

Perforation associated with barium enema in acute appendicitis

N. Shust, C. E. Blane, K. T. Oldham

¹ Section of Pediatric Radiology, Department of Radiology, University of Michigan Hospitals, 1500 East Medical Center Drive, Ann Arbor, MI 48109-0252, USA

² Section of Pediatric Surgery, Department of Surgery, University of Michigan Hospitals, 1500 East Medical Center Drive, Ann Arbor, MI 48109-0245, USA

Abstract. A child with the suspected diagnosis of atypical acute appendicitis underwent a diagnostic barium enema. The study was complicated by perforation with leakage of a large amount of barium into the peritoneal cavity. The complex hospital course that resulted has prompted us to reevaluate the barium enema in the diagnosis of appendicitis and review the literature for contraindications. We conclude that this particular complication is extremely rare and that barium enema still has a part to play in some patients where the clinical diagnosis is uncertain.

A child with the suspected diagnosis of atypical acute appendicitis underwent a barium enema at a community hospital. The study was complicated by perforation of the appendix with extravasation of the barium. The patient underwent emergency surgery with appendectomy followed by life-threatening septic complications which resulted in transfer to our institution. This experience prompted us to review the literature for contraindications to barium enema and to reevaluate the study in this clinical setting.

Case report

An otherwise healthy 11-year-old boy was evaluated at a community hospital for a 3-day history of fever and right mid- and upper abdominal pain accompanied by emesis and diarrhea. On plain abdominal radiograph an appendicolith was suspected; however, this could not be confirmed by abdominal ultrasound. After observation overnight the patient appeared clinically improved the following morning but was still febrile. A second ultrasound examination, including the kidneys, and an intravenous urogram were normal. The possibility of an atypical presentation of appendicitis with negative ultrasound examination was considered. The patient was stable without evidence of peritonitis. A single-contrast barium enema was performed without bowel preparation. The barium enema revealed appendiceal perforation. Intraperitoneal extravasation of the barium was recognized and the study immediately terminated. The

child was taken to the operating room urgently and an appendectomy was performed. Despite broad-spectrum antibiotic coverage he remained febrile and suffered cardiac arrest 4 h after surgery. On transfer to our institution he required high levels of ventilatory support and was hemodynamically unstable on arrival. Following resuscitation a laparotomy was performed and a large right subphrenic abscess was drained. He continued to receive broad-spectrum antibiotic coverage and despite total parenteral nutrition developed a wound dehiscence. The child was discharged from hospital 5 weeks after admission.

Discussion

The diagnosis of acute appendicitis remains primarily a matter of clinical judgement. The ongoing issue in the current health care climate is how to minimize the number of negative explorations, generally accomplished with minimal morbidity, without creating a delay in treatment and increasing the attendant risk of perforation, an event with major morbidity and occasional mortality.

Diagnostic efforts have been directed to this end. Diagnostic imaging routines including barium enema and ultrasound have been advocated. The recent literature has explored the use of ultrasound in the diagnosis of appendicitis; however, the specificity and sensitivity of the study decreases when the imaging is limited to those patients with atypical presentations or extended to all patients with abdominal pain [1, 2]. Certainly the presence of an appendicolith or abscess strongly suggests the diagnosis of appendicitis and visualization of a normal appendix is rare [2, 3]. But ultrasound is acknowledged to be extremely operator dependent, and unfortunately those children who pose a diagnostic dilemma are often the least cooperative for an ultrasound examination. Lastly, in community hospitals the ultrasound examinations may well be performed by people with limited pediatric ultrasound experience. Thus in many institutions barium enema examination retains an important place in diagnostic evaluation of the patient with atypical appendicitis.

