus the thickness between the two layers of gas ordinarily represents the thickness of both bowel walls. In case of effusion into the peritoneal cavity, the diagnosis can often be made because of the increased thickness of the shadow separating the layers of gas, which results from the entrance of fluid between the two loops. In the case of pneumoperitoneum a different picture is presented. Gas enters in between the two loops so that there is a definite separation by a medium of lower density and the outer limits of the wall of each loop of bowel can thus be delineated. This is practically pathognomonic of pneumoperitoneum and is easily observed in ordinary supine films of the abdomen.

That this finding is not a rare one is indicated by the fact that it was present in five cases of acute perforation of the colon in

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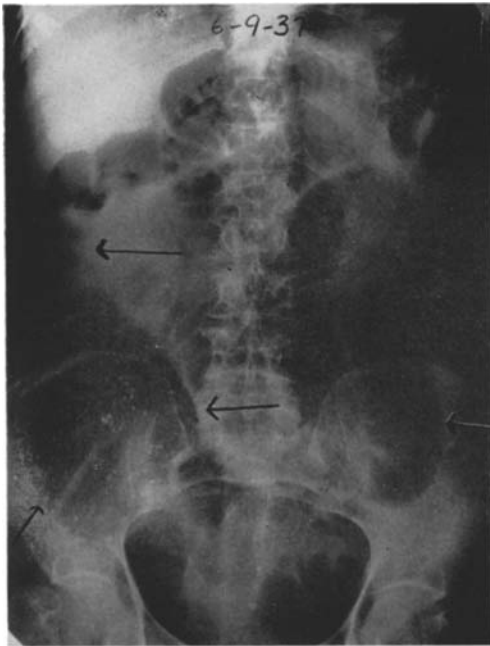


Fig. 1. Case B. B.: Acute obstruction of the colon from carcinoma of the ascending portion; roentgenogram of abdomen (supine position) taken June 9, 1937. The marked distention of the cecum (arrows), indicating the possibility of imminent perforation, the soft tissue mass in the ascending colon (arrow), indicating the position of the obstructing tumor, and the gas-filled dilated loops of small bowel resulting from regurgitation through the ileocecal valve are all well shown. Note especially the appearance of the outer wall of the small intestine (left arrow) and compare with Fig. 2.

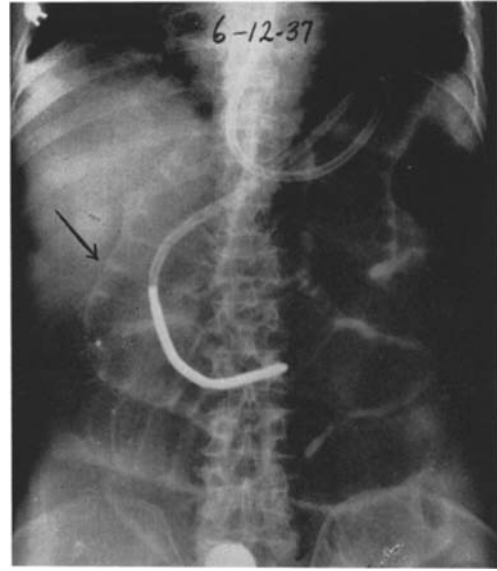


Fig. 2. Same case as Fig. 1; roentgenogram (supine position) taken June 12, after perforation of the cecum. Note the disappearance of the shadow of the colon, with a striking increase in the distention of the small bowel. The outer margins of the bowel loops (arrow) may now be seen owing to the presence of gas about them, producing contrast. The diagnosis of pneumoperitoneum can be made from this film without the use of the upright or lateral decubitus position.

which reasonably satisfactory roentgenograms were obtained with the patient in the supine position. It is perfectly obvious in practically all cases in which artificial pneumoperitoneum is undertaken. We have observed it in a number of patients in whom a perforated ulcer of the stomach occurred and in whom unusually large amounts of gas were present. In perforations of the upper intestinal tract, because the quantity of gas which escapes is commonly small, this sign is frequently absent and it becomes necessary to make films in the upright or lateral decubitus position in order to determine the diagnosis more definitely. In the case of perforations of the colon, however, much larger amounts of gas are extruded, so the sign is usually present.

