13. Acute intestinal obstruction

Acute obstruction of the intestine in the form of strangulated hernia was one of the first abdominal emergencies to be referred to the surgeon for treatment, while obstruction accompanied by similar symptoms, but due to internal causes that were not so obvious as an external hernia, swelling, was among the latest urgent abdominal cases to be referred by the physician to the surgeon. If there is any condition in which early diagnosis and avoidance of attempts at purgation are necessary, it is intestinal obstruction.

The pathology and causation of acute intestinal obstruction are questions far too big to discuss fully in a small book. We are here concerned only with the common causes and the main types of cases that come for diagnosis. It is not always essential, in diagnosis, to know the exact cause of the obstruction, though every effort should be made to ascertain it as accurately as possible. It is useful to have a knowledge of the proportion of cases due to the main pathological causes of obstruction. The list in Table 5 is a compilation of the overall causes of intestinal obstruction (both small and large bowel) taken from thirteen reported series comprising a total of 12,731 patients. The differences in the distribution of etiologies between adults and children are readily apparent. These findings do not apply to tropical regions.

When the bowel is completely obstructed, the course of the disease is inevitably fatal unless the obstruction is relieved by:

Table 5. Causes of Intestinal Obstruction

<table>
<thead>
<tr>
<th>Causes</th>
<th>Adults</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hernia</td>
<td>41%</td>
<td>Hernia</td>
</tr>
<tr>
<td>Adhesions</td>
<td>29%</td>
<td>Pyloric stenosis</td>
</tr>
<tr>
<td>Intussusception</td>
<td>12%</td>
<td>Ileocecal intussusception</td>
</tr>
<tr>
<td>Cancer</td>
<td>10%</td>
<td>Atretias and annular pancreas</td>
</tr>
<tr>
<td>Volvulus</td>
<td>4%</td>
<td>Adhesions</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>4%</td>
<td>Miscellaneous</td>
</tr>
</tbody>
</table>

1. The spontaneous rectification of the condition
2. Formation of an external fecal fistula
3. Operative interference

The third method is always advisable in unrelenting complete obstruction. So long as the obstruction is complete, exclusion of strangulation is virtually impossible (see below). Therefore, intestinal intubation is useful and safe only in cases of partial small bowel obstruction, especially in the early postoperative period or after a recent bout of peritonitis. Until comparatively recently, the mortality after operation in cases of intestinal obstruction (excluding strangulated external hernias) was high, but during the last two decades better results have been obtained. The main desideratum is to diagnose the case early.

Intestinal obstruction may exist in a chronic or subacute form for a considerable period before an acute attack ensues. In the chronic form, the symptoms are similar in kind but different in degree from those resulting from an acute attack. Chronic obstruction, if uncorrected, usually terminates sooner or later in an acute attack.

Symptoms

Acute intestinal obstruction is always to be regarded seriously, but at the outset two points must be emphasized: first, the variability of the symptoms according to the site and cause of the obstruction, and, sec-
ond, the deceptive nature of those symptoms unless great care is taken by the observer. It is generally true that the higher up in the gut the obstruction, the more severe the symptoms. It is indeed usually possible to estimate which part of the gut is obstructed by considering the symptoms, and cases may be roughly divided into three groups according to whether the obstruction is in (1) the upper small intestine, (2) the lower small intestine, or (3) the large bowel. Let us first consider the symptoms and signs listed in Table 6.

These symptoms and signs are seldom if ever all present at the same time, and the value of each symptom must first be discussed.

Pain. Pain is often very severe from the outset. It is referred to the epigastric and umbilical regions or sometimes to the hypogastrum, and usually comes on in bouts or spasms, though if a considerable segment of mesentery is implicated or if peritonitis has supervened, the pain may be continuous. The spasmodic pain is due to the peristalsis of the intestine trying to overcome the obstruction. This can easily be demonstrated during the examination of an intussusception, when the soft tumor may be felt to harden just before the screaming of the infant. The higher up in the intestine the obstruction is located, the more severe the pain tends to be.

Vomiting. Vomiting is an almost constant feature but varies greatly in the different forms. The higher up in the intestine the obstruction occurs, the sooner vomiting sets in and the more profuse is the regurgitation. In obstruction of the large bowel, vomiting may be absent but nausea and anorexia are usual. In obstructive vomiting, first the stomach

| TABLE 6. GENERAL SYMPTOMS AND SIGNS OF ACUTE INTESTINAL OBSTRUCTION |
|---------------------------------|--------------------------|
| Pain                            | Distention |
| Vomiting                        | Tenderness of abdomen |
| Constipation (inability to pass faces or flatus) | Visible peristalsis |
|                                 | Shock       |
Distention at first may be merely local, due to the dilatation of the coils of gut immediately above the obstruction. In some cases, where ordinary clinical examination does not show any definite distention, a radiograph may reveal local distention of the intestine. In obstruction of the end of the ileum, a local hypogastric distention may first be observed, and in volvulus of the sigmoid, the outline of the affected coil of large bowel may stand out very distinctly. In subacute or partial obstruction of the lower end of the small bowel, the distention gradually affects coil after coil, so that when the patient comes under observation with acute symptoms, the typical ladder-pattern type of distention is seen on looking at the abdomen (Fig. 23). In general, the more distal the obstruction, the greater the degree of distention. But distension may be minimal or absent in the earliest stages of strangulating obstruction because patients usually seek advice early, owing to the severity of the pain.

Tenderness. Tenderness of the abdomen is not usually found until distension appears. Pressure over a distended coil is generally painful. A completely strangulated coil of small intestine quickly becomes dis-

tended, tense, and tender on pressure. In the later stages of obstruction, when peritonitis has ensued, there may be general pain all over the abdomen. Rigidity of the abdominal wall is unusual except in those cases where there is some local peritonitis around an obstructed or strangulated section of bowel. In obstruction of the small intestine, a mass may be appreciated if a closed, strangulated loop is present.

Peristalsis. Visible peristalsis is not a constant accompaniment of obstruction but is diagnostic when present except in some few very thin persons, in whom the normal peristaltic movements of the intestines can be seen through the abdominal wall. It is not usually seen in the very acute cases of strangulation; in subacute obstruction, however, it is more frequently noted and is valuable in diagnosis. In some instances, peristalsis may be accompanied by a gurgling of gas, which may occasionally be heard to pass through a narrowed part of the gut. If a stethoscope is applied to the abdomen during a bout of pain, it may be possible to hear sounds caused by fluid passing through the site of obstruction under the pressure caused by the peristaltic wave. However, when distention is great or has been present for some time, the abdomen may be very quiet and without borborygmi. Although high-pitched, tinkling rushes are helpful when the remainder of the clinical picture is consistent with intestinal obstruction, their absence should not exclude the possibility of obstruction.

Shock. In severe cases the pulse may be weak, the skin cold and sweating, the temperature subnormal, and the pupils dilated, but as a rule the symptoms are not so severe as this. True shock is a very late finding and means that the diagnosis has been missed for too long.

SYMPTOMS DUE TO DIFFERENT TYPES OF OBSTRUCTION

The features of an attack of obstruction vary according to (1) the part of gut obstructed, (2) whether or not the mesentery with the contained blood vessels is also affected, and (3) the completeness or incompleteness of the obstruction.
The part of the gut obstructed. The symptoms due to obstruction—(1) high up in the small intestine, (2) low down in the small intestine, and (3) in the large bowel—can be roughly differentiated.

