

## **Gas-filled Appendix with Meniscus: Outline of the Appendicolith**

L.R. Bigongiari<sup>1</sup> and J.D. Wicks<sup>2</sup>

Departments of Radiology, University of Kansas Medical Center, Kansas City, Kansas,<sup>1</sup> and University of Michigan Hospital, Ann Arbor, Michigan,<sup>2</sup> USA

**Abstract.** A meniscus was produced in a gas-filled appendix by the outline of the obstructing appendicolith. This meniscus appearance should be specific for appendicitis since it represents the obstructing stone. This sign can be elicited by oblique or other projections, perhaps with fluoroscopic control.

**Key words:** Appendicitis — Gas-filled appendix — Appendicolith.

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Lim [1] recently reported three cases of patients with acute abdominal complaints and gas-filled appendices on abdominal radiographs. She stressed the nonspecificity of this sign for appendicitis since the etiologies of these patients' symptoms were other than appendicitis. The finding of a gas-filled appendix has been described in appendicitis many times both with and without qualification as to its reliability [2–12]. We are reporting for the first time to our knowledge the demonstration of a specific radiographic sign for appendicitis, namely, a gas-filled appendix with a meniscus at its base caused by the outline of the obstructing appendicolith.

### **Case Report**

A 23-year-old black man was admitted because of abdominal pain for 7 days and recent onset of chills and fever. The pain initially was periumbilical but then became diffuse. Three days prior to admission he had the onset of watery diarrhea every 2 h ac-

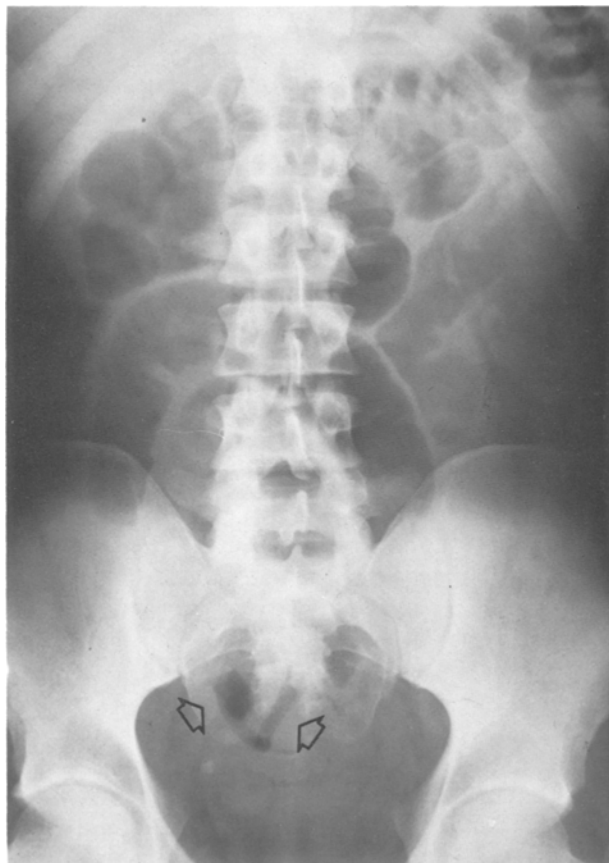
companied by anorexia and nausea. The pain moved primarily into his lower abdomen. Treatment with sulfisoxazole (Gantrisin®) and diphenoxylate (Lomotil®) produced relief of diarrhea but had little effect on the pain.

On admission, his temperature was 99.8°F. His abdomen was mildly distended but without guarding. He had generalized direct abdominal tenderness greatest in the suprapubic area where rebound tenderness was also present. On rectal examination, he had diffuse tenderness greatest anteriorly. Abdominal films showed dilated small bowel loops with air fluid levels and a calcific density in the right pelvis. An intraluminal density was identified in the base of the air-filled appendix (Fig. 1). The white blood cell count was 13,400 with 80% polymorphonuclear leukocytes. Urinalysis showed a pH of 5 with occasional white blood cells but was otherwise negative. An excretory urogram demonstrated normal urinary tracts and an air-filled appendix with meniscus due to an obstructing intraluminal mass best demonstrated on oblique view (Fig. 2). The calcification was outside the urinary system. Later that evening his white blood cell count rose to 15,600 and his temperature to 100.5°F.