The importance of this finding lies in the

fact that in many instances, particularly in the case of acute obstruction of the colon which is being treated conservatively, the onset of the perforation may be difficult to determine by the clinical findings. Many of these patients are extremely ill because of the obstruction and because of the nature of the lesion which is producing it. During the period of treatment their clinical findings may change relatively little after the onset of the perforation. Frequently, of course, there are evidences of collapse, but because of the serious condition of the patient preceding the catastrophe it may escape clinical detection. In most instances in which acute obstruction of the gastro-intestinal tract is being treated conservatively, routine bedside films of the abdomen with the patient supine are being made. Certainly they should be undertaken at regular intervals to determine the degree of distention of the intestinal tract, if for no other reason. Careful examination of such routine films may reveal the super-

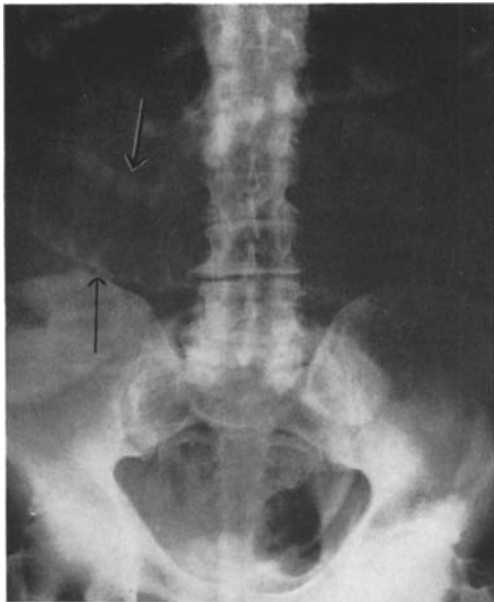


Fig. 3. Case of perforation of the colon with pneumoperitoneum; roentgenogram of abdomen, supine position. Note the distended loops of small bowel, both their inner and outer contours (arrows) being readily visible.

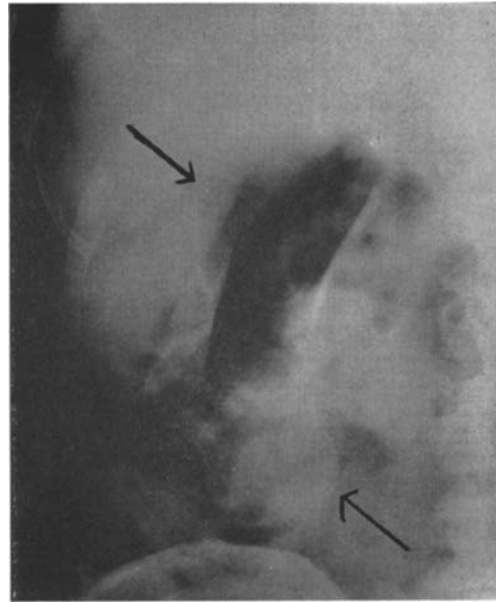


Fig. 4. Case A. S.: Spontaneous pneumoperitoneum of unknown origin, without symptoms of peritonitis; roentgenogram of right upper quadrant of abdomen, supine position. Note the distended loops of small bowel, the outer walls of which (arrows) are clearly visible. The diagnosis of pneumoperitoneum is obvious despite the supine position and the local area of the abdomen which was examined.

vention of perforation and peritonitis and this may furnish the first evidence indicating the necessity for more radical treatment.