1. Obstruction high up in the small intestine. This leads to acute symptoms, vomiting comes on very early and is frequent and violent, initial pain is greater, and distention is not an early feature. The vomit is green and bilious. Such symptoms are typically seen when a large gall-stone ulcerates into the duodenum. Obstruction of the duodenum by a cicatrizied ulcer may sometimes be acute owing to sudden spasm and edema around the ulcer. In such cases everything taken by mouth is returned, but no feculent vomit occurs and sometimes peristalsis of the stomach may be seen. The same symptoms are seen in infants suffering from congenital hypertrophic pyloric stenosis. Distention is seen only in the epigastic region. With obstruction of the upper jejunum, the symptoms are still very acute and the vomiting begins early and is frequently repeated, while distention is not at first a noticeable feature. The farther down the jejunum the obstruction, the less acute the symptoms.

2. Obstruction of the lower part of the small intestine. The pain is somewhat less severe than that of obstruction higher up. Shock and pain may be present, but vomiting is a little later in onset and some time elapses before feculent vomiting occurs. Distention comes on after a few hours. In subacute cases, the ladder pattern of distention is seen, and peristalsis is often visible. When there is obstruction in the lower ileum, considerable fluid is still absorbed from the bowel proximal to the destruction, and thus the magnitude of early volume deficits may not be great. With upper jejunal obstruction, volume deficits are large, even early after onset.

3. Large-bowel obstruction (Fig. 24). Pain is much less acute, shock is comparatively insignificant (except in some cases of volvulus and intussusception), vomiting is a fairly late and infrequent symptom, while distention almost from the onset of the acute attack is the rule. An exception must be made in the case of intussusception, for in these cases distention is not an early symptom and should not be awaited, since a distended abdomen accompanying an intussusception generally means that strangulation has supervened.

The consequences of large-bowel obstruction will be influenced by the state of competence of the ileocecal valve. If the valve is incompetent (as it is in about 15 to 20 percent of cases of colonic obstruction) and allows reflux into the small intestine, the patient's condition and the radiological picture often resemble those found in partial obstruction of the small intestine. When the ileocecal valve is competent, however, a closed loop exists between the obstructing mechanism and the valve, and gangrene of the cecum as a result of severe distention is a constant threat. Tenderness in the right iliac fossa in such a case usually suggests that this complication is imminent or has already occurred.

Fig. 24. The appearance of moderate distention of the large gut.

Compression of the blood vessels. Strangulation of bowel. When the vessels in the mesentery of a coil of gut are compressed, first the veins and later the arteries become occluded. There is, in fact, a strangulation of the coil, and the gut soon becomes gangrenous. This strangulation of the coil of gut adds greatly to the immediate danger, for the obstruction is complete and, unless the condition is soon relieved, perforation of the
bowel will occur and cause a fatal general peritonitis. This condition is commonly brought about by bands, by external or internal hernia, or by volvulus. The onset of symptoms is usually sudden, accompanied by great pain and early vomiting. Because intense symptoms usually begin early and bring the patient to the hospital soon, distention is often absent until late in the course of the illness. Collapse and severe shock are late manifestations. If the case is untreated within a short period, local peritonitis will tend to become general, and by the time the case comes to the surgeon, there may therefore be definite abdominal rigidity over the affected part of the abdomen. A mass consisting of the closed loop is sometimes felt.

The extent or completeness of the obstruction. The symptoms of obstruction vary greatly with the degree of occlusion of the lumen of the gut. When the obstruction is partial or if the muscular contractions can to any extent force the contents past the obstructed part, the symptoms are less severe.

Partial obstruction usually comes to medical attention when a chronically narrowed area of intestine that may otherwise be completely asymptomatic becomes somewhat occluded, usually by intraluminal content (e.g., food particles or stool). Spontaneous resolution is exceedingly common, but the process may be repeated days, weeks, or months later. The obstructive lesion may be kinking of the gut due to adhesions, a benign stricture as with Crohn’s disease or radiation, or a malignant stenosis. It has been shown that a narrowing of the small intestine to as little as 1.5 cm in diameter is usually without symptoms.

In partial obstruction the symptoms are similar to those described for complete obstruction, but the pains are less severe and the vomiting less prominent. One of the most misleading features of partial obstruction is that profuse watery diarrhea is very common. Yet paradoxically, the passage of gas is almost always absent. Because the obstruction is partial and often relents rather quickly and spontaneously, plain X-rays may not be diagnostic. Occasionally it is necessary to arrange for a barium study of the small intestine as soon as an attack begins.

A Richter’s hernia of the cecum (of which one instance has occurred in the author’s practice) may be unaccompanied by any obstruction of the bowel, and the herniated part of the gut wall may become gangrenous without giving rise to any acute symptoms.

When omentum only is strangulated, symptoms consist mainly of pain and vomiting, but the vomiting never becomes feculent. Obstructive symptoms, if any, are minimal. The systemic symptoms in omental strangulation are usually slight, but if a large mass becomes gangrenous (e.g., an umbilical hernia), fever and signs of inflammation may result.

Diagnosis

DIAGNOSIS OF OBSTRUCTION OF THE SMALL INTESTINE

When a patient is seized with acute abdominal pain, becomes weak—with a feeble pulse, cold extremities, an anxious look, and sweating skin—and soon begins to vomit first the stomach contents, then bile, then yellowish material that becomes brownish and feculent-smelling while the abdomen initially is flaccid, flat, and not tender, that patient is suffering from acute obstruction of the small intestine. The diagnosis should be made without waiting for distention to appear, nor—if the above symptoms are present—is there any need to demonstrate constipation. If the symptoms are not so acute there will be additional signs, for there is an inverse relation between the acuteness of the symptoms and the probability of the presence of signs. The higher up in the gut the obstruction, the more frequent the pains. Attacks of pain come on every three to five minutes in the upper ileum and every six to ten minutes in the lower ileum. When pain, vomiting, and shock are slight, distention and visible peristalsis are more likely to be seen, and constipation is usually present.

DIFFERENTIAL DIAGNOSIS OF ACUTE OBSTRUCTION OF THE SMALL INTESTINE

Diagnosis must be considered either before distention has developed or after that sign has appeared. Always remember that almost half the cases of acute obstruction are due to strangulated hernias; therefore al-
ways examine first all the hernial orifices, particularly both femoral rings.

*Distention absent.* When no distention is present, acute obstruction has to be distinguished from all the other acute abdominal catastrophes. The pain is often characteristic in type, occurring in bouts of acute intensity during which the severity is indicated by the patient's drawn features; it is usually central in position except in those cases in which a coil is strangulated, when the pain may be referred to the site of strangulation. Sometimes borborygmi may be heard passing along the bowel. The stethoscope should be applied to the abdomen and auscultation carefully carried out during the time that corresponds to a bout of pain. During the intervals between the bouts, the patient's face shows apprehension of the return of the pain. From the acute inflammation—perforated gastric ulcer, pancreatitis, appendicitis with peritonitis, cholecystitis—it is distinguished by the absence of rigidity and by the more frequent vomiting, which tends to become feculent. Renal and biliary colic are distinguished by the location and radiation of the pain and the absence of feculent vomit. Neither stoppage of the bowel contents nor distention follows the other colics. In torsion of a viscus (ovarian cyst, testicle), the vomiting does not become feculent. Gastric crisis is excluded by finding no other sign of tubers. It is usually sufficient to test the knee jerks and the pupillary reactions.

In many cases in which the diagnosis of obstruction of the small intestine is in question, great help may be obtained from a study of a plain X-ray of the abdomen. Normally little or no gas or fluid can be seen in the regions of the abdomen occupied by small gut. When there is obstruction, however, the contents are dammed back, and a plain radiograph will often show small collections of gas, each lying on top of a minute pool of liquid whose fluid level is characteristic. This aid is particularly helpful in the early stages of obstruction of the upper jejunum, when no clinical distention may be observed. Two X-ray examinations should be made, one with the patient in the vertical position and the other with the patient lying in the horizontal position (Plates 9A, B, 10A, B). These simple studies are cheaper, easier on the patient, and, in

*Differential Diagnosis of Acute Obstruction*

my opinion, just as likely to provide a diagnosis as the currently ubiquitous CT scan. If there is still a question during the attack, a contrast study with barium by mouth can often establish the diagnosis.

