



## Perforations of the Extrapertoneal Rectum during Barium Enema

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**Rectal injuries during barium enema are uncommon but not unusual complications. Radiologists and surgeons must be able to recognize them, as early diagnosis is essential for effective treatment. The Authors discuss various aspects of problems arising from rectal perforation, and report their experience on seven cases.**

**KEY WORDS:** Barium enema examination - Perforation of colon - Perforation of rectum.

**R**ectal injuries during barium enema are uncommon but not unusual complications. Radiologists and surgeons must be able to recognize them, as early diagnosis is essential for effective treatment. Although most Authors<sup>1-10</sup> state that this complication occurs in about 1% of cases, data from the literature are not complete, since not all cases of perforation are reported.

### Pathological anatomy and physiopathology

Rectal perforations may be either complete or incomplete. The complete type, involving all the tunics of the intestinal wall, cause the intestinal contents (barium and feces) to enter the perirectum or free peritoneum. The incomplete type may involve lesions of the tunica mucosa only, almost always due to direct trauma by the probe. Barium may thus infiltrate the rectal wall, causing granuloma (barytoma, which may simulate a tumor) or intramural abscess.<sup>5</sup> Instead, when only the muscular tunic is broken, nearly always due to over-distension, perforation may be biphasic, with extravasation of barium when increased intraluminal pressure ruptures the tunica mucosa during defecation. Although barium alone has little pathogenic action, it adheres closely to tissues it touches. After about two hours it is practically impossible to remove it from the peritoneum, and it adheres even more strongly to perirectal cell tissue. In a few days it causes inflammation, with granulomatous reactions, sometimes developing into sclerosis and fibrosis. The seriousness of rectal perforation is mainly due to the presence of bacteria in feces: barium favors germ growth and infections may thus be revealed as local suppurations or generalized sepsis.

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### Pathogenesis

Rectal perforation during barium enema is linked to two pathogenetic factors: pathological conditions weakening the rectal wall, and poor technical execution of the examination. If the radiologist thrusts a stiff probe too high in the wrong direction, forgetting that the anal canal and rectal ampulla form a right angle opening backwards, s/he may cause direct laceration of the anterior rectal wall (Fig. 1). Balloon probes, used in cases of incontinence, are particularly dangerous: excessive inflation may break the visceral wall, especially if the probe is pushed high up where the rectum is less elastic. If the balloon is over-inflated with compressed air, it may explode, seriously damaging the mucosa. Lastly, if the tip of the probe is inadvertently folded over during insertion, it may suddenly straighten during even gentle inflation, with traumatic results. Too rapid and over-pressurized inflation of the barium enema, particularly if there is some obstacle higher up (stenosis, spasm, defecatory effort), may also perforate the rectal wall due to over-distension. Most prone to these complications are patients with rectal pathologies and reduced resistance (ulcerative colitis, effects of radiotherapy, intestinal parasites such as amoeba or bilharzia, fistulas, fissures, tumors, or ischemic colitis). Tissue fragility in geriatric patients is demonstrated by the fact that the average age of cases reported in the literature is 75. Endoscopy performed a few days before barium enema, especially if accompanied by biopsy or polypectomy, may weaken the rectal wall. Incontinent patients are also at risk, mainly due to the frequent use of balloon probes in their case.

### Diagnosis

Early diagnosis of rectal perforation, possibly by the radiologist, is essential. It may also be suspected by clinical signs and symptoms.



