Appendiceal Abscess Imaging-Guided Drainage in Children: Can it Replace Laparotomy?

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Abstract

Introduction: Acute appendicitis is the most common condition requiring emergency abdominal surgery in the pediatric population. Abscess formation is a serious consequence to the delayed diagnosis. Percutaneous imaging-guided drainage is the first-line of treatment for infected or symptomatic fluid collections in the abdomen and pelvis. The aim of this study is to determine the role of imaging-guided drainage in treating pediatric patients with appendiceal abscess.

Materials and Methods: The diagnosis of appendicitis was based on clinical data, ultrasound (US) and CT scan. Abscess was diagnosed by the presence of fluid collection, +/- air fluid level, having an enhanced wall on CT scan. Abscess drainage was performed guided by CT scan using Seldinger technique. Follow up was done by focused CT scan.

Results: The study consists of 33 pediatric patients, 18 males and 15 females, with age range of 6 to 15 years. Twenty-four cases (72.8%) had solitary abscesses. For four of them, needle aspiration was done and for the rest, catheter insertion was performed. Only in two cases, imaging-guided drainage failed, which warranted surgical interference. Nine cases (27.2%) had multiple collections. Six collections were treated by needle aspiration, while 16 had catheter insertion. Unfortunately, two of these cases, eventually, needed surgery. The drainage procedure for all cases was done guided by CT scan. Non-surgical complications occurred in two cases (6%). The mean dwell time of the inserted catheters was 6.2 days. The mean inpatient stay in the hospital was 10.3 days.

Conclusion: Imaging-guided percutaneous drainage is a safe and effective treatment for appendiceal abscesses in children. It can replace invasive surgery.

Key Words: Appendicitis – Abscess – Imaging-guided drainage – Laparotomy.

Introduction

ACUTE appendicitis is the most common condition requiring emergency abdominal surgery in the pediatric population. 60,000–80,000 pediatric cases are diagnosed as acute appendicitis, annually in the United States [1,2]. It is one of the major causes of hospitalization in children [3].

Acute appendicitis presents a challenging problem to clinicians because it must be differentiated from a variety of other conditions that result in acute abdominal pain in children [4].

There are serious consequences to the delayed diagnosis of acute appendicitis. Reported complications include perforation, abscess formation, peritonitis, wound infection, sepsis, infertility, adhesions, bowel obstruction and death [4].

Helical CT has been shown to be a highly sensitive and specific modality for the diagnosis of acute appendicitis in children and adults. The reported sensitivity of CT for the diagnosis of acute appendicitis has ranged from 87% to 100% and the specificity has ranged from 89% to 98% [5,6].

Percutaneous imaging-guided drainage is the first line of treatment for infected or symptomatic fluid collections in the abdomen and pelvis, in the absence of indications for immediate surgery [7]. Imaging guidance for drainage is most commonly performed with ultrasonography (US) and computed tomography (CT) [7].

The aim of this study is to determine the role of imaging-guided drainage in treating pediatric patients with appendiceal abscesses and to detect if it can replace the more invasive surgery.

Material and Methods

Patient selection and imaging techniques:

This is a study of patients for whom imaging-guided drainage, of appendiceal abscesses, was performed during the period between January, 2006 and April, 2009, in King Fahd Military Medical Complex, Kingdom of Saudi Arabia (KSA). The hospital’s institutional review board approved this study.
Imaging was considered after initial evaluation of the patients, by emergency department physicians, with a clinical diagnosis of right iliac fossa mass (? appendiceal). Sonography followed by CT scan were done for all patients.

Abdomino-pelvic sonograms were performed using a Logic 500 machine (GE healthcare–Milwaukee–WI) equipped with 5.0-10MHz linear array transducer.

All CT studies were performed on a helical Hi-Speed Advantage dual-detector scanner (GE Healthcare–Milwaukee–WI). Images were acquired from the iliac crests (bottom of the L3 vertebral body) down to the inferior pubic rami using helical mode at a pitch of 1.5, with 5-mm collimation, reconstructed at a 3-mm intervals.

Rectal and IV contrast material was used in most patients. Exclusionary criteria for administration of rectal contrast were: inability to retain rectal contrast, presence of bloody stools, or pre-existing conditions that placed patients at a high risk for intestinal perforation (e.g. inflammatory bowel disease). These children received oral contrast material two hours before imaging. Patients with a contraindication to IV contrast material administration were imaged with rectal or oral contrast material only.