*Volvulus of the stomach.* In considering the diagnosis of obstruction in the upper part of the small gut, one must exclude volvulus of the stomach, a rare but well-recognized condition.

Acute volvulus of the stomach occurs chiefly in older people. It gives rise to violent and repeated vomiting, followed (after the stomach is empty) by continuous retching. The vomit contains no bile. Pain is steady and located high in the epigastrium or behind the lower sternum. For that reason and because of the patient's age, it is often thought to arise from angina or myocardial infarction. The epigastrium becomes distended, but the lower abdomen remains empty and retracted. A stomach tube usually cannot be passed into the stomach. Symptoms of collapse may ensue if gangrene of the stomach develops. However, symptoms may be periodic, lasting several hours, only to reappear days later, often after an especially large meal. Gastric volvulus is commonly associated with large paraesophageal hiatal diaphragmatic hernias.

*Distention present.* When distention is present, one must consider uremia, mesenteric thrombosis or embolism, or the late stage of peritonitis due to any cause.

*Uremia* should be diagnosed by careful consideration of the history, by examination of the urine for albumin and the blood for urea nitrogen, and maybe by detecting enlargement of the kidneys. Sometimes, in uremic patients, there may be a mere trace of albumin in the urine, but a low specific gravity would make one suspicious, and examination of the heart and determination of the blood pressure might throw light on the case.

*Acute blockage of the mesenteric arteries or veins* by an embolus or thrombus may lead to symptoms indistinguishable from those due to internal strangulation. In both cases the vascular disturbance leads rapidly to serious changes in the bowel. Sometimes a palpable mass is formed by the affected coil or gut. A history of recent endocarditis or the pres-
ence of auricular fibrillation might point to a possible embolism, while hepatic disease, the existence of thromboangitis obliterans, or previous thrombotic trouble may sometimes suggest the possibility of mesenteric thrombosis. Though there is no mechanical obstruction in the intestines in a case of vascular occlusion, the affected gut soon becomes paralyzed and hemorrhagic, and the blood that is almost always poured into the bowel lumen as a consequence of the infarction sometimes passes into the gut farther on (see also Chap. 16).

Unless promptly dealt with, mesenteric thrombosis is soon followed by peritonitis.

DIAGNOSIS OF STRANGULATION

When the diagnosis of acute obstruction of the small bowel has been made with reasonable certainty, the next question to answer is whether there is strangulation of the gut, for nonoperative treatment by passing an intestinal tube and applying suction is not applicable in such instances. A strangulated coil usually soon becomes tender on pressure and, if near a sensitive part of the parietal peritoneum, may later lead to overlying muscular rigidity. When, however, the affected coil lies in the pelvis, these features are less in evidence and this differential diagnosis cannot be relied on. It is a truism that so long as a mechanical small bowel obstruction is complete, the presence or absence of strangulation cannot be excluded with certainty until the abdomen is opened. Fever, leukocytosis, tenderness, rigidity, shock, and loss of peristaltic sounds are all late findings and, when present, usually indicate that delay has been excessive. Although X-rays may show a single distended coil in the shape of a coffee bean, distention is usually so late that the plain X-rays are interpreted as normal in about half of all cases of strangulation.

It may be impossible to distinguish between a late case of intestinal obstruction and late peritonitis unless the history gives some indication. In late peritonitis, there is usually paralytic intestinal obstruction, while in the late stages of mechanical obstruction, there is frequently peritonitis. In peritonitis, however, the vomit is seldom so definitely feculent as in late mechanical obstruction of the middle or lower small intestine.

OBSTRUCTION OF THE SMALL INTESTINE BY A GALLSTONE

A gallstone that causes obstruction generally ulcerates into the duodenum, causing the symptoms of very acute obstruction—that is, severe pain and frequent vomiting. The vomit may contain blood from the ulcerated opening, and this may lead to an erroneous diagnosis of peptic ulcer. The stone passes on gradually and the symptoms abate considerably, but in a day or two the stone stops again at the lower end of the ileum (which is the narrowest part of the small intestine) and the symptoms recur. Therefore, if one is faced with a case involving symptoms of obstruction of the upper small gut in which these symptoms subside but are followed in a day or two by others suggestive of obstruction of the lower small gut, the cause is likely to be a gallstone (Fig. 25). This is the more likely if there has been a history suggestive of gallstones or if the patient is an obese woman of middle or advanced age. What little distention develops may be concealed by a fat-abdominal wall, so that the abdomen may actually appear normal. The character of the vomit

![Diagram of gallstone obstruction of the small intestine.](image-url)
remains feculent, though there may be longer intervals between the bouts of pain and vomiting. Considerable distention may develop toward the end of the case.

The above characteristics make gallstone obstruction of the small intestine easier to diagnose than would be considered likely from the rarity of the conditions. Some of these large gallstones contain material opaque to X-rays, and a plain X-ray of the abdomen will then show the stone in the intestine. If the radiograph should give evidence of air in the biliary passages (Plate 9A), the observer would be justified in considering gallstone ileus as the probable cause of the symptoms. In one patient under my care, the radiograph also showed other large stones in the gallbladder, which in due course were passed along the intestine and evacuated per anum.

**BOLUSES OF INDIGESTIBLE FOOD**

Sometimes the small intestine may be obstructed by a mass of indigestible food—for example, orange pith, dried fruits, cherrystones, or (in America) persimmon, which causes pain, vomiting, and increasing distention—but as a rule the constitutional symptoms in these cases are not so severe. This complication is particularly likely to occur after distal gastrectomy, when the grinding function of the stomach is lost, and especially in edentulous patients. Even in individuals with an intact stomach, boluses of food may cause obstruction of the small intestine when a narrowed area is present, such as that caused by Crohn’s disease of the ileum. I have been impressed by how frequently this is the obstructing mechanism in patients with Crohn’s disease. It is usually but not always relieved by nonoperative treatment.

**INTESTINAL PSEUDO-OBSTRACTION**

Recently, a new syndrome has been recognized consisting of recurrent attacks of what appears to be partial obstruction of the small intestine. Initially, there is no history of previous abdominal operation, and no groin or other hernia is demonstrable. Often other members of the patient’s family have been victims of the same type of attack. Gastroesophageal reflux is common in these patients. The syndrome is caused either by defects of the circular musculature of the intestine or by abnormalities in autonomic innervation. Occasionally, it is a manifestation of progressive systemic sclerosis, in which case Raynaud’s phenomenon is often an associated condition. Jejunal diverticula are likely to be found in those cases attributable to defects in the circular muscle. Because of the picture of obstruction of the small intestine, many of these patients are subjected to multiple operations before the correct diagnosis is established. At operation, the usual finding is only that of dilated intestine without a definable point of obstruction. Recognition of the true state of affairs is vital lest long segments of intestine, perhaps harboring uninflamed jejunal diverticula, be resected, leaving the patient as an intestinal cripple—a circumstance once encountered by the writer.

The diagnosis can be established in many instances without operation so long as it is weighed by the physician. *Intestinal pseudo-obstruction should be considered in any patient who has repeated episodes of partial intestinal obstruction, especially in the absence of hernias or a history of previous operations*. In such a patient, a weak lower esophageal sphincter and disordered motility of the jejunum and/or colon by manometric examination will provide the correct diagnosis, especially if a family history is present.

Operation should generally be avoided in these patients except under very special circumstances in which manometric studies have shown that benefit can be achieved by bypass of specific areas of severe involvement.