When the peritoneal cavity was entered at exploratory celiotomy, approximately 300 cc of serous fluid exuded through the wound. A mass was palpable through the right mesocolon beneath the cecum. While mobilizing the right colon the surgeon entered a large abscess which extended into the pelvis over the pelvic brim. The gangrenous appendix was identified in the abscess cavity as a structure completely separate from the cecum. A 1-cm firm, partly calcified fecalith consistent with the radiographically demonstrated intraluminal mass was also removed from the abscess cavity. Decompressed, the appendix measured 8 cm long and 0.4 cm in diameter. Culture of the abscess grew *E. coli*.

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*Address reprint requests to:* Lawrence R. Bigongiari, M.D., Department of Radiology, University of Kansas Medical Center, 39th and Rainbow Boulevard, Kansas City, KS 66103, USA.



**Fig. 1.** AP supine abdomen shows dilated, air-filled loops of small bowel, a gas-filled appendix in a RLQ soft tissue density (arrows), and a calcification in the soft tissues of the right bony pelvis



**Fig. 2.** RPO view from excretory urogram demonstrates the meniscus (arrow) configuration due to the intraluminal fecalith in the proximal air-filled appendix. The calcification is outside of the urinary system

## Discussion

Appendicitis begins with occlusion of the lumen of the appendix usually by a slowly enlarging appendicolith. As the closed segment of appendix becomes distended by the accumulation of mucous secretions, the capillary venules within the appendiceal wall are compressed producing vascular congestion and edema. The subsequent inflammatory reaction produces areas of thrombosis and infarction in the appendiceal wall and irritates the peritoneum. Enteric bacteria may enter the tissues. Adjacent structures become edematous as the inflammation spreads. The friable wall of the enlarging appendix will eventually perforate, producing a local abscess or generalized peritonitis by contamination with bacterial flora [10].

Plain film examination of the abdomen is positive in 50% of patients with appendicitis [13]. The various radiographic manifestations of appendicitis depend on the stage and extent of the process. Visualization of appendiceal stones in association with acute clinical symptoms is extremely reliable in the diagnosis of

appendicitis [14, 15]. Appendicoliths are demonstrated in 22% to 50% of children [16, 17] and in up to 10% to 12% of adults [14, 18]. Edema of the cecal wall with a long air fluid level on decubitus view [11] and luminal dilation [19] may be identified. The terminal ileum may also demonstrate edema and ileus [2, 10, 12]. Generalized haze in the right lower quadrant reflects localized tissue swelling and fluid exudate in the peritoneal cavity [2, 10, 13]. In some cases the cecum may be contracted by spasm [12]. One liter or more of ascites may form rapidly and diffusely [13] or localize in the right paracolic gutter [20]. Inflammatory mass or abscess may be outlined by fluid-filled loops or intrinsic gas bubbles [10]. Non-specific signs such as obliteration of normal fat planes, skeletal muscle spasm, pneumoperitoneum, small bowel obstruction, or ileus distant from the area of inflammation are occasionally seen [10].

The appendiceal lumen can be filled with gas in three situations. First, when its communication with the cecum is compromised, the lumen can be filled with gas by gas-forming organisms [10]. This finding

can be identified on plain film in about 2% of patients with appendicitis [6, 12]. If the appendix is anatomically situated so that its lumen is above its orifice when the radiograph is taken, the normal appendix may contain gas [21]. And lastly, the appendix, like the rest of the gut, may participate in ileus with obstructive or nonobstructive distension [1]. Therefore, the finding of gas in the appendix must be interpreted in the context of the individual patient's anatomy, other associated x-ray findings, and the clinical situation.

Demonstration of a meniscus caused by air outlining an appendicolith should be pathognomonic since it defines the primary etiologic agent. If gas is identified in the lumen of the appendix, this naturally produced contrast medium may be manipulated to outline obstruction at the base or tip of the appendix, or back into the cecum to exclude obstruction of the appendix. Oblique, prone, or upright positioning perhaps even with cross-table filming may be helpful. Spot films with fluoroscopic positioning could be utilized.

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