The barium enema has been used safely for many years to help evaluate children with possible appendicitis and

children with a perforated appendix [4–8]. The radiographic findings have been grouped under three headings:

1. A normal examination with filling of the complete appendix and normal adjacent bowel without evidence of inflammation
2. A positive examination with a non-filled or partially filled appendix with adjacent inflammatory findings in the cecum, terminal ileum, or rectosigmoid
3. An indeterminate examination where there is absence of filling of the appendix and no definite evidence of inflammation in adjacent bowel [4, 6, 7]

Many authors have suggested these criteria are helpful in reducing the delay in diagnosis of appendicitis in some children while obviating the need for unnecessary surgery in others [4, 5, 7, 8]. Summarizing the data from four studies where over 1000 barium enema examinations were performed, there was no single instance of complications [4, 5, 8, 9]. There is a single report in the literature of an 8-month-old child with extravasation of barium into the peritoneum during the barium enema [7]. This child also had the diagnosis of perforated appendicitis confirmed at surgery.

Barium peritonitis secondary to gastrointestinal perforation has been thought in the past to represent a life-threatening event [10]. More recently, improved metabolic monitoring, effective antibiotics, and more aggressive hemodynamic support have reduced the mortality and morbidity of this complication in children [11]. The hypovolemia and septic shock which followed this patient's barium peritonitis likely precipitated the cardiac arrest at the outlying hospital. The extreme rarity of barium spillage into the peritoneum in acute appendicitis, whether the appendix is ruptured or not, has prompted speculation that proximal appendiceal obstruction, which precedes suppuration of the distal appendix, prevents filling of the more distal friable appendix that is at risk for perforation [12].

In patients with atypical presentations, or where coincident illness is present, further diagnostic investigation may be appropriate. As a general screening study in the

child with abdominal pain, ultrasound can be helpful with no associated risk. The finding of an abscess related to a perforated appendix can direct surgical management. Certainly the barium enema examination carries an increased risk, but this risk remains small. A diligent search of the literature yielded a single previous report of leakage of barium into the peritoneal cavity, making this an extremely rare complication of a very useful diagnostic procedure that is relatively widely available in the community.

References

1. Puylaert JBCM, Rutgers PH, Lalisang RI, de Vries BC, van der Werf SDJ, Dörr JPJ, Blok RAPR (1987) A prospective study of ultrasonography in the diagnosis of appendicitis. *N Engl J Med* 317: 666–669
2. Jeffrey RB, Laing FC, Townsend RR (1988) Acute appendicitis: Sonographic criteria based on 250 cases. *Radiology* 167: 327–329
3. Kao SCS, Smith WL, Abu-Yousef MM, Franken EA Jr, Sato Y, Kimura K, Soper RT (1989) Acute appendicitis in children: sonographic findings. *AJR* 153: 375–379
4. Berk RN (1976) Barium enema examination in acute appendicitis. *JAMA* 236: 394–395
5. Rajagopalan AE, Mason JH, Kennedy M, Pawlikowski J (1977) The value of the barium enema in the diagnosis of acute appendicitis. *Arch Surg* 112: 531–533
6. Smith DE, Kirchner NA, Stewart DR (1979) Use of the barium enema in the diagnosis of acute appendicitis and its complications. *Am J Surg* 138: 829–834
7. Garcia C, Rosenfield NS, Markowitz RI, Seashore JH, Touloukian RJ, Cicchetti DV (1987) Appendicitis in children: accuracy of the barium enema. *Am J Dis Child* 141: 1309–1312
8. Schey WL (1973) Use of barium in the diagnosis of appendicitis in children. *AJR* 118: 95–103
9. Hatch EI, Naffis D, Chandler NW (1981) Pitfalls in the use of barium enema in early appendicitis in children. *J Pediatr Surg* 16: 309–312
10. Silverman FN (1985) Caffey's pediatric X-ray diagnosis: an integrated imaging approach, 8th edn. Year Book Medical Publishers, Chicago, pp 1368–1370
11. Eklof O, Hald J, Thomasson B (1983) Barium peritonitis. Experience of five pediatric cases. *Pediatr Radiol* 13: 5–9
12. Wangenstein OH, Dennis C (1939) Experimental proof of the obstructive origin of appendicitis in man. *Ann Surg* 110: 629