

# Appendicitis Associated with Recent Barium Study

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There have been several reports of "barium-induced" appendicitis in the literature. When confronted with a possible case of this phenomenon, a review of the literature on the subject was carried out. The suggestion is made that there is no evidence to support a cause-effect relationship between barium retained in the appendix and appendicitis.

Diseased appendices can be marked by retained barium and a higher likelihood may then exist for the subsequent development of appendicitis. Following the finding of prolonged retention of barium after contrast study, it is recommended that the patient be instructed as to the possibility of developing symptoms of acute appendicitis. Patients who present with symptoms of appendicitis should be questioned as to history of recent barium study, and x-rays should be reviewed with the possibility of finding appendoliths.

Acute appendicitis associated with barium study of the bowel has been described in the literature.<sup>1-5</sup> These papers have strongly suggested that barium contrast material, when retained in the appendix, can on occasion induce inflammation. Furthermore, they imply that a more widespread awareness of that possibility would stimulate earlier diagnosis of appendicitis in selected instances.

Two additional case reports of "barium-associated appendicitis," one from the Family Medicine Service, University of Washington Hospital in Seattle, and one from the Surgery Service at the same facility, will be presented. A critical review of the literature addressing "barium-induced appendicitis" will then be presented, together with conclusions regarding the current status of barium and appendicitis with suggestions concerning patient management.

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## Case Reports

### Case 1

A 76-year-old Filipino male presented to the University Hospital Emergency Room with a 24-hour history of fever, productive cough, and diffuse abdominal pain. The patient's past history was remarkable for congestive heart failure. Four days prior to admission, the patient had undergone a barium enema examination as part of a diagnostic work-up for occult gastrointestinal blood loss.

On physical examination, the patient had mild tachypnea, an oral temperature of 38.2 C, diffuse rales and rhonchi at the lung bases, and diffuse abdominal tenderness without masses. Laboratory examination revealed gram-positive diplococci in the sputum, a chest roentgenogram showing a possible left lower lobe infiltrate, hypoxia, and numerous left upper quadrant air-fluid levels on an upright film of the abdomen.

The impression on admission was pneumonia complicated by a secondary ileus, and broad-spectrum antibiotic therapy was started. The

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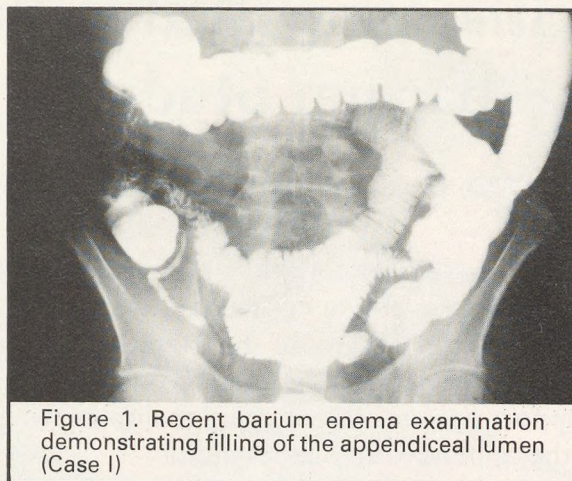


Figure 1. Recent barium enema examination demonstrating filling of the appendiceal lumen (Case 1)

patient's abdominal symptoms did not improve, and on the second hospital day they became more localized to the right lower quadrant. On rectal examination, tenderness was noted on the right side. Repeat white count demonstrated leukocytosis with a left shift. The diagnosis of acute appendicitis was made.

A review of abdominal radiographs revealed that the appendix had filled with contrast media during the recent barium enema (Figure 1). The admission abdominal film as well as subsequent films demonstrated a persistent radiopaque density in the right lower quadrant without other residual barium (Figure 2).

At surgery, a perforated appendix was found. Subsequent radiologic and pathologic examination of the surgical specimen confirmed intraluminal barium and inflammatory changes (Figure 3). The patient recovered following a stormy course.

### Case 2

A 23-year-old white male presented to the Emergency Room with a three-day history of nausea, vomiting, and anorexia. In addition, pain, migrating first from the midepigastric region of the abdomen to the periumbilical and then to the right lower quadrant was present. The patient was febrile and had a positive psoas sign on the right. He had undergone an upper GI barium examination

one year prior to admission, as a follow-up study for duodenal ulcer disease.

A plain film of the abdomen revealed a barium coated fecalith in the right lower quadrant with a small collection of gas immediately distal to it (Figure 4).

Exploratory surgery revealed a grossly inflamed appendix. Subsequent radiologic and pathologic examination of the specimen confirmed a barium-coated fecalith within the appendix (Figure 5). The patient did well postoperatively.

