Case Reports
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Retained Appendicolith in Children - a Case Report and Literature Review

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Abstract

Objective – The aim of this report is to present the case of a child with a retained appendicolith. This occurs when an appendicolith is expelled from the appendix as a result of perforation and the failure to remove it during surgery. All previous cases with this complication were also searched through the PubMed search engine. **Case Report** – We present the case of an eight-year-old boy who was referred to our clinic with an acute abdomen. An ultrasound indicated a perforated appendix. An open appendectomy was performed. The gangrenous perforated appendix was shown and removed. On the sixth postoperative day, an abdominal ultrasound was performed, showing several smaller purulent collections in the pelvis. Subhepatic to the right, a hyperechoic echo was verified, corresponding to a retained appendicolith. On the eleventh postoperative day, there was an increase in temperature with abdominal pain. Repeated ultrasound showed a denser subhepatic collection with previously verified appendicolith. A midline laparotomy was performed. Three abscess collections were found: pericecal, retrovesical, and subhepatic, in which drains were placed. The subhepatic appendicolith was found and was extirpated. A repeated ultrasound finding showed an orderly abdominal finding. **Conclusion** – Our case, and the cases presented from the literature, clearly indicate that retained appendicolith, as a complication, will almost certainly form an abscess. In cases of perforated appendix, a retained appendicolith must always be considered in differential diagnosis as a possible cause of various symptomatologies. Upon confirmation by ultrasound or computed tomography, the surgeon must find a way to remove the appendicolith and resolve the abscess.

Key Words: Retained Appendicolith ▪ Appendectomy ▪ Children ▪ Pediatric Surgery.

Introduction

Acute appendicitis is a common pediatric surgical emergency. Successful surgical appendectomy requires removal of the appendix and its contents. A retained appendicolith is a complication that occurs when the appendicolith is expelled from the appendix as a result of perforation and the failure of removal during surgery. A retained appendicolith can be found after open or, more frequently, laparoscopic appendectomy. It is known that in almost all cases a retained appendicolith will cause an abscess. The location of the abscess depends on where the appendicolith is found. An appendicolith is found in approximately 12-30% of patients with appendicitis (1). An appendicolith is a fecal mass soaked in calcium phosphate and organic residues deposited around it. The formation of an abscess around the appendicolith is due to the bacteria in it that act as a nidus of infection. Depending on the onset of symptoms, the time between the appendectomy and the diagnosis of a retained appendicolith can range from a few days to several years (2, 3). X-rays can detect only 10-15% of appendicoliths. Ultrasound and computed tomography (CT) scans are the diagnostic modalities of choice (4). It is important to note that appendicoliths must be removed because otherwise the focus of the infection may remain.

We present the case of an 8-year-old boy and a review of the literature.

Methods

A systematic literature review was conducted according to PRISMA guidelines, using the PubMed online database on September 12, 2021. The search was performed in all fields, based on the Medical Subject Headings (MeSH) terms; (appendicolith* OR fecalith* OR fecolith* OR coprolith* OR stercolith*) AND (retain* OR residu* OR dropped). Regarding the type of articles, their availability (abstract, full paper), date of publication and gender, no limiters were used. Only articles in English for the age group 0 to 18 were searched. After a detailed reading of abstracts and complete articles, papers were selected that dealt with the relevant topic in the narrowest sense. On the basis of the previous search strategy, a total of 59 studies were obtained from the database. By careful reading of abstracts and complete manuscripts, with the defined topic of interest for discussion, 12 manuscripts were selected (Fig. 1; Table 1).