**ACUTE OBSTRUCTION OF THE LARGE INTESTINE**

Obstruction of the large bowel seldom gives rise to such acute symptoms as those met with in acute obstruction of the small bowel. In the normal person, the contents of the colon move on much more slowly and are retained much longer than those of the small intestine. The acute symptoms in the large bowel are often preceded by milder attacks
of subacute obstruction. The main causes of large bowel obstruction are cancer of the colon (70 percent), diverticulitis (5 percent), and volvulus (10 percent). Fecal impaction in the rectum may also sometimes cause some obstruction with abdominal distention.

Cancer of the colon

If strangulated hernia and adhesive obstruction are excluded, cancer of the large bowel is the commonest cause of intestinal obstruction in persons over middle age. The symptoms are often insidious, and though in most cases an acute attack of obstruction may be the direct cause for the calling in of the surgeon, there are many earlier warning signs and symptoms that should put the observer on guard and cause a thorough examination to be made.

SYMPTOMS OF CANCER OF THE COLON
PRIOR TO ACUTE OBSTRUCTION

Diarrhea and the passage of blood and mucus may result from ulceration of the bowel. The occurrence of diarrhea may lead patients to assert that the bowels are regular, whereas the looseness is but secondary to the irritation caused by the constipated feces. Due to the presence of mucus, the condition may wrongly be diagnosed as mucous colitis.

The presence of a palpable abdominal mass, which in the early stages may be freely mobile, is uncommon, since the majority of the cases are of the contracting scirrhit type with no palpable tumor (Fig. 26).

The growth may adhere to the bladder or the pelvis of the kidney and cause symptoms referable to the urinary organs, or it may cause gastric symptoms owing to adhesion to the stomach.

Pericolicitis, or inflammation of the tissues around the colon, may be the first symptom of note. A local abscess may form and mask the primary condition. Sometimes perforation of the bowel into the general peritoneal cavity suddenly takes place, and diffuse and generally fatal peritonitis ensues.

SYMPTOMS OF CANCER OF THE COLON
SUBACUTE OBSTRUCTION

These are the same symptoms as those caused by acute obstruction, but they are all of slighter degree. Gradually increasing constipation is often the first abnormality, and if this supervenes in a person over middle age who has previously been perfectly regular as to the bowels, suspicion should be aroused and a thorough investigation carried out. Diarrhea sometimes alternates with the constipation. Occasional attacks of distention and flatulence are common. Peristalsis may sometimes be seen through the abdominal wall, and local swelling may subside with a gurgling sound due to passage of flatus through the stricture. Pain is cramp-like and due to the peristalsis. Sometimes the patient will describe the pain as traveling across the abdomen and increasing in intensity up to the site where the gurgling occurs and where the obstruction is situated. The pain is often mistaken for indigestion, and the accompanying nausea or sickness is attributed to a bil-
ious attack. This is especially true in obstructions of the right side of the colon.

SYMPTOMS OF ACUTE OBSTRUCTION

Acute obstruction is sometimes, though seldom, the first significant symptom that compels attention. The acute symptoms are, as a rule, precipitated by a hard bolus of food stopping up the lumen, which has been gradually narrowing for a long time. Plum stones or similar hard objects may suffice to complete the obstruction. The contents of the left side of the colon are more firm, and the obstruction is more common in that part. The main symptoms are attacks of colicky pain, gradually increasing distention, and the failure to pass flatus or feces.

Since the contents of the cecum and the right half of the colon are more fluid, it is not so common for acute symptoms of obstruction to supervene from a growth in this part. If, however, the ascending colon does get obstructed by a scirrhoid growth, the final onset of acute obstruction may lead to a sudden distention of the cecum that, as long as the ileocecal valve remains intact, will form a painful, rounded, resonant, and probably tender swelling in the right iliac fossa and the hypogastrium.

When the obstruction is in the left side of the colon and the ileocecal valve functions well, it will be possible to locate the obstruction by noting where the distention suddenly ceases. This can be more clearly shown by a plain radiograph (Plate 9B).

When, however, the ileocecal valve loses its efficiency, the lower ileum soon becomes distended, and it may be very difficult to determine the exact point of obstruction, for the symptoms of small-gut obstruction are added to those of obstruction of the large bowel. Severe pain, frequent vomiting, and increasing distention present great difficulties, and even an X-ray may not unravel the problem. Whenever such a differentiation is considered, an emergency contrast enema or sigmoidoscopy is of the greatest diagnostic value and should always be done.

Distention, vomiting, pain, and constipation occurring in an elderly person without any evidence of peritonitis, are generally due to cancer of the large bowel, volvulus, diverticulitis, or, rarely, intussusception or uremia. Inasmuch as cancer of the rectum may at a late stage lead to complete and acute obstruction, it is always necessary to make a careful rectal examination. The urine must be examined to exclude renal disease.

Diverticulitis of the colon

When diverticulitis causes obstruction of the colon, it produces symptoms indistinguishable from those of cancer of the bowel. Chronic inflammation may cause subacute and eventually acute obstruction of the colon. The symptoms will first be troublesome constipation, perhaps alternating with attacks of diarrhea, local pain and flatulence. A barium enema may reveal a condition of diverticulosis as well as a long tubular stricture.

Minor degrees of obstruction may be relieved by medical means, but when acute obstruction supervenes with great abdominal distention, the need for a surgeon will become imperative. Unless it is known that the patient has been for some time suffering from diverticulitis, it may be impossible to make certain whether the obstruction of the colon is due to cancer or diverticulitis before the abdomen is opened. Even after the abdomen has been opened and the local lesion examined, there may be great difficulty in determining whether it is cancer, diverticulitis, or a combination of the two conditions.

A common, but generally unrecognized, cause of obstruction of the small intestine is an adhesion of the small bowel to an area of inflammation around an inflamed diverticulum of the colon or to a peridiverticular abscess.

Volvulus

A volvulus is caused by the twisting of a coil of gut on its own axis to such an extent that the lumen of the bowel is occluded. If the twist is se-
vere enough, the veins and then the arteries may also be compressed, resulting in gangrene of the affected loop.

Volvulus of the large intestine occurs usually in one of two places—the sigmoid and cecal regions. The sigmoid is by far the more common location, owing to the fact that the sigmoid mesocolon is long and the base of attachment narrow, so that twisting of the loop more readily occurs. Ileocecal volvulus is more rare.

**VOLVULUS OF THE SIGMOID COLON**

Sigmoid volvulus causes symptoms of acute or subacute intestinal obstruction of the large bowel type. There is usually a preliminary period during which attacks of abdominal pain and constipation may occur.

The *acute attack* is signaled by absolute constipation, acute abdominal pain, and *rapid distention of the abdomen*. If the vessels of the loop are completely occluded, gangrene of the loop quickly develops and peritonitis ensues rapidly, but gangrene of the colon is usually late because occlusion of the vessels tends to occur slowly. Fortunately, gangrene of the sigmoid has become less common in recent years.

Subacute volvulus is distinguished by abdominal pain (chiefly referred to the umbilical and hypogastric zones), constipation, and gradually increasing distention. The distended sigmoid coil may *sometimes* stand out in the lower abdomen like the segment of a large pneumatic tire, but later the whole abdomen will become generally distended.

The condition should be suspected when early and great distention supervenes and is the prominent feature in a case of acute obstruction. Localization of the distention to the hypogastrium at the outset, or the standing out of *one large coil*, may point clearly to a sigmoid volvulus. The pain of sigmoid volvulus is usually hypogastric and not severe; I have known a twisted sigmoid in a young woman to cause pain in the lower lumbar region posteriorly that was thought to be due to acute dysmenorrhea. Considerable help can be gained from examination of a plain X-ray of the abdomen when the one distended coil may be plainly visible (Plate 11A). Barium enema should be considered in all suspected cases. Not only is it diagnostic by demonstrating the so-called

**OBSTRUCTION OF THE LARGE GUT**

bird beak at the apex of the twist, but it is often therapeutic in untwisting a nongangrenous loop (Plate 11B). An alternative therapeutic and diagnostic maneuver is a sigmoidoscopy, regarded by many surgeons as the first and best test.