Appendiceal abscesses were diagnosed by US and confirmed by CT scan (Fig. 1). They presented as fluid collections (with enhanced walls on CT scan), +/- internal air-fluid levels. On US, they were at times seen as heterogeneous, partially cystic masses, with or without air-fluid levels.

**Abscess drainage:**

Patients diagnosed to have appendiceal abscesses were prepared for imaging-guided drainage. They were requested to be fasting for 6 hours prior to the procedure. Full hematological profile was also demanded for all patients.

Local anesthesia (using 1% lidocaine injection) was given for all patients, apart from irritable ones, those who still experienced pain and those for whom transgluteal approach for drainage was planned. For those patients, sedation was done by an anesthetist.

Under complete aseptic conditions and CT guidance, Seldinger technique (Fig. 2) was used for abscess drainage in all patients. This technique involved the insertion of a hollow needle into the abscess cavity, followed by placement of a guide wire through the needle to create a percutaneous path for a drainage catheter. After the guide wire was inserted, the needle was withdrawn and the catheter was placed over the wire and inserted into the dependant part of the abscess. The percutaneous deployment of 8–14F catheters required the use of 0.035- or 0.038-inch wires. The needle puncture was performed with a needle system that accommodated these wires (18-19 gauge angiographic needles).

The approaches for abscess drainage used were either transabdominal or transgluteal. Transabdominal approach was done in 31 patients, while trans-gluteal approach (Fig. 3) was used in two patients, due to having deep pelvic abscesses.

Patients in the transgluteal approach were not placed in the supine position (as the transabdominal approach), but were placed in the decubitus position. Needle insertion was as medial as possible, to avoid injury of the sciatic nerve. Needles were inserted via the greater sciatic notch.

**Catheter management:**

The abscess cavities were decompressed at the time of drainage with direct suction by using syringes attached to the catheters. Irrigation of the abscess cavities with 10–15-mL of 0.9% saline was eventually done to encourage further drainage of thick debris. Some of the material aspirated from the abscesses was sent for culture and susceptibility tests.

If the abscess cavities were adequately drained by aspiration of their contents, no more was done. The patients were kept under observation in the hospital for a period specified by the physicians, according to their clinical profiles. Prior to discharge from the hospital, Follow-up CT scan was done, confirming adequate abscess treatment.

If further drainage of abscess cavities was needed, the catheters were secured in place and were flushed every 8–12 hours with 5–10mL of saline solution to clear them of any adherent plugs or encrustations that might cause blockage.

**Results**

Our study consists of 33 pediatric patients, 18 males and 15 females, whose ages ranged from 6 to 15 years.

Three patients suffered from coagulopathy which was corrected prior to the procedure.
Twenty-four patients (72.8%) had solitary abscesses. For four of them, needle aspiration was done and for twenty, catheter insertion was the chosen procedure.

Nine patients (27.2%) had multiple collections. Needle aspiration was done for six of these collections. For the remaining sixteen, catheter insertion was performed (Figs. 4,5).

The mean dwell time of the catheters was 6.2 days.

The mean inpatient stay in the hospital was 10.3 days.

Drainage failed to improve patients’ clinical conditions in four cases (12%). This was confirmed by follow-up CT scan, which showed abscess re-accumulation. These patients were treated surgically.

Complications occurred in two patients (6%), who had peri-catheter oozing, that was mild and required no interventional treatment.

Fig. (1): Pelvic appendiceal abscess. A) US image showing a mass of heterogeneous echo texture in the right iliac fossa. B) Axial. C) Coronal and D) sagittal reformatted post-contrast enhanced CT images show mass of heterogeneous enhancement presenting air fluid levels (thick arrows).
Fig. (2): Drainage of pelvic appendiceal abscess. A) Axial non enhanced CT scan of the pelvis shows the needle inside the abscess cavity. Arrow points to tip of the needle. B) Axial non enhanced CT scan of the pelvis shows the catheter around the guide wire. C) Axial non enhanced CT scan of the pelvis shows the catheter inside abscess cavity. Note reduced size of the cavity after aspiration and D) Follow-up axial non enhanced CT scan of the pelvis after withdrawal of catheter (5 days after insertion) shows almost disappearance of the abscess cavity.

Fig. (3): Trans-gluteal approach for pelvic abscess drainage. The patient was sleeping in left lateral decubitus position. A) Axial non enhanced CT scan shows the tip of the needle in the abscess cavity (arrow). B) Axial non enhanced CT scan shows the tail of the drainage catheter in the abscess cavity (short arrow).
Discussion

Acute abdominal pain is a common complaint in the pediatric age group, accounting for approximately 4% of office encounters in children aged 5–14 years [8]. The majority of children with acute abdominal pain have self-limited nonsurgical disease [8].