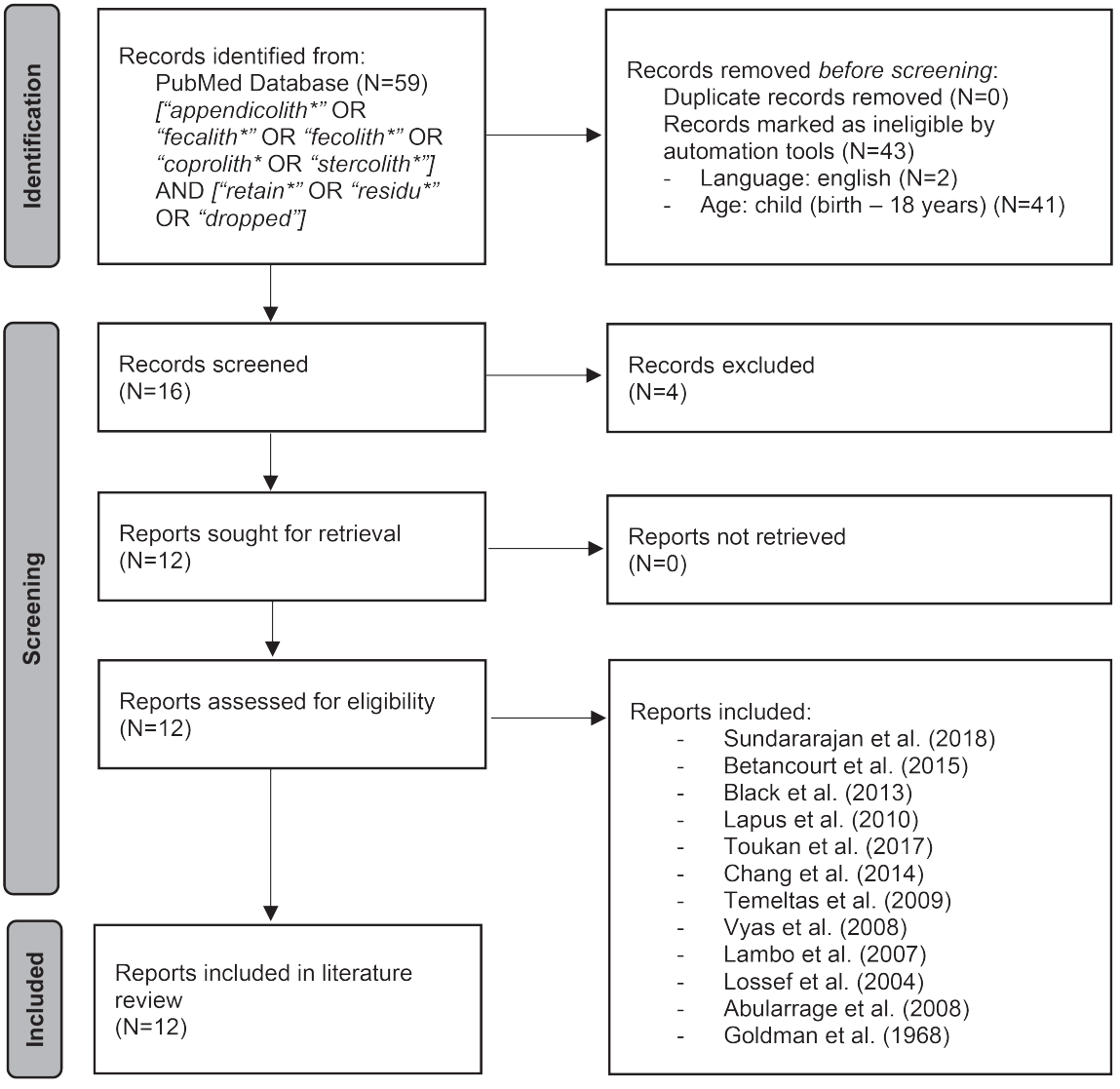

Fig. 1. *PRISMA Flow Diagram.*

Table 1. Review of Cases of Retained Appendicolith

Manuscript	Gender of the patient	Age of the patient (years)	Type of surgery (open / laparoscopic)	Location of the abscess	Complication time from initial surgery	Radiological method by which appendicolith was found
Sundararajan et al. (2018)	Male	11	Open	Subpulmonic abscess and pneumonia	2 weeks	CT
Betancourt et al. (2015)	Female	2	Laparoscopic	Empyema	3 weeks	US / CT
Black et al. (2013)	Female	6	Laparoscopic	Perihepatic abscess	2 weeks	US / CT
Lapus et al. (2010)	Male	10	Laparoscopic	Retroperitoneal abscess	2 years	CT
Toukan et al. (2017)	Male	15	Laparoscopic	Liver abscess and pneumonia	6 months	CT
Chang et al. (2014)	Male	15	Open	Periappendiceal abscess	Immediately	CT
Temeltas et al. (2009)	Male	14	Open	Gluteal abscess	4 years	CT
Vyas et al. (2008)	Female	17	Laparoscopic	Tubo ovarian abscess	6 months	CT
Lambo et al. (2007)	Male	15	Laparoscopic	Retroperitoneal abscess	1 years	US / CT
Lossef et al. (2004)	Female	11	Laparoscopic / Open	Posterior subhepatic abscess (Morison's pouch)	4 months	CT
Abularrage et al. (2008)	Male	10	Open	Periumbilical abscesses	1 week	CT
	Female	3	Laparoscopic	Periappendiceal abscess	10 days	CT
Goldman et al. (1968)	Male	11	Open	Periappendiceal abscess	4 months	X-ray Sinogram and barium enema

CT=Computed tomography; US=Ultrasound.