**ILEOCECAL OR CECAL VOLVULUS**

This gives rise to symptoms similar to but more acute than those described under obstruction of the lower end of the small gut, but in addition there will be localized distention due to the dilated cecum, observable either in the epigastrium or the right side of the abdomen. Pain is very severe and vomiting is a prominent symptom. Later, the general distention masks the local cecal dilatation. X-rays may show a characteristic picture, with the twisted loop oriented toward the left hypochondrium (Plate 12A, B).

**VOLVULUS OF THE TRANSVERSE COLON**

This is seldom seen except after major abdominal operations in which the intestines had to be displaced and the colon may have been twisted in replacement. I have known it to occur after abdominoperineal excision of the rectum and after hysterectomy. Some days after the operation, the abdomen becomes greatly distended and the bowels are not opened, yet there is no sign of peritonitis or of paralysis of the intestines. Reopening of the abdomen is necessary to correct the volvulus.

Surgeons in certain parts of the tropics need to remember that volvulus, of both the large and the small bowel, is relatively much more common there than in temperate climes.

**Differential diagnosis of obstruction of the large gut**

In every case it is necessary first to examine all the hernial apertures. There are four conditions that may deceive the observer and lead to the erroneous belief that primary obstruction of the large bowel is present.
These four conditions are:

1. Colitis with distention
2. Uremia
3. Peritonitis
4. Reflex paralysis of the colon

**COLITIS WITH ATOMIC DISTENTION OF THE INFLAMED BOWEL**

There are cases of severe ulcerative colitis and Crohn's colitis in which, either as a direct result of the ulceration or as a consequence of the toxemia, the large bowel becomes enormously distended and atonic, so that organic obstruction is diagnosed. Toxic dilatation of the colon has also been reported in patients with anemic dysentery, *Clostridium difficile* colitis, and salmonellosis. If the patient is seen at a late stage for the first time, it may be impossible to distinguish between toxic megacolon and obstruction, but the long history of symptoms pointing to ulceration of the colon (diarrhea, with passage of blood and mucus) in the one case and the usual preceding history of subacute obstruction in the other may help determine the condition. In toxic dilatation of the colon, the distention is usually most marked in the transverse colon (Plate 13A). In ulcerative colitis, the obstruction is never complete. Rotation of the position of the patient at frequent intervals may allow some passage of flatus and decompression of the colon.

**UREMIA**

Severe abdominal distention and vomiting are sometimes seen in uremia, and unless a practice is made of examining the urine and blood in every case of supposed intestinal obstruction in middle-aged or older persons, serious mistakes will be made. The estimation of the blood pressure and percussion of the cardiac dullness may throw light on doubtful cases. Symptoms indistinguishable from those of intestinal obstruction may occur.

**PERITONITIS**

There are some forms of peritonitis that are accompanied by only the slightest rigidity of the abdominal wall, and there are some abdominal walls in obese, flabby subjects that are almost incapable of becoming rigid on account of the weak, fat-infiltrated muscles. In such patients the distention and vomiting of peritonitis may be mistaken for mechanical obstruction. The late stages of peritonitis are accompanied by a paralytic obstruction of the bowels, and the later stages of intestinal obstruction are sometimes accompanied by peritonitis due to organisms escaping through patches of local gangrene or ill-nourished areas of the gut.

In the early stage of both conditions, the diagnosis is usually clear on considering the history and symptoms, but in the later stages it may be impossible to differentiate them.

**REFLEX PARALYSIS OF THE COLON (COLONIC ILEUS)**

There is a deceptive form of paralytic distention of the colon that I have, on several occasions, known to simulate obstruction of the large bowel. It appears to be a reflex result of an acute inflammation somewhere in the abdomen, and in three cases that I can recall, it was a secondary effect of acute cholecystitis and masked the primary condition. It may develop spontaneously or, more often, after some retroperitoneal operations. The ascending transverse and descending colons may be distended, and it may be difficult to get the bowels to act. These symptoms, with the pain and vomiting, are sufficient to divert attention from the true cause unless special care is taken.

A barium enema or colonoscopy will always distinguish this condition and the other nonobstructive colonic dilatations from true mechanical occlusion. A colonoscopy can also be both diagnostic and therapeutic. This examination should be omitted in cases of colitis with distention, where perforation is easily possible.
Paralytic obstruction of the intestines (adynamic ileus)

So far we have been dealing with mechanical obstruction of the gut. There is another form of obstruction of the bowel that gives rise to distention and vomiting in which no mechanical obstruction is present and the condition is due to a paralysis of the musculature of the bowel. This condition may occur as a terminal phase in general peritonitis or may ensue after severe chest injuries, after myocardial infarction or during pneumonia, or after operations on the spine or abdomen. Today, paralytic ileus is encountered in addicts overdosed with narcotics and sometimes in patients with terminal malignancy given large doses of pain-alleviating drugs. The abdomen becomes distended but on auscultation borborygmi are not usually heard. The whole abdomen tends to be silent but regurgitation of gastric contents takes place, more in the nature of an overflow than due to active movements of the intestine. Both the small and large intestines are involved in the process, so that on an X-ray, gaseous distention involving both will be seen. Apart from keeping the stomach empty (by tube and suction) and maintaining the body fluids and electrolytes, this condition does not call for operation. When, however, the patient is first seen by the surgeon in this condition, it is not always easy to be sure whether the final paralytic state of the bowel may not have been a terminal state following mechanical obstruction. In such cases, a careful history may permit a correct judgment to be made.
Appendicitis. Plain film of the abdomen shows a fecolith (appendicolith) in the right lower quadrant and distention of the small intestine. Perforated appendicitis and peritonitis were found at surgery.

Comment: The diagnosis of appendicitis is clinical. Occasionally, the presentation may be confusing. Plain films are seldom helpful, and the use of barium enema is controversial for fear of perforation. Ultrasonography and CT scanning are increasingly used when the symptoms are unclear.

A
Appendicitis. Ultrasonography shows the appendix (arrow) over the psoas muscle (p). There was no change in shape when graded compression was applied.

Comment: When an appendix can be visualized ultrasonographically and its shape not changed by compression, appendicitis is highly likely. In addition, presence of fluid suggests rupture and perappendiceal abscess. Although a normal appendix is not seen on ultrasound, nonvisualization does not exclude appendicitis. In young women with nonspecific lower abdominal signs, ultrasonography, using both abdominal and transvaginal modes, may help distinguish appendicitis from other gynecological abnormalities.
B
This CT scan shows a thick-walled appendix (arrow) with a periappendicular fluid collection. "Dirty fat" surrounds the collection and extends toward the mesentery; it indicates an inflammatory reaction.
Comment: In contrast to ultrasonography, CT is not affected by variations in the position of the appendix or by superimposed gas.

A
Acute diverticulitis. Barium enema shows pericolonic abscess and fistulous tract arising from sigmoid diverticulitis.

B
CT scan shows thickened wall of the sigmoid colon (S). There are multiple diverticula. Fluid and "dirty fat" extend in the sigmoid mesocolon (large arrow). Free air (small arrow) indicates intraperitoneal rupture, an uncommon finding except in diabetic patients.
Comment: Intramural or pelvic abscesses may be misinterpreted as bowel loops. Many consider CT to be the diagnostic procedure of choice in patients suspected of having acute diverticulitis.
A
Perforation of peptic ulcer, in a case of perforated peptic ulcer, upright film shows small amount of free air between the right diaphragm and the liver and under the left diaphragm.

Comment: Suspected free air is a most common indication for obtaining abdominal X-rays. Technically, free air is best seen on upright chest films. If the patient cannot stand, a lateral decubitus film with the left side down ("left decubitus") would bring the air over the liver.

