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Review Article

Dropped Appendicolith: Complications and Management

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E-mail: ramyayethadka@gmail.com**Abstract**

Appendicitis is one of the most common acute abdomen presenting to emergency department and appendicectomy is the commonest emergency laparotomy performed worldwide. Laparoscopic appendicectomy is gaining popularity nowadays due to its advantageous over open procedure. But the complications such as postoperative abscess formation are more common with laparoscopic approach, the culprit being dropped appendicolith in most cases. This review explains about the presentation of dropped appendicolith, complications, prevention and the management of the same.

Keywords: Appendicitis, appendicectomy, appendicolith**1.Introduction**

Appendicolith is also known as faecolith, coprolith, stercolith, enterolith, or concretion. It represents calcified deposit in the appendix.

Wegeler[1] was the one who used the term 'calculosi concrementi' to describe hard faecal concretions, which he found in the lumen of the appendix. Forbes and Lloyd-Davies[2] defined the 3 terminologies: faecal pellet, calcified faecolith and calculi with respect to calculous disease of appendix based on the calcium content. They defined appendicolith as calcified ovoid faecal mass which is moderately hard in consistency, light or dark brown colored which is crushable with a slightly granular surface and nodules of calcification.

Appendicolith is composed of firm faeces and some mineral deposits. It contains fats (coprosterols), inorganic salts (calcium phosphate) and organic residue (vegetable fibres) in a proportion of 50%, 25% and 20%, respectively [3]. Its hardness is directly related to the quantity of calcium in it. The presence of a small scybalum of inspissated faecal material within the appendix lumen acts as a nucleus which irritates the appendicular mucosa to cause secretion of excess amount of calcium salt. Thus

calcium salts and faecal debris become layered around the fecal nucleus to form the appendicolith[4].

Most appendiceal fecaliths are found in the paediatric and young adult age groups and more frequently in men than in women[5]. It is stated that the low-fibre diet has been associated with increased risk of faecalith formation[6].

The importance of appendicolith lies on its association with development of appendicitis. Appendicolith is found in approximately 1/3rd of patients with appendicitis[7] and the chance of developing appendicitis is 5-7% in the presence of faecalith. The mechanism of development is by luminal obstruction and by destroying the mucosa with its local mass effect[8]. Appendicolith has also been implicated in recurrent right iliac fossa pain[9] and appendicular torsion[10]. It is associated with complicated appendicitis, being present in around 18% of perforated appendicitis[11][12] and are associated with earlier and higher rates of perforation in children[13].

1.1. Dropped appendicolith

Appendectomy is one of the most common emergency laparotomy performed worldwide. Kurt Semm performed first laparoscopic appendectomy in 1980[14]. Since then the use of laparoscopic approach has become increasingly common as it offers several potential advantages over the traditional open approach. However the important complication like postoperative abscess formation and appendicolith expulsion rate are more with laparoscopic approach.

Retained, or dropped appendicolith is a rare complication that can occur as a consequence of stone expulsion from the appendix before surgery due to perforated appendix or during open or laparoscopic appendectomy[15][16].

The appendicoliths can drop at the time of resection of the appendix or during forceful extraction through the umbilical port. Sites where retained faecalith can be found are most commonly in the pelvis[17] or Morrison's pouch[16][18]. In rare instances, the appendicolith has been localized in the iliopsoas compartment[19], gluteal region[20] or subcutaneous plane[21]. The combination of pneumoperitoneum and irrigation used during laparoscopic appendectomy might be responsible for the migration of appendicolith and for the unusual sites of presentation. Time between appendectomy and the diagnosis of dropped appendicolith varies from 10 days to several years.

2. Complications of Dropped Appendicolith

Dropped appendicolith is important due to its associated complications. Due to its pressure effect and potentially infectious nature following complications have been reported.