Case Report

We present the case of an eight-year-old boy who was referred to our clinic with an acute abdomen. In the previous two days he had been admitted and treated in another hospital due to fever (38° C) and pain in the right hip. Laboratory findings were as follows: leukocytes (Leu) 9.17×10^9/L, C-reactive protein (CRP) 83.2 mg/L, procalcitonin (PCT) 1.27 ng/mL. Ceftriaxone was prescribed. An abdominal ultrasound indicated a perforated appendix. With the development of peritonitis, he was referred to us. Upon admission, the indication for emergency surgical treatment was immediately established. Laboratory findings were as follows: Leu 9.54×10^9/L, CRP 153.2 mg/L, PCT 5.02 ng/mL.

An open appendectomy was performed (grid-iron incision). The gangrenous perforated appendix was shown and removed. An abdominal aspirate was taken for microbiological analysis and a drain was placed. Gentamicin / Metronidazole therapy was initiated. *Bacteroides spp.* and *Escherichia coli* which are sensitive to the initiated therapy were isolated in the aspirate. On the fourth postoperative day, the drain was removed with the following laboratory findings: Leu 22.73×10^9/L, CRP 152.7 mg/L, PCT 1.10 ng/mL. The boy felt better day by day. On the sixth postoperative day, an abdominal ultrasound was performed showing several smaller purulent collections in the pelvis between 1.5 and 3 cm in size. A hyperechoic subhepatic echo was verified to the right (posterior echo measuring 15 mm) corresponding to a retained appendicolith. Along with the appendicolith, hypoechoic fluid content was seen. The therapy that had already been initiated was continued. On the ninth postoperative day the findings were as follows: Leu 14.31×10^9/L, CRP 11.6 mg/L, PCT 0.21 ng/mL.

Fig. 2. *Extracted appendicolith.*

The boy seemed to be recovering well, but on the eleventh postoperative day there was an increase in temperature (39° C) with abdominal pain. A repeat ultrasound scan showed aperistaltic loops of bowels, and a denser subhepatic collection with the previously verified appendicolith. Laboratory findings were as follows: Leu 24.39×10^9/L, CRP 56 mg/L. Surgical treatment was initiated to drain the abscess and remove the retained appendicolith. A midline laparotomy was performed. Three abscess collections were found: pericecal, retrovesical, and subhepatic, in which drains were placed. The subhepatic appendicolith was found and retrieved (Fig. 2). Aspirates were taken again for microbiological analysis and therapy was changed to Piperacillin / Tazobactam. *Enterococcus faecium, Escherichia coli* and *Streptococcus constellatus,* which are sensitive to the new therapy, were isolated in the aspirate. On the fifth postoperative day, the drains were removed with the following laboratory findings: Leu 9.91×10^9/L, CRP 18.3 mg/L, PCT 0.80 ng/mL. On the tenth postoperative day, the boy was in good general and local condition (Leu 7.72×10^9/L, CRP 3.6 mg/L, PCT 0.07 ng/mL). A repeat abdominal ultrasound scan finding showed an orderly abdominal finding. Five months later the boy was completely without problems.

Discussion

A review of the literature revealed different localizations of appendicoliths and, consequently, different clinical symptoms, which clearly indicates that a retained appendicolith should never be neglected in the differential diagnosis after an appendectomy, whether open or laparoscopic. It is also important to note that in the case of a suspected retained appendicolith, radiological diagnostics must often be extended beyond the abdominal region. This fact is indicated by the cases of Sundararajan et al. (5) and Betancourt et al. (6).

In the first case (5), a chest X-ray showed a homogeneous opacity, while ultrasound examination of the thorax showed a thick multiloculated turbid fluid in the posterolateral aspect of the left pleural cavity. The child underwent video-assisted thoracoscopic surgery (VATS) which showed localized empyema. The crust around the lower lobe failed to clear. After a CT, a left thoracotomy was done and revealed a thick-walled subpulmonary abscess surrounding an appendicolith. In another case (6), CT scan of the chest verified the presence of an empyema with a calcified focus. The patient was treated by placing an ultrasound-guided chest drain. The appendicolith was removed under fluoroscopy guidance using basket retrieval, which is certainly a less invasive method than thoracotomy.