B
This CT scan shows free oral contrast (c) and contrast fluid level in the peritoneal cavity. There is only a small amount of free air anteriorly (small arrow). Although the actual perforation is seen at the duodenal bulb (large arrow), this is an uncommon occurrence.

Comment: In the majority of cases, the clinical presentation of perforated ulcer is characteristic and free air is seen on upright films. However, free air may not be present in posterior perforations. Similarly, in debilitated patients, the symptoms may be nonspecific and small amounts of free air may be missed on plain radiographs, especially if the patient cannot stand or sit. Both CT and sonography are very accurate in showing free fluid. Only a few milliliters of free air can be detected by CT.
A
Subphrenic abscess. The CT scan shows air and fluid collections in the left subphrenic space (arrows). Sympathetic pleural effusion is also present.

Comment: Computed tomography is accurate in searching for intra-abdominal abscess, especially in the postoperative patient. In the latter condition, the mere presence of fluid or air (loculated or free) does not necessarily imply the presence of an abscess.

B
Acute necrotizing pancreatitis. Computed tomography shows extensive fluid collections in the abdomen and retroperitoneum. There is an area of necrosis (n) in the body of the pancreas that does not enhance after intravenous contrast material. Compare with enhancement of the tail (t).

Comment: Although a normal CT scan does not exclude uncomplicated acute pancreatitis, it can provide significant information on the extent and severity of disease. Abnormalities seen on CT usually lag behind clinical recovery.
A Cholelithiosis and cholecystitis. Longitudinal sonogram shows calculi within the gallbladder and acoustic “shadowing” beyond the stones.

Comment: In this condition, there may be considerable variability of the imaging findings. Presence of gallstones and thickened gallbladder wall are nonspecific findings. Even pericholecystic fluid or gas in the gallbladder should be evaluated in conjunction with the clinical picture.

B Ultrasonography shows a slightly distended gallbladder with thick wall. The viscus is filled with midlevel echoes, indicating debris or sludge. High-level echoes with distal acoustic shadowing (arrow) indicate gallstones.

Comment: We have seen similar images in patients with chronic cholecystitis. Conversely, patients with acute cholecystitis may have normal sonograms or studies showing only gallstones.
A
Normal scintigram. Normal biliary scintigraphy (HIDA scan) in a patient with upper abdominal pain excludes acute cholecystitis. There is filling of the gallbladder (arrow) and excretion of radioisotope (Technetium 99m) into the bowel. This excludes cystic duct occlusion.

Comment: Nonfilling of the gallbladder does not always predict acute cholecystitis. Delayed scanning at six hours or injection with morphine (which produces spasm of the ampulla of Vater) or CCK (which empties the gallbladder) may enhance filling of the gallbladder, but such maneuvers may not be practical or may be contraindicated in patients with acute, severe symptoms.

B
Acute cholecystitis. Computed tomography shows gas in distended gallbladder (arrow), indicating infection with gas-producing organism.

Comment: Gas in the biliary tree and gallbladder may be also seen in patients with previous biliary surgery, including papillotomy and bile duct stents, or in patients with gallstone ileus.
PLATE 9

A
Obstruction of the bowel due to gallstone ileus. Plain film shows air in the biliary tree; occasionally, the actual stone is seen on the films.

B
Obstruction of the colon by carcinoma of the sigmoid. Massive distention of the large bowel from the cecum to the sigmoid, where the obstruction was situated. Dilatation of the small bowel is not seen because of a competent ileocecal valve.

PLATE 10

A
Ileal obstruction from inguinal hernia. Patient supine. Film shows marked distention of small bowel loops. There is small amount of air in the hepatic flexure, suggesting incomplete or early obstruction. There is no gas in the remainder of the colon or rectum (caution: rectal examination introduces gas in the rectum). Presence of a bowel loop in the inguinal canal (arrow) indicates a hernia, which may or may not be the cause of obstruction.

B
Patient erect. Film shows distended small bowel with multiple air-fluid levels in a step ladder-like pattern.
A

Volvulus of the sigmoid. Plain film shows markedly distended sigmoid colon in the left upper abdomen in an inverted-U pattern. There is no gas in the lower pelvis and rectum, while the proximal colon is distended.

B

Barium enema shows characteristic beak (arrow) at the site of sigmoid twist. Note the proximal colonic distention.

Comment: Barium enema may occasionally relieve the volvulus. If this is attempted, care should be taken not to exert excessive pressure for fear of perforation; the barium bag should not be higher than three feet from the tabletop.

A

Volvulus of the cecum. On the plain film, the distended cecum orients itself away from the right ilioc fossa.

B

Barium enema may help differentiate obstruction of the cecum without retrograde passage of the contrast (arrow) from nonobstructive distention.
**A**
Toxic dilatation of the colon. Plain radiograph shows dilatation of the transverse colon and mild small bowel dilatation in a patient with ulcerative colitis. There are numerous filling defects, "pseudopolyps" (arrow), representing intact mucosa amid deep ulcers. This may be difficult to distinguish from "thumbprinting" caused by submucosal hemorrhage or edema, usually seen in intestinal ischemia.

**B**
Ileocecal intussusception. Barium enema shows characteristic "spring coil" pattern. This is best appreciated on the postevacuation film.
Intestinal ischemia. This CT scan shows abnormal gas (arrows) in the wall of the intestine, pneumatosis intestinalis, and the mesentery. Clinical correlation is imperative because there are many benign causes of pneumatosis intestinalis.

B
Dynamic CT scan with intravenous contrast enhancement shows thrombus in superior mesenteric vein (arrow). The juxtaposed mesenteric artery is patent, opacified with contrast material.

Comment: Normal imaging findings are often nonspecific. Computed tomography permits direct visualization of the bowel wall, the mesentery, and the blood vessels, which usually can be evaluated only indirectly by plain films or barium examinations. Angiography may detect arterial occlusion, but nonocclusive ischemia remains a difficult diagnosis.
A
Ruptured aortic aneurysm. A CT scan without contrast shows a large aneurysm (a) and extensive hemorrhage (b) in the retroperitoneum, displacing the left kidney.

Comment: Ultrasonography is accurate to detect and monitor the size of an abdominal aneurysm. However, CT more accurately depicts rupture and extent of hematoma. The high density of the fluid indicates hemorrhage. CT scans of ruptured aneurysms are rare because the condition of the patient usually precludes this type of examination.

B
Tubo-ovarian abscess. Transabdominal ultrasonography shows an oblong, well-encapsulated fluid collection in the cul-de-sac, behind the uterus (U).

Comment: The appearance is nonspecific and, in the presence of acute symptoms, the differential diagnosis includes rupture of an ovarian cyst, ectopic pregnancy, or perforated appendicitis.
14. Intussusception and other causes of obstruction

Intussusception

Intussusception or invagination of the intestine is the most common abdominal emergency in children under two years. It constitutes 15 percent of all cases of intestinal obstruction. In most parts of the world it is much less common in later childhood and adult life, only 30 percent of cases occurring after the second year of life. (This does not hold good for some parts of Africa and India.) The catastrophe is all the more unexpected in that it usually attacks the most healthy-looking and well-nourished babies. The condition consists in the invagination of one portion of intestine into the portion next to it. Commonly, if not invariably, the invaginated part (intussusceptum) enters the part below (intussuscipiens). Clearly, the most anatomically favorable part for such an occurrence is in the ileocecal region, where the narrow ileum can readily enter the large cecum, and in actual clinical experience this is the most common place for the condition to start (Fig. 27). There are three varieties of intussusception—enteric, enterocolic, and colic. Enteric, where the small intestine alone is involved, is uncommon; colic, in which the colon alone is affected, is less rare but not very common; enterocolic is the most common variety. The enterocolic type is subdivided into ileocecal, in which the apex of the invaginated part is the ileocecal valve,
and ileocolic, in which a part of the gut near the end of the ileum forms the advancing apex.