2.1 Intraabdominal abscess

Postoperative abscess formation is approximately five times more frequent with laparoscopic approach than in open surgery[22]-[24]. In cases of perforated appendicitis, the prevalence of post-operative abscess formation is up to 20 per cent[20]. Retained faecalith has been found in 42% of appendiceal abscesses[11][12]. The abscess formation is due to the potentially infectious appendicolith which harbours bacteria. Patient presents with pain abdomen, fever with chills and other constitutional symptoms. History of appendectomy in the past will be present in most situations. The sites of abscess formation which are documented in the literature are subhepatic abscess[16][18] pelvic abscess[17], tubo-ovarian abscess[25], paracaecal[26], psoas abscess [19] and gluteal abscess[20][27].

2.2 Delayed wound healing

Monfore and Mortegut[28] described a case of delayed wound healing following appendectomy, where a retained faecalith was found to remain free in the peritoneal cavity. Wells[29] reported a case in which the operative incision failed to heal following drainage of abscess without appendectomy and then faecalith was found remaining in the appendix. Delayed healing is due to the constant irritant nature of the faecalith.

2.3 Fistula

A case has been reported where in a patient 4months following appendectomy presented with fistula in the wound site[30].

3. Investigations

Weisflog [31] in 1906 first described the radiographic characteristics of calcified appendicolith.

3.1 Plain abdominal radiography

Appendicolith can be detected by plain abdominal radiographs in 10 to 15% of patients with acute appendicitis. Diagnostic value is well marked lamination with relative translucency of the central part. Mobility, when present, is also a useful diagnostic sign[2].

3.2 Ultrasound abdomen

On ultrasound, calcified appendicolith is seen as a hyper echoic focus at caeco-appendiceal junction. It is cost effective, avoids radiation exposure and helpful while retrieving the appendicolith by percutaneous technique.

3.3 Contrast enhanced computerised tomography [CECT]

It is the investigating modality of choice for the diagnosis and for the preoperative localisation of appendicolith and postoperative abscess. The presence of an appendicolith per se is not considered diagnostic for acute appendicitis in the absence of pericecal inflammatory changes or appendiceal wall enhancement. 2-13% of asymptomatic individuals have appendicolith on routine abdominal CT[32][33]. Of all the CT signs of acute appendicitis, the presence of appendicolith has been reported to have 100% specificity but low sensitivity (44%)[34]. CT findings of abscess, extraluminal gas, and ileus have the highest specificity but low sensitivity[35] in comparison to the detection of an intraluminal appendicolith which has low sensitivity and specificity in the detection of perforation. Though the presence of an appendicolith is significantly associated with appendicitis, an appendicolith alone is insufficient to diagnose acute appendicitis on CT[36]. However, when associated with abdominal

pain, there is 90% probability of acute appendicitis in patients[37] besides a 50% higher risk of appendiceal perforation. The typical imaging description of symptomatic dropped appendicolith is an abscess containing one or more high-attenuation foci.

4. Differential diagnosis

Other causes of calcific areas of high attenuation in the abdomen include dropped gallstones, calcified epiploic appendagitis, dropped surgical clips, and calcified mesenteric lymph nodes. Among the reported causes prevalence of dropped appendicolith is much less common than dropped gallstones, which have been reported to spill out of the gallbladder in as many as 40% of cholecystectomies [38-40].

5. Prevention

Every attempt should be made to avoid spillage of appendicolith during surgery. Careful dissection should be strictly adhered to. Double ligation of appendicular base has been associated with less chance of spillage[41]. During extraction, use of retrieval bags to retrieve the appendix will reduce the chances of spillage during extraction and avoids inadvertent spillage to or contamination within port site wounds.

6. Management of dropped appendicolith & Intraabdominal abscess

Most intraabdominal abscess due to retained appendicolith can be treated with percutaneous drainage and antibiotics. Though this treats the abscess, it does not necessarily remove the appendicolith which is the root cause and nidus of infection. Thus in cases of retained appendicolith, the definitive management involves removal of the appendicolith[16][21]. Failure to do so may result in recurrent intra-abdominal abscesses, wound infection and fistula formation [42].