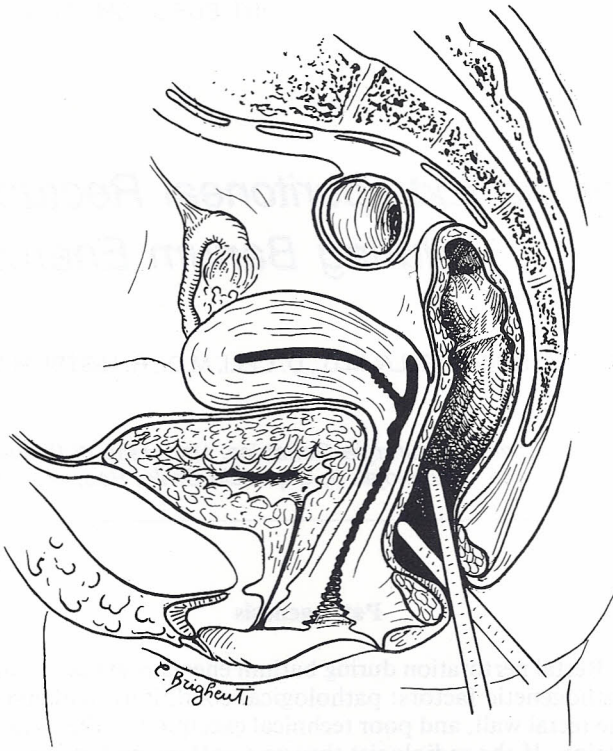


FIG. 1.—Diagram of the pelvis. If introduced incorrectly, probe may cause direct perforation of anterior wall of rectum.

#### Clinical signs and symptoms

Unlike intraperitoneal perforations, extraperitoneal lesions may only give rise to obscure, slight clinical symptoms. Rectal pain on introducing the probe, lasting during and after introduction of the radio-opaque substance, is a symptom which must always be carefully evaluated. Moreover, as the mucosa above the dentate line has no nerve endings, patients may experience no rectal pain at all. Spontaneous bleeding or blood on the withdrawn probe or glove are very probable indications of trauma.

A state of shock may sometimes occur right from the start of the examination, with tachycardia, hypotension, pallor and excessive sweating. The abdomen remains soft and moderately painful to deep palpation in the hypogastric region. Subcutaneous emphysema of the flanks or legs is rare. Raised temperature and peritonitis are generally the later expressions of an infection which is generally fatal.

#### Radiological signs

Radiological signs are always typical and provide an immediate and definite diagnosis.

Radiologically, perforations of the colon may be divided into two groups. The first are intramural lesions, the prognosis of which is generally favorable. The second include true perforations with rupture of the whole wall. They are conventionally subdivided into four categories according to site of perforation.<sup>8</sup>

Ruptures not passing the tunica serosa of the colon have clear morphology and show up on X-rays as an intramural collection of barium. The thin transparent line between two barium opacities is the rectal wall<sup>9</sup> (Fig. 2).

Instead, the first type of complete perforation is found when the rupture occurs in the anal canal under the elevators, releasing gas, barium and/or feces into the perirectal tissues or ischioanal fat. This type of perforation is very often only observable in post-evacuation X-rays, as the probe, generally of balloon type, may temporarily block a small rupture. The inevitable formation of a local barytoma is visible in all X-rays, even taken much later. They show a very well-defined oval or round opaque mass, sometimes with poor homogeneity and marbling due to feces.

If perforation occurs above the anal elevators but under the peritoneal reflection, X-rays show release of gas, feces and barium into the retroperitoneum.<sup>4</sup> However, in this case X-rays may show very varied images, depending on the type and quantity of released material (gas only, barium only, or both). In small lesions of the wall or in diverticulitis, only gas may show, mainly in double-contrast enemas, while the more viscous barium adheres to the mucous surface. In this case, only transparent areas are observed in the lower retroperitoneum, sometimes with thin, irregular, fan-shaped, interfingered lines and transparent aureoles marbled with gaseous microbubbles in the soft pararectal tissues. These images are generally indistinct in outline and tend to spread outwards on both sides. They then extend along the psoas muscles to the perirenal area; mediastinic emphysema may develop.<sup>6</sup>