The prevalence of acute appendicitis in children presenting with acute abdominal pain ranges from 1% to 4% [9].

Clinical symptoms and signs associated with acute appendicitis include crampy, periumbilical or right iliac fossa pain; nausea; vomiting; point tenderness in the right iliac fossa; rebound tenderness and leukocytosis with a left shift. Although knowledge of the classic findings is important, the clinical diagnosis of acute appendicitis in children is not always straightforward. Approximately one-third of children with acute appendicitis have atypical clinical findings [4]. Younger children are not able to clearly describe their symptoms. In addition, the presenting signs and symptoms of many nonsurgical conditions may mimic those of acute appendicitis, and most children with a suspected diagnosis of appendicitis do not have it. 5%–25% false-negative appendectomy rates were reported for the pediatric population [10].

There are serious consequences to the delayed diagnosis of acute appendicitis. Reported complications include perforation, abscess formation, peritonitis, sepsis, infertility, adhesions, bowel obstruction and death [4].

Morbidity and mortality in acute appendicitis is related almost entirely to appendiceal perforation. The prevalence of appendiceal perforation in various pediatric series has ranged from 23% to 73% [11]. The perforation rate is even higher in younger children, with rates of 62%–88%, being reported in preschool children [11]. Up to one-half of patients with perforated appendicitis may experience a complication [11].

With respect to treatment, abscesses generally require a combination of either percutaneous or surgical drainage and antibiotics for complete cure, since antibiotics do not reach sufficient concentrations within abscess cavities [7].

In our study, a combination of percutaneous aspiration ± drainage and antibiotic therapy (which had been determined after obtaining material for culture and susceptibility test) was performed.

Contraindications for percutaneous treatment are relatively few. The main ones are uncorrectable coagulopathy and lack of safe percutaneous access. For practical purposes, the absence of a safe percutaneous path is the only factor that prohibits percutaneous abscess drainage, since in most instances coagulopathy can be corrected to allow drainage [7].

There were no absolute contraindications for percutaneous drainage in our series. Three patients suffered from coagulopathy which was corrected prior to the procedure.

It may be difficult to access fluid collections deep in the pelvis, because of anterior bowel, bladder and uterus as well as, lateral bones and blood vessels. In such abscesses, percutaneous access with routine anterior or lateral approaches is often impossible. If an abscess is close to the rectum, a transrectal approach may be used [12].

The transgluteal approach through the greater sciatic foramen is an alternative approach to deep pelvic abscesses [14]. Initially described by Butch et al. [8], the transgluteal approach requires CT guidance and patient positioning in either the prone or the decubitus position. Butch et al., cited a higher
incidence of pain (approximately 20% of patients) with this approach [13] and therefore recommended that the approach was not to be used in children. However, Gervais et al. [14] have shown the transgluteal approach to be reasonably well tolerated by children. The choice of transrectal versus transgluteal access to a deep pelvic abscess is often determined by operator preference. The transgluteal approach has the advantages of allowing percutaneous access to abscesses located farther cephalad and of being performed under sterile conditions [7].

We performed appendiceal abscess drainage for two patients using the transgluteal approach, guided by CT scan, due to the deep position of their abscesses in the pelvis. Sedation of those patients was done, in addition to local anesthesia, to alleviate any chance of occurrence of pain.

The American College of Radiology has reported an 80% success rate for percutaneous abscess drainage in adults, with success being defined as complete drainage with no further procedures required [15]. Although the literature about percutaneous drainage in children is more limited, the available data suggest similar outcomes [14,16]. McCann et al., reported that treatment of appendiceal abscess with imaging-guided intervention was successful in 92.3% of children [17]. In our study, the success rate for imaging-guided intervention was 77.8% in cases having multiple abscesses and 91.7% in cases with solitary abscesses.

Reported complications of percutaneous drainage in children are rare. Jamieson et al. [18] reported a single colonic fistula that healed after prolonged drainage. Stanley et al. [19] reported no complications in 13 pediatric patients and vanSonnenberg et al. [20] reported one episode of pulmonary hemorrhage and one case of pericatheter oozing. In our study, we faced mild pericatheter oozing in two cases (6%) which required no further intervention.

Conclusion: Imaging-guided percutaneous drainage is a safe and effective treatment for appendiceal abscesses in children, minimizing the use of the more invasive surgical interference.

References