Failure rates of initial non-operative approaches for ruptured appendicitis range from 6%-26% [43-47] and the presence of an appendicolith is predictive of failure of initial non-operative management with elective interval appendectomy. The following methods have been advocated for the retrieval of appendicolith.

6.1 Open surgical methods

Appendicoliths are usually small, are often surrounded by a necrotic rind of tissue, and are sometimes located in inaccessible recesses of the peritoneum. Thus surgical localization and removal will be technically difficult. Thus various

preoperative localisation procedures have been described.

CT-Guided Kopans modified Hookwire Placement for Preoperative Localization of an Appendicolith: Preoperative CT-guided localization of small inaccessible retained appendicoliths can be readily performed using a Kopans hookwire. In 2005 Steven[48] used the Kopan hookwire for the preoperative localisation of dropped appendicolith in a patient who presented with abscess in morrison's pouch. Kopans hookwire is a 20 gauge needle which is used for localizing occult breast lesions, preoperative localization of small musculoskeletal lesions, small lung lesions, lymph nodes and soft-tissue neoplasms. Precise hookwire localization facilitates surgical removal of the appendicolith.

Ultrasound guided localization using Harpoon needle: Yahia Assiri [49] in 2012 used harpoon needle for the preoperative localisation of perihepatic appendicolith in a patient followed by open surgery.

These procedures may be effective if open surgery is planned to remove an appendicolith, but may be ineffective for a laparoscopic approach. The needle localization procedure requires an anesthetic procedure in the CT suite, and the insertion of a long hook wire or needle may be very invasive and time consuming which are the drawbacks of these methods.

6.2 Laparoscopic removal

Laparoscopic removal of an appendicolith with the use of Laparoscopic ultrasound (LUS): In a study done by Seung *et al*[50] in 2006, laparoscopic probe with a flexible tip fitted with a 7.5-MHz linear transducer was introduced through the right paramedian port to reach the right subhepatic space for localization of an appendicolith. LUS allowed easy localization of the appendicolith and its subsequent laparoscopic removal. It is helpful for localizing a small appendicolith that is buried in fibrotic and necrotic tissue and avoiding time-consuming adhesiolysis to localize an appendicolith.

6.3 Percutaneous retrieval

In the era of minimally invasive surgery and intervention radiology, percutaneous route for the appendicolith retrieval is becoming popular as most of the mentioned techniques can be done under local anaesthesia and the post procedure complications are minimal. Although open surgical incision and drainage with retrieval of the appendicolith is the preferred method of treatment, in the recent years, percutaneous retrieval has gained greater acceptance.

O'Shea and Martin [51] retrieved an appendicolith via a fistulous tract arising from a

chronically inflamed abscess collection secondary to appendicitis.

Rasuli *et al*[42] also used a percutaneous approach for removal of faecalith with pelvic abscess. Under fluoroscopic and endoscopic guidance a high-pressure balloon was inserted over a hydrophilic wire via a 3-cm skin incision. The balloon was inflated, and a 34-F sheath was advanced into the abscess cavity. A flexible urologic cystoscope was used to locate the appendicolith, which was subsequently removed using a urologic stone extractor.

Singh *et al*[26] used a stone basket passed through a 12-F sheath to remove a small appendicolith which had formed paracaecal abscess.

In 2012 Hegarty *et al*[52] did retrieval of the appendicolith in a patient who presented with abscess in the ileopsoas compartment. Under ultrasound guidance collection was performed using a One-Step Needle. Sequential dilation up to 26 F was performed using an Amplatz Renal Dilator Set over an Amplatz wire with placement of a 26-F sheath. The stone was captured using a Captura Helical Stone Extractor.

Percutaneous retrieval is easy and has higher patient acceptance. But faecaliths may be fragile and can break into small irretrievable fragments once the basket is tightened around the stone.

7. Conclusion

Complications arising from the dropped appendicolith are rare and can present several years after appendectomy. Careful handling with extraction of the appendicular specimen will minimize this complication. Once the postoperative abscess has been developed, detection with the use of CECT or ultrasonography should be done and goal of treatment should be removal of appendicolith.

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