In barium enemas with perforation, barium fills the low-

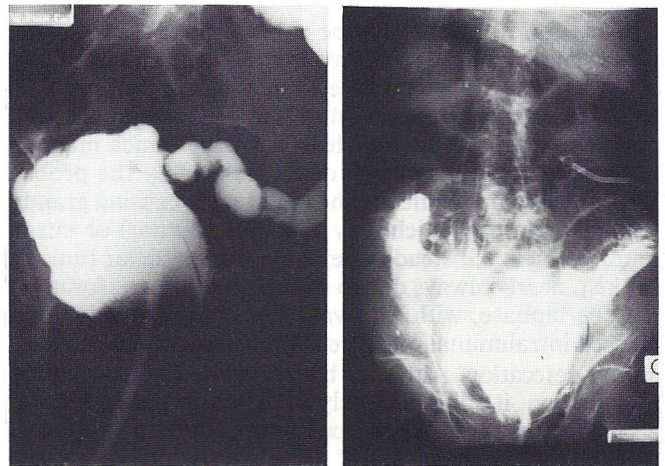


FIG. 2.

FIG. 3.

FIG. 2.—Intramural rupture of tunica mucosa. Barium enema, with balloon probe inflated in rectal ampulla. Extravasation of barium parallel and adjacent to rectal ampulla. Collection appears separated from barium in ampulla by a well-defined thin transparent line, representing thickness of colonic mucosa.—FIG. 3.—Retroperitoneal rupture of colon. X-ray taken two months after barium enema. Widespread dis-homogeneous extravasation of barium into retroperitoneum, with irregular opacity, particularly at limits, and evident opaque striae fanning outwards along pararectal spaces and psoas muscles. Hydronephrosis due to retroperitoneal fibrosis was drained by pyelostomy.



er retroperitoneum and extends round the rectum and later laterally and upwards. X-rays show some opacity, with irregular, indistinct margins and sometimes very thin, clear, well-defined striae, fanning outwards along the pararectal lines. These images are often mixed with gaseous images (Fig. 3). Changes in the patient's position never change the morphology or site of these collections.

These retroperitoneal extravasations are occasionally associated with further complications which definitely alter clinical prognosis and radiological findings. Perforations discharging directly into the perineum have also been described.<sup>10</sup>

Another later complication, almost inevitable in extensive retroperitoneal perforation, is retroperitoneal fibrosis which, due to fibro-retracting lesions, causes stretching and later ureteral stenosis and hydronephrosis.<sup>2</sup>

The last type of complete perforations is characterized by the spread of gas, barium and feces inside the peritoneal cavity, due to rupture of a colonic segment above the reflection. This is an extremely serious clinical situation. Radiologically, images are very specific and different from those mentioned previously. Released barium adheres to the mesocolon, peritoneum and loops, forming well-defined floccules of various size, often accompanied by signs of free intraperitoneal gas and rare pneumomediastinum.<sup>3</sup>

### Therapy

Rectal perforation during barium enema is a surgical emergency, with immediate 50% mortality. While milder forms may spontaneously heal and pass almost unobserved, if more serious lesions are not immediately treated, they may develop into infections of the soft perirectal tissue, leading to almost always fatal septic shock a few hours or days later. Even in mild cases pelvic sclerosis with rectal and ureteral stenosis may develop later, conditions which are difficult to treat. Unfavorable prognostic factors are extensive extravasation of barium, delay in diagnosis, presence of feces in the rectum, and inadequate preparation of the patient. In all cases therapy includes wide-spectrum antibiotics, immediate intensive care to prevent shock, and parenteral nutrition for a sufficient period of time.

Surgery must be related to the seriousness of the lesion, its location, and associated pathologies. Colostomy is recommended by almost all Authors, and becomes compulsory in large-scale lesions with complete rupture of the rectal wall. Suture of the lesion appears to be useless or even harmful, as it prevents drainage of barium and secretions.

When and how to drain the collected barium must be decided case by case. In early-diagnosed small perforations it may be unnecessary: barium is voided spontaneously through the anus. If surgical drainage is necessary, mainly in the presence of chronic suppuration due to infection, it may be downward, laterally through the ischioanal fossa or posteriorly through the precoccygeal space. If perforation is intraperitoneal, drainage may be through the

abdomen. The advantages of this route are more accurate evaluation of the lesion, more complete surgical cleaning, and treatment of associated lesions; the disadvantage is the risk of infecting the peritoneal cavity.