In certain parts of the tropics—for example, central Africa and India—intussusception is more common in adults. It is usually of the ileocolic type, does not lead to complete obstruction, and may not cause any bleeding per rectum. Colicky pain and the presence of a tumor are the two main symptoms.

In the case of the most common form—the enterocolic—as the end of the ileum is invaginated into the colon, a portion of the mesentery goes with it, and constriction and later strangulation of the vessels occur, causing edema of the gut wall, with intestinal hemorrhage and finally gangrene. The irritation caused by the intruded gut leads to excessive secretion of mucus. The part of the gut that first becomes invaginated remains at the apex of the advancing portion, and it progresses at the expense of the ensheathing layer (intussusciptens). The apex is sometimes extruded at the anus. If left untreated, intussusception ends in one of two ways. Most commonly the intestinal lumen is gradually oc-

### SYMPTOMS AND SIGNS

The symptoms and signs of intussusception are usually characteristic. They comprise a few or many of the following, according to the stage at which the case is seen:

1. Abdominal pain
2. Passage of blood and mucus per anum
3. Vomiting
4. An abdominal swelling
5. Shock
6. Visible peristalsis
7. Absence of the cecum from the right iliac fossa
8. Constipation
9. Tenesmus
10. Distention of the abdomen
11. Fever (sometimes)
12. Obstruction and peritonitis (late stage)

**Abdominal pain.** The onset is usually with a fit of screaming—the infant's method of indicating pain. The legs are drawn up during the screaming attacks. The pain is very severe but is not continuous and
corresponds to the violent peristaltic contraction of the gut. Between the bouts of pain, the child may lie quietly but often has an apprehensive look. Less often, the child does not scream or show any sign of abdominal pain other than pallor and intermittent drawing up of the legs or restlessly rolling over on the bed.

**Blood and mucus.** At a period varying according to the site of the invagination—later if it starts in the ileum, earlier if in the transverse colon—blood and mucus are passed per anum. This usually occurs within a few hours. The blood is often quite slight in amount, and it is seldom copious. Slime mucus is mixed with the blood and, not infrequently, some brown or yellow fecal material may also be passed. Cases do occur, however, in which no blood is passed per anum before the child comes under observation, sometimes up to as long as twenty-four or forty-eight hours after onset of the pain. The practitioner must be prepared to diagnose intussusception before blood has been passed per anum.

**Vomiting.** This generally occurs, but it is not severe at first. It is never a serious feature until the late stages, when complete obstruction has ensued or peritonitis has developed. The contents of the stomach are returned, any liquid taken is not retained; later, there may be bilious vomit, but feculent vomit is rare.

**Abdominal tumor.** By the time blood appears at the anus, a tumor is present in the abdomen. It is caused by the invaginated gut and is felt either in the right loin, right hypochondrium, epigastrium, left hypochondrium, left lumbar region, or left iliac region, according to the advance made by the intussusception through the colon. The tumor is oval in shape and has often been compared—quite aptly—to a sausage. Sometimes the swelling becomes harder, the change corresponding to the muscular peristaltic contraction. Frequently it is easy to feel the swelling, but in many cases relaxation of the abdominal wall is insufficient to allow recognition of the mass. The hiding of the intussusception by the overhanging liver is responsible for many failures to detect the tumor.

**Symptoms and Signs**

**Shock.** The severity of the pain is shown by the extreme facial pallor, the dilated pupils, and the anxious appearance of the child. True circulatory shock is late, and the mortality is much higher when it occurs. The diagnosis should be established before it occurs.

**Visible peristalsis.** Peristalsis may sometimes be seen through the abdominal wall, and the simultaneous hardening of the tumor has been referred to above.

**Empty right iliac fossa.** In the common enterocolic variety, almost from the beginning of the illness the right iliac fossa will appear empty on palpation due to the taking up of the cecum into the advancing invagination (signe de Dance) (Fig. 28).

**Bowels.** Constipation is by no means always absolute. Exceptionally, an intussusception may be present and yet the bowels may open fairly nor-
INTUSSUSCEPTION

nally; not uncommonly, fecal material may be mingled with the blood and mucus that come away. As the condition advances, however, the obstruction increases and ultimately becomes absolute. One must therefore be prepared sometimes to diagnose intussusception in the absence of absolute constipation.

Tenesmus. As the intussusception approaches the rectum, tenesmus may be indicated by the constant straining efforts of the infant. At this stage the congested apex may sometimes be felt on rectal examination. In some cases the apex of the intussusception may protrude through the anus as a red, congested, fleshy mass.

Distention. In late or neglected cases, the increasing obstruction of the lumen of the gut results in abdominal distention and increased frequency of vomiting.

Obstruction and peritonitis. The final stage is that of complete intestinal obstruction and peritonitis due to gangrene of the devitalized gut and infection of the peritoneum. Repeated vomiting, signs of toxemia, and exhaustion end the scene.

In addition to the above symptoms, fever of up to 100°F or even higher may be present as early as the first twenty-four hours.

DIAGNOSIS

It is usually not difficult to diagnose an intussusception. The age of the child; the previous good health and sudden onset of acute pain coming on in bouts, which cause severe temporary shock; the passage of blood and mucus per anum; and the presence of a sausage-shaped swelling in the abdomen are sufficiently characteristic to admit of no doubt. The cases of real doubt are those in which, when the doctor sees the patient, the attacks of pain may be quiescent and no tumor can be felt. In such cases, if the history is at all suggestive or characteristic and blood and mucus have been passed, a barium enema should be done. By this means

DIFFERENTIAL DIAGNOSIS

the diagnosis can be definitely made, and at the same time the enema will help to reduce any intussusception that may be present (Plate 13B).

DIFFERENTIAL DIAGNOSIS

In the early stages the condition must be distinguished from:

1. Simple colic
2. Colitis and enterocolitis
3. Rectal polyps

In the later stages one must exclude:

1. Prolapsed anus and rectum
2. Other causes of obstruction and peritonitis
3. Henoch's purpura

Simple colic. With simple colic the evidence of pain is not so outstanding, nor is shock so extreme. No lump can be felt in the abdomen, and no blood is passed per anum. Pain usually ceases when the bowels are emptied.

Colitis and enterocolitis. These furnish the main difficulty in diagnosis in young infants, among whom acute enterocolitis is not uncommon. Colitis is sometimes accompanied by the passage of blood and mucus per rectum. The chief distinguishing features are as follows:

1. In colitis there is usually a stage of preliminary diarrhea unaccompanied by blood.
2. The infants who readily fall victims to colitis are frequently ill nourished. Intussusception usually attacks well-nourished, obese infants.
3. In colitis there are more frequent stools, as a rule containing more fecal material than in cases of intussusception.
4. In colitis there is no abdominal tumor to be felt.  
5. The cecum can be felt in the right iliac fossa, and possibly gurgling may be elicited by pressing on it, or borborygmi may be heard on auscultation. There is not the emptiness that is so noticeable on palpating the fossa in most cases of intussusception.  
6. The crises of pain are not usually so severe in colitis.  
7. In colitis there is sometimes tenderness along the whole course of the colon.

Obstructive symptoms and distention are not so common in colitis. Tenesmus may be present in both cases. There may be an epidemic of similar cases that may help in the diagnosis of colitis. As mentioned above, a radiograph after a barium enema will always settle the diagnosis. Two or three degrees of fever may be present in each condition, so this symptom cannot be used as a differentiating feature.

*Prolapsed anus and rectum.* Cases in which the apex of the invagination protrudes through the anus have to be distinguished from prolapse of the rectum. In the latter, a ring of prolapsed mucous membrane is seen around a central opening, and the finger can be inserted for only a short distance between the mucosa and the external sphincter; in a prolapsed intussusception, the opening of the protruding portion is toward the posterior aspect of the projection, and the finger can easily be inserted between the anterior or lateral portions of the projection and the anal sphincter. Any intussusception that has advanced to the anus will usually be accompanied by considerable distention and symptoms of intestinal obstruction.