To illustrate such a sequence of events the following case is reported:

Mrs. B. B., aged 73, was admitted with evidences of obstruction of the bowel, which had been present about five days. The roentgenographic examination of the abdomen (Fig. 1) revealed a dilated cecum with a soft tissue mass in the region of the ascending colon, suggesting strongly the presence of an obstructive process at this point, producing a tumefaction. There were a number of loops of small bowel, also distended with gas, probably owing, in this instance, to regurgitation through the ileocecal valve. This does occasionally occur, although it is uncommon in obstruction of the colon; it may have occurred in this instance because the obstruction was so close to the valve itself. Distention of the cecum was of marked degree. For various reasons suction treatment was instituted and conservative treatment was considered. Routine films of the abdomen were made at intervals of twelve hours. Seventy-two hours later some change in the patient's condition occurred, but she had been so seriously ill prior to this that the change was not clearly observed. The roentgenogram taken at this time, however, showed a very striking alteration (Fig. 2). The loops of small bowel were greatly dis-

tended. The cecum was no longer observed, no doubt having been deflated. The wall of the small bowel is clearly visible in this film (arrow) both from within and without. A distinct separation of the loops from each other and from the remainder of the abdomen is made out, indicating the presence of some contrast material around the loops, of a density less than that previously observed. The diagnosis of perforation with spontaneous pneumoperitoneum and peritonitis was immediately suggested. Upright films of the abdomen were made and these confirmed the presence of large quantities of gas and fluid in the peritoneal cavity. The patient was submitted to exploratory laparotomy immediately and the findings described were confirmed. There was a perforation of the cecum which permitted the escape of gas and fluid in the peritoneal cavity. The patient later succumbed.

This case illustrates the importance of repeated routine examination of the abdomen and the value of the observation of this sign in the early diagnosis of a spontaneous pneumoperitoneum from perforation.

A case of a similar type is illustrated in Figure 3. Here again there was a perforation of the colon and the markedly dis-

tended loops of small bowel with the outer wall clearly visible are again shown. The diagnosis likewise was confirmed when films in the upright position were made.

That spontaneous pneumoperitoneum is not always productive of clear clinical symptoms is illustrated by the following case.

Mr. A. S., aged 78, came in complaining of dysentery, gaseous distention, and vomiting, of four years' duration. He was seen in the Out-Patient Department, neither prostrated nor particularly toxic, and the clinical impression was possible cholecystitis. While the abdomen seemed tympanic on percussion, this was thought to be from gaseous distention of the intestines. The patient was referred for x-ray examination of the gallbladder. The film of the gallbladder region is shown in Figure 4. It was made in the usual postero-anterior prone position, and again the outline of the loops of small bowel is clearly observed in the right upper quadrant. Despite the local area of the abdomen which appears in the roentgenogram, the diagnosis of pneumoperitoneum is obvious at once. Further studies in the upright and lateral decubitus positions confirmed the presence of large quantities of free air in the peritoneal cavity. The origin of this air was never determined. The patient was seen for four days, during which the pneumoperitoneum persisted without further untoward symptoms. He then disappeared and the final outcome remains in doubt.

This case is cited to illustrate the fact that careful observation of roentgenograms

of the abdomen, made in the supine position, may indicate the presence of pneumoperitoneum in the absence of symptoms, despite the failure to obtain upright or lateral decubitus films.

SUMMARY

A roentgenologic sign of pneumoperitoneum hitherto not reported or clearly defined is described. It consists of the demonstration of the outer as well as the inner bowel wall due to the accumulation of gas between the loops of bowel. It is of value because it can be observed in roentgenograms of the abdomen made in the supine position.

This sign may be the first evidence of the presence of pneumoperitoneum in cases in which such a condition is entirely unsuspected. Routine roentgenograms of the abdomen should be made at frequent intervals in all cases of obstruction of the gastro-intestinal tract which are being treated conservatively. Such films should always be examined for evidences of pneumoperitoneum because of the possibility of supervention of perforation without obvious clinical signs.

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