### Literature Review

Several authors have expressed concern over the phenomenon of retained appendiceal barium following contrast studies of the bowel. Gubler and Kukral<sup>1</sup> stated that they were much impressed with the "seriousness of sequelae due to prolonged retention of barium in the appendix." Vukmer and Trummer<sup>2</sup> noted that barium is considered harmless to the gastrointestinal mucosa, but has been reported to give rise to granulomatous reaction in the presence of infection or luminal obstruction. They also report that appendiceal lithiasis has been observed in 5 to 12 percent of cases of acute appendicitis, and perforation is associated in 50 percent of these cases. They theorize that the rapid progression to perforation





Figure 2. Persistent radiopaque density in the right lower quadrant (Case I)

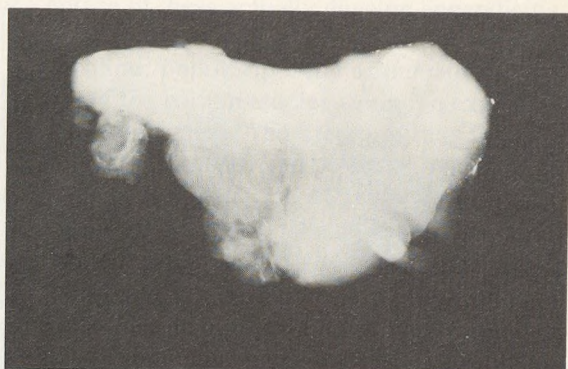


Figure 3. Radiograph of surgically removed specimen confirming intraluminal barium (Case I)

is due to complete obstruction of the appendiceal lumen distal to the fecalith. The same authors cite Johnson<sup>2</sup> who observed an eight percent appendiceal barium retention rate for longer than 72 hours in a series of 1,100 colon examinations. They go on to recommend informing patients when barium studies result in appendiceal barium retention and advising patients to "seek medical attention without delay at the onset of symptoms suggestive of appendicitis." Dehart<sup>3</sup> stated that "it is generally conceded that retained barium may result in acute appendicitis by the process of lumen obstruction." He felt that his case report supported the mechanism of barium concretion leading to obstruction and inflammation.

Berg and Berg<sup>4</sup> and others have suggested prompt removal of the appendix following post-study detection of barium fecaliths. Bowcock in Johnson<sup>5</sup> has recommended radiographic surveillance of the patient in anticipation of symptoms prior to surgical exploration. Gubler and Kukral<sup>1</sup> suggest that an interval appendectomy be done for all patients who demonstrate barium retention for longer than one month. Others, however, disagree. Vukmer and Trummer<sup>2</sup> recommend that, following barium examination of the large bowel, follow-up films be done in anticipation of barium retention. If barium is noted at that time, the patient should be informed and prompted to report to a physician at the first appearance of symptoms. Furthermore, Gubler and Kukral<sup>1</sup> advise that fil-

ling the appendix deliberately during barium enema examination is not diagnostically rewarding and should be discontinued. They advocate repeating x-ray examination of every patient whose appendix fills with barium. Interval appendectomies again are suggested when barium retention exceeds one month.

In 1953, Gubler and Kukral<sup>1</sup> offered four cases of appendicitis which they felt were secondary to retained appendiceal barium following examination of the bowel with that contrast medium. Several questions arose from their case reports. The fecaliths which allegedly caused the appendicitis were not studied to prove barium as a nidus of their growth, nor could one be certain as to which of several fecaliths they described caused the problem (two of the four were not radiopaque). In their recommendation to cease deliberate efforts to fill the appendix on barium examination of the bowel, they overlooked both the impossibility of controlling appendiceal filling after upper gastrointestinal study and the widely accepted desirability expressed by radiologists to fill the terminal ileum or appendix during colon study in order to confirm a thorough examination of the cecum.

Gubler and Kukral<sup>1</sup> and Young<sup>6</sup> advocated that patients retaining barium longer than one month undergo elective appendectomy; however, none of those authors provided factual data regarding cause and effect of barium and appendicitis nor were they able to demonstrate a reliable incidence of





Figure 4. Plain film of the abdomen denoting fecalith with small gas collection immediately distal to it (Case II)

occurrence. One is left with opinions and recommendations without the support of controlled studies. Perhaps a more credible thought by Vukmer and Trummer<sup>2</sup> is that barium retention "signals some intrinsic or extrinsic abnormality of the appendix."

In Johnson,<sup>3</sup> a group of 1,106 barium examinations were followed up. One hundred twenty-two of these (11 percent) demonstrated retained barium in the appendix after the cecum had emptied. After 72 hours, 89 still demonstrated retained barium in the appendix (8 percent). Unfortunately, no follow-up to determine how many went on to develop appendicitis was done, but it would be difficult to assume an eight percent appendicitis rate.