If respiratory symptoms occur and an appendectomy has been performed in the patient's history, these two cases clearly indicate that we must suspect a retained appendicolith in the chest as a differential diagnosis. If the pain is predominantly localized in the upper right quadrant, we must suspect perihepatic or liver localization of a retained

appendicolith that has formed an abscess. In the case of a six-year-old girl (7), the surgeon considered both surgical extraction and conservative treatment. However, due to the relatively small size of the abscess, the patient was treated with only IV antibiotics. In our case, despite the verified appendicolith, we opted for conservative antibiotic treatment because the clinical condition seemed to be improving day by day. As the clinical condition worsened on the eleventh day, we were forced to perform immediate surgery and remove the appendicolith.

In a 15-year-old boy, a chest X-ray showed consolidation of the right lower lobe with minimal pleural effusion, analogous with previous cases (5, 6). Ultrasound showed a liver abscess, while CT showed solid calcification. Ultrasound-guided percutaneous drainage was performed, while laparoscopically guided drainage of the abscess was performed a few days later. An appendicolith was found and removed (8). In an 11-year-old girl, abdominal CT showed an abscess in the posterior subhepatic space (Morison's pouch) containing a focal calcification that was believed to be a retained appendicolith (9).

The most favourable situation is when the appendicolith does not wander far, but remains in the periappendicular region. The importance of immediate removal of appendicoliths was emphasized by Chang and Cheng (10). In their 15-year-old patient, a CT scan of the abdomen showed an abscess containing a free appendicolith medially from the appendix. Analogous to our case, after 10 days of antibiotic therapy and removal of the drainage tube on the eighth postoperative day, the patient was discharged without any complications.

In a 10-year-old boy, after unsuccessful CT-guided percutaneous drainage of the abscesses with pigtail catheters, and treatment with IV antibiotics and confirmation of a retained fecalith, the patient was brought to the operating room for laparoscopic drainage of the abscess and retrieval of the appendicolith (11). The same authors in the second case state that a CT scan showed a locally perforated appendicitis and a 5-mm focal calcification consistent with a fecalith, but by laparoscopic appendectomy, the fecalith could not be identified due to obscuration by the bowel. Ten days later a CT scan showed two abscesses and a retained fecalith. The patient was brought back to the operating room for drainage and retrieval of the fecalith (11).

In the case of an eleven-year-old boy (12), four months after appendectomy, purulent drainage appeared through the lower angle of the wound. A plain X-ray of the abdomen, which was requested 1 month later, revealed an oval laminated calcification situated in the right lower quadrant. The boy was readmitted to the hospital and surgical exploration revealed a fecalith in the center of a chronic abscess cavity outside the cecal wall on its inferior aspect.

An appendicolith may also move to the retroperitoneum (13), which is very inconvenient for surgeons. A ten-year-old boy had a solid mass in the right paralumbar lateral region, which was sensitive to palpation, but without erythema, heat or fluctuation. An antalgic gait was observed. CT examination of the abdomen and pelvis with intravenous contrast showed a large retroperitoneal mass with variable low attenuation and multiple calcifications. He was taken to the operating room for ultrasound-guided drainage and a retroperitoneal mass biopsy. The pus was drained, and a solid egg-shaped mass was extracted laparoscopically. Two months after laparoscopic appendectomy and progression of right shoulder pain in a 15-year-old boy, CT confirmed the presence of a retrohepatic collection. The patient underwent US-guided percutaneous drainage of the retrohepatic collection (14).

In a 14-year-old boy, CT revealed a gluteal abscess with an intra-abdominal component, and a small, round calcified mass located within the abscess. After removal of the intra-abdominal adhesions between the appendix, retroperitoneal enlargement of the abscess component was found. A gluteal incision was used for drainage of the abscess and removal of the appendicolith (15). An unusual complication of perforated appendix occurred in a 17-year-old woman. A tubo-ovarian abscess developed secondarily by migration of an appendicolith

into the right fallopian tube after interval laparoscopic appendectomy. Drainage of purulent and gelatinous material was unsuccessfully attempted and the decision was made to perform a right salpingo-oophorectomy. The partially calcified appendicolith was dissected and freed, while the noncalcified portion of the appendicolith remained adherent to portions of the fallopian tube (16).

Conclusion

Our case, and the cases presented from the literature, clearly indicate that retained appendicolith, as a complication, will almost certainly form an abscess, either within a few days or a few years. Localizations can be various. In cases of perforated appendix, retained appendicoliths must always be considered in differential diagnosis as a possible cause of various symptomatologies. Upon confirmation by ultrasound or CT, the surgeon must find a way to remove the appendicolith and resolve the abscess.

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Conflict of Interest: The authors declare that they have no conflict of interest.

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