*Obstruction and peritonitis.* The late stages of an intussusception in which the apex has not advanced as far as the rectum and that is accompanied by advanced symptoms of intestinal obstruction or peritonitis (i.e., distention, frequent vomiting, toxemia, and collapse) can only be diagnosed from the other causes of those symptoms by the history of onset and the previous course of the disease.

*Hench's purpura.* In children who have passed infancy and occasionally in infants, intussusception has to be distinguished from Hench's purpura, a disease characterized by abdominal pain, vomiting, and the passage of blood per anum and frequently accompanied by arthritis and an eruption of purpuric spots. The bleeding from the gut is due to an effusion of blood into the walls of the intestine. The youngest child in the series described by Hench was four years old, so the age incidence of the two diseases may be a help in diagnosis. In doubtful cases a very thorough search must be made for purpuric spots or joint affections. Very rarely have the two conditions been coexistent. Here again, a barium enema may clinch the diagnosis.

**SUBACUTE AND CHRONIC INTUSSUSCEPTION**

There are some cases of chronic intussusception that are accompanied by slight signs of intestinal obstruction but progress steadily with repeated attacks of pain, sometimes at considerable intervals, until a final serious attack of obstruction occurs. In these cases there may be normal or almost normal fecal motions until the final attack, and the observer is very likely to be misled by the chronicity or intermittence of the symptoms. I have known such a case taken for *tuberculous peritonitis* and *enteritis*. There were loose fecal motions and an epigastric swelling thought to be rolled-up omentum, but in reality an intussusception had occurred. In these subacute cases the help afforded by radiography is of the utmost value.

**INTUSSUSCEPTION OF THE PELVIC COLON IN OLD PEOPLE**

Intussusception is very rare in old people, but when it does occur, it generally affects the sigmoidorectal region. This leads to frequent hypogastric pains and tenesmus, while mucus and later blood are passed through a rather patulous anus. Rectal examination easily demonstrates the edematous apex of the intussusception, which is seldom more than a few inches long. A malignant growth or polyp may sometimes form the apex.
In parts of Africa and in India, intussusception is more common in adults than in infants.

Intestinal obstruction in newborn infants

Intestinal obstruction in infants and young children is always serious and usually dangerous.

Newborn babes may have complete obliteration of the lumen of some part of the small or large intestine, or they may present obstruction due to malrotation of the intestinal loop. The obstruction may be in the duodenum, jejunum, ileum, or large bowel. Sometimes there is not a complete obstruction but a narrowing or stenosis; in these cases the symptoms will be more gradual in onset.

If the obstruction is in the duodenum or upper ileum, the symptoms begin within forty-eight hours of birth with the onset of vomiting, which continues and becomes persistent. The vomit invariably contains bile. All the liquid food taken by mouth is quickly returned, and the stomach and upper duodenum become distended and cause fullness in the epigastrum. The lower abdomen is normal. There may be visible gastric peristalsis. The baby is apathetic, does not show any desire to take anything by mouth, and rapidly wastes away and becomes dehydrated. A straight X-ray will show much gas in the stomach and duodenum but not beyond. The clinical picture and the characteristic X-ray picture usually make the diagnosis fairly clear. When the so-called double bubble of the stomach and first part of the duodenum is seen, the obstructing mechanism is duodenal atresia, annular pancreas, or duodenal bands associated with malrotations.

When the obstruction is lower down in the intestine, in the ileum, the symptoms come on more slowly but quite definitely. The coils of intestine will gradually distend and may form a ladder pattern. The vomiting, which comes on several days after birth, will change from bilious to brownish and will have a feculent odor. An X-ray will show coils of distended small bowel but no gas in the colon. The obstructing mechanism is usually an atresia, although volvulus of the midgut and meconium ileus should be considered.

An imperforate anus is usually noted at birth, but if there is an occlusion of the colon higher up, several days may pass before serious symptoms occur. The gradually increasing abdominal distention, and perhaps the onset of vomiting, will cause alarm, and the absence of normal stools will certainly cause further investigation to be made.

In atresia of the jejunum, ileum, or large gut, stools of small amounts of desquamated epithelial cells may be passed that, though not normal, may divert attention from the serious abnormality.

MECONIUM ILEUS

Meconium ileus is a form of intestinal obstruction that, until comparatively recently, was almost invariably fatal; during the last twenty years, however, a method of treatment has been evolved that saves the lives of these patients.

Meconium ileus is a condition, usually associated with fibrocystic disease of the pancreas, in which the meconium in the lower part of the intestine becomes inspissated to such an extent that the lumen of the bowel is completely occluded. The meconium is thick and sticky and cannot easily be shifted along the bowel. Commonly it is found plugging the last 10, 20, or even 30 cm of ileum, which is considerably dilated and greatly thickened. Vomiting starts a day or two after birth, and there is moderate distention. The stools may not give much definite information, but a straight X-ray will show the coils of intestine varying greatly in size, usually without air-fluid levels. Insipissated meconium sometimes has a granular appearance (on a radiograph) that is never seen in other forms of obstruction. In uncomplicated cases, a Gastrografin enema will usually make the diagnosis and clear the obstruction without resort to open operation. In any neonatal patient with obstruction of the small intestine, a contrast enema usually demonstrates a so-called microcolon. This should not be misinterpreted as an anatomical narrowing. Rather, it represents a functional collapse of the colon that is easily reversed either by use alone or by gently distending enemas if deemed
necessary. Treatment of the pancreatic deficiency has to be continued afterward.

**HYPERTROPHIC PYLORIC STENOSIS**

This condition usually arises in the second month of life. The symptoms begin about the sixth week after birth with vomiting that gradually becomes persistent. The vomit does not, as a rule, contain any bile. Gastric peristalsis may be seen, and usually a small tumor, the so-called olive or olive pit, can be felt in the upper abdomen, lying under the liver in the right hypochondrium or epigastrium. The symptoms are usually sufficiently characteristic to make diagnosis straightforward. An ultrasonic examination may be needed to confirm the presence of the olive.

**INTESTINAL OBSTRUCTION DUE TO MALROTATION OF THE MIDGUT**

At an early period of normal embryonic development, as the midgut returns to the abdominal cavity from the umbilicus, there occurs a counterclockwise rotation of the midgut so that the cecum and the part of the colon that forms the hepatic flexure take their normal position on the right-hand side of the abdomen.

Occasionally this rotation does not occur, and in some infants attacks of intestinal obstruction may follow. It has, however, been shown comparatively recently that this anomaly may be present and may cause symptoms in adults.

In neonatal life, malrotation produces intestinal obstruction either because of bands that extend from the incompletely rotated cecum to the posterior abdominal wall, thus binding and occluding the duodenum, or because of volvulus of the midgut. The latter occurs because there is no fixation of the mesentery of the small intestine, thus allowing several rotations about the axis of the superior mesenteric vessels and consequent gangrene.

The abnormal symptoms presented in adult life are those of acute or subacute obstruction of the intestine, because they usually arise as a result of volvulus of the midgut rather than because of the duodenal bands. The attacks may occur from early life up to as late as the sixth decade, and the interval between the recurrent bouts of obstruction varies from a few weeks to several months. As a rule the attacks are self-limited and last from one to three days. The symptoms are fairly definite. Each attack begins with central abdominal pain accompanied by vomiting and ending with diarrhea, indicating that the obstruction has righted itself. Between the attacks there may be no abnormal physical signs or symptoms, but a history of such attacks should lead the observer to consult a radiologist with a view to a special X-ray examination to detect malrotation of the midgut.