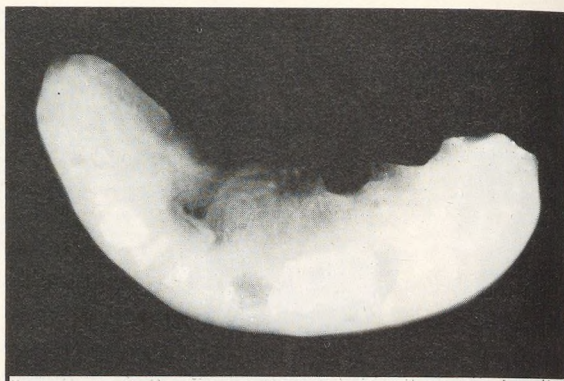


Figure 5. Radiographic examination of the surgically removed specimen confirming barium coated fecalith within the appendix (Case II)

Collins<sup>7</sup> studied 71,000 postsurgical appendices. Of these, 2.5 percent had retained barium intraluminally. He did not clarify the indications for the procedures further, other than to state that 26 percent were specimens from cases of "acute appendicitis," while the others were cases of the poorly defined category "chronic appendicitis,"—an entity of questionable existence. These data do not help to resolve the barium-appendicitis issue.

Soter,<sup>8</sup> who supports radiologic examination in difficult cases of diagnosing acute appendicitis, stated, "appendiceal stones consisting mainly of barium and producing acute appendicitis are rare. However, considering how often barium is employed in the examination of the gastrointestinal tract, one should not attribute any etiological significance to barium retained in the appendix." Evidence supporting this view was not presented in his paper.

Does barium *cause* appendicitis? If so, how long does it take? The case reports reviewed vary—48 hours to 48 months. The literature makes it extremely difficult if not impossible for one to draw incriminating conclusions. Opinions are the order of the day in the literature to date. Perhaps the most logical viewpoint is that of those authors who submit that retained barium is a marker of disease (a narrow appendiceal lumen, a kinked ap-



pendix, or decreased motility in that portion of the intestine) denoting an appendix that will sooner or later require removal. This is to ignore whether the barium "helped" with the inflammatory changes or whether the inflammation would have followed an inevitable course without the presence of barium. It is difficult for one to believe that an agent could on one hand incite inflammation in 48 hours or remain dormant for four years. Conversely, it is difficult to believe that an agent which took four years to build concretions and obstruct an appendiceal lumen could incite the process in only 48 hours. This question has been inadequately evaluated and for this reason it is little surprise that there is such a difference of opinions.

Perhaps Bowcock<sup>9</sup> summarized the current status of this question in 1936 when he said, "Obviously, prolonged barium retention must constitute either a rather uncommon but normal variant, or the finding is one of pathologic significance. Proof of either assumption, normal or abnormal, can be derived only from prolonged observation of many patients in whom retention has been demonstrated." Thus, he had advocated an as yet unaccomplished, difficult study which would require a rather elaborate experimental design.

## Discussion

It is the authors' feeling that no causal relationship between retained barium and acute appendicitis can be supported from the available literature. More acceptable is the thought that diseased appendices perhaps can be somewhat predisposed to retain barium and mark an increased likelihood of subsequent appendicitis (whether or not the barium actually aids in stimulating the inflammation). Difficult, controlled studies would be necessary to further elaborate on this question. The recommendations cited by authors over the last 25 years have been based mainly on clinical impressions and limited data.

In order to propose patient management, it is important to consider the incidence of appendiceal barium retention, the necessity to fill the appendix deliberately during examination, the cost effectiveness of follow-up roentgen studies, and the consequences of observing the informed patient. This literature review has noted that possibly ten percent of patients with barium filled appendices retain the contrast medium longer than 72 hours. One would suspect that a very small

percentage of these actually develop appendicitis, simply due to the infrequency of this reported complication. Follow-up x-ray examination of ten percent of the barium studies would be expensive and time consuming. The literature thus far does not justify the expense and potential morbidity of elective appendectomy on the subset of patients with one-month residual appendiceal barium.

Understanding that radiologists often depend on the filling of the appendix to assure adequate gastrointestinal studies, the authors do not recommend that this maneuver be stopped. Following the finding of retained barium in the appendix, the patient should be informed about symptoms of possible complicating appendicitis and alerted to seek medical care early should these symptoms appear. The patient should be advised not to embark on prolonged travel in isolated areas, including cruises overseas, for an arbitrary three to four months, based solely on the review of case reports and the apparent average time of onset of symptoms following study.

A history of recent barium study and a search for appendoliths by x-ray examination should be stressed in the assessment of patients when the diagnosis of appendicitis is entertained.

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