### Prevention

Of fundamental importance in preventing rectal perforations are careful anamnesis and evaluation of the suitability of performing a barium enema, assessing both possible signs of inflamed mucosa (mainly ulcerative colitis or diverticulitis) and of intestinal obstruction, which may lead to acute and unexpected increase in intracolonic pressure.

Rectal exploration is an important preventive measure, at least in cases in which the clinical situation or history indicate possible lesions of the anal canal or ampulla.

The use of balloon probes or stiff-tipped catheters should always be avoided, because already damaged rectal mucosa may be dangerously stretched and excessively high intracolonic pressure created.<sup>7</sup> Instead, the radio-opaque material should be carefully and gently introduced, using systems responding automatically and instantly to sudden variations in intracolonic pressure, i.e., gravity systems. The barium container should be hung about 1.5 metres higher than the horizontal patient.

The patient's clinical record should also be checked for recent colonoscopy with biopsy, since this almost inevitably causes small mucous lesions which may subsequently rupture.

### Case histories

We observed seven cases of rectal perforation during barium enema carried out using a balloon probe. Patients were three men and four women, mean age 67.8.

#### Case 1.

A 76-year-old woman received a barium enema during a check-up after digestive bleeding. No associated pathologies were found. The balloon probe perforated the anterior wall of the rectum. Diagnosis was immediate and transverse colostomy was performed. Treatment was successful.

#### Case 2.

A man of 71, who had already undergone Hartman's resection, was given a barium enema as a check-up. The probe ruptured the rectal stump. Immediate diagnosis meant that medical therapy was effective.

#### Case 3.

A man of 61 was given a barium enema by balloon probe during a check-up for pain in the right iliac fossa. Colonic diverticulosis was diagnosed. Rupture of the rectum was only revealed two days later, when the patient was hospitalized for septic shock. The delay in medical therapy was fatal.

#### Case 4.

A woman of 62 underwent transverse colostomy after surgery for intestinal perforation due to diverticulitis. Two months later,



during a barium enema given to evaluate possible colostomic closure, the balloon probe ruptured the rectum. Immediate diagnosis meant that medical therapy was successful.

*Case 5.*

A woman of 63 was given a barium enema for chronic constipation. The probe ruptured the posterior wall of the rectum. Therapy consisted of transverse colostomy. Later, following chronic anal suppuration, abdominal drainage led to successful healing.

*Case 6.*

A woman of 70 was given a barium enema during a check-up for suspected ulcerative colitis. The probe caused an immediately diagnosed rupture of the extraperitoneal rectum, treated by direct suture and abdominal drainage. Two years later, following kidney failure despite pyelostomy, the patient died of paralytic ileum due to retroperitoneum fibrosis.

*Case 7.*

A man of 72 was given a barium enema for rectal bleeding, only later found to be due to hemorrhoids. The balloon probe caused incomplete perforation of the anterior wall of the rectum, unrecognized as such and diagnosed as an ulcerated rectal lesion. Two months later, following swelling at the same point, biopsies revealed granulated tissue and X-rays showed a barytoma. Conservative treatment resulted in healing.

### Conclusions

Rectal perforations during barium enema are undoubtedly rare, considering the now routine use of this diagnostic procedure. However, their occurrence must always be borne in mind by radiologists and surgeons, both because of their unfavorable prognosis for at least 50% of patients and because of the legal implications accompanying this kind of iatrogenic damage.

We believe that therapy cannot be rigidly prescribed. It should be instituted case by case, after evaluation of the patient's general condition, possible delay in diagnosis, and associated clinical signs and X-ray data.

Although apparently based on simple technical skill, prevention is in reality more difficult, seeing that, since the first reports in the literature, going back to 1932, perforations during barium enema are still reported. For this reason, it is still important to insist on the need for accurate anamnesis, careful use of endorectal probes, high-quality X-rays immediately examined by the radiologist, and observation of the patient.

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