Revised abstract

Amyand’s hernia (AH) is a rare condition in which the vermiform appendix is included in the sac of an inguinal hernia, regardless of whether the appendix appears normal or is inflamed. Most cases of AH are diagnosed intraoperatively at the time of inguinal hernia repair, as its clinical diagnosis is difficult and the role of computed tomography (CT) and other diagnostic imaging is not well described in the literature.

In this report, we describe a 79-year-old female who presented to the emergency department with nonspecific symptoms of nausea, vomiting, and constipation. An emergency CT scan of the abdomen showed a perforated appendix trapped in the sac of a right-sided inguinal hernia but no intra-abdominal sepsis, and the patients’ symptoms and physical examination were nonspecific and suggested neither a strangulated hernia nor appendicitis.

Complicated appendicitis in an AH is a surgical emergency. An accurate diagnosis is necessary for proper triage of patients and appropriate management. CT plays an important role in revealing an unsuspected diagnosis. It is crucial that radiologists are aware of this rare presentation of the appendix in an inguinal hernia sac and familiar with other types of AH.

Original abstract

Amyand`s hernia (AH) is a rare entity that refers to the presence of a vermiform appendix within the sac of an inguinal hernia, regardless of the normal or inflamed status of the appendix. Most cases are diagnosed intraoperatively at the time of repair of an inguinal hernia. The role of computed tomography (CT) in diagnostic imaging of AH is not well described in the literature.

We report a rare case of acute appendicitis complicating AH in a 79-year-old female patient, who presented to the emergency department with nonspecific symptoms of nausea, vomiting, and constipation. The condition was identified preoperatively through an emergency CT scan of the abdomen. Symptoms and physical examination were non-specific and suggested neither strangulation of hernia nor appendicitis.

**Introduction**

An inguinal hernia containing the appendix is referred to as Amyand’s hernia (AH), which is named after Clausius Amyand, the surgeon who performed the first successful appendectomy of a perforated appendix in an inguinal hernia (1,3). AH represents only 1% of all inguinal hernias, and an inflamed appendix within AH is even rarer and is seen in only 0.07–0.13% of cases (2,4).

Cases of acute appendicitis in a hernial sac have been reported in patients ranging from 3 weeks to 88 years old.

While inguinal hernias occur more in male patients, acute appendicitis in the sac of an inguinal hernia occurs more frequently in female patients (4,10). Losanoff and Basson created a scale that classifies AH as follows: type 1, the presence of a normal appendix within an inguinal hernia; type 2, acute appendicitis within an inguinal hernia without intra-abdominal sepsis; type 3, acute appendicitis within an inguinal hernia with either abdominal wall or intra-abdominal sepsis; and type 4, acute appendicitis within an inguinal hernia with any abdominal pathology (5,6).

**Clinical case and imaging findings**

A 79-year-old female with a past medical history of stroke, atrial fibrillation, and hypertension without any known past abdominal surgery presented with a 3-day history of nausea, vomiting, and constipation. The patient was moderately somnolent and afebrile, and her vital signs were within the normal range. A routine laboratory panel demonstrated a moderately elevated white blood cell count of 19.7 x 109 cells/L (3.5–8.8 x 109 cells/L) and C-reactive protein of 207 mg/L (<10 mg/L), which suggested an infection. Her abdominal physical exam was notable for diffuse tenderness in the lower abdominal quadrants and bilateral reducible inguinal hernias with mild tenderness on the right side but no rebound tenderness.

The patient immediately underwent an abdominal computed tomography (CT) scan with intravenous contrast to rule out intra-abdominal abscess and obstruction.  The CT scan showed an inflamed appendix (Figures 1–3), which was trapped in a right-sided inguinal hernia sac. The appendix was surrounded by fluid and extraluminal gas, indicating perforation (Figures 1–3). All findings suggested perforated appendicitis within an inguinal hernia (i.e., AH type 2 according to Losanoff and Basson) (5). Additionally, there was a large left-sided inguinal hernia containing the bowel without signs of strangulation or obstruction (Figure 2, arrow B). The patient underwent an emergency appendectomy via an inguinal incision, and the intra-operative findings confirmed a gangrenous appendix in the lateral right inguinal hernia surrounded by pus and fecal contamination, as suggested on the pre-operative CT scan. The patient made an uneventful recovery and was discharged on postoperative day 5 in stable condition.

**Discussion**

Traditionally, almost all cases of AH are diagnosed intraoperatively (2). Despite the increased use of diagnostic imaging, especially CT, as a diagnostic tool in patients presenting with acute abdomen, the vast majority of cases are still diagnosed during surgery, as most AHs present with either the symptoms of an incarcerated hernia requiring emergency surgery or are incidentally found during an elective hernia procedure. The lack of tenderness over McBurney’s point and other distinctive signs and symptoms of acute appendicitis make preoperative diagnosis of inflamed AH through physical examination difficult (8).

Unlike other bowel-containing inguinal hernias that may cause ileus, AHs usually present without signs of obstruction, and inflammation markers usually remain within the normal range (9). In this case, however, inflammation markers were elevated. The differential diagnosis for AH may include strangulated hernia, Richter’s hernia, orchitis, rectocele, inguinal lymphadenitis, epididymitis, and hemorrhagic testicular tumor (9).

The role of CT in AH diagnosis is not well described in the literature. Vermillion et al. (10) and Ashe et al. (11) previously reported cases in which preoperative CT successfully identified AH.

The number of AHs with appendicitis that were correctly and preoperatively diagnosed by CT appears to be increasing (12,13); however, almost all successful preoperative diagnoses of AHs are made based on scans performed to rule out other more serious pathologies, such as bowel obstruction or strangulation (12).

Our case and previously reported cases in which AH was accurately and preoperatively diagnosed by CT scan demonstrate that CT scans play an important role in revealing an unsuspected diagnosis. Although AH is an extremely rare condition, radiologists should be aware of this unusual location of the appendix and should be familiar with the subtypes of AH, as these subtypes determine surgical management.

Any inguinal hernia that contains the bowel is easily detected with axial CT; however, sagittal and coronal reconstructions may aid the diagnosis and classification of AH (12,13).

A blind-ending tubular structure trapped in an inguinal hernia sac is considered a pathognomonic CT sign of AH. Wall thickening, hyperemia, and peri-appendiceal fat stranding suggest an inflamed appendix regardless of the anatomical location of the appendix (1,7). Furthermore, the presence of fluid and extraluminal gas suggests perforation.

**Conclusion**

AH is a rare condition, and complicated AH with an inflamed appendix is even rarer and more difficult to clinically diagnose. Complicated appendicitis in AH is a surgical emergency, and accurate diagnosis and rapid triage of patients for appropriate management reduce the rate of complications. CT is a valuable diagnostic tool in the pre-operative work-up for AH.

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Classification of Amyand Hernias, after Losanoff and Basson 5,6

| **Classification** | **Description** | **Surgical management** |
| --- | --- | --- |
| Type 1 | Normal appendix within an inguinal hernia | Hernia reduction, mesh repair, appendicectomy in young patients |
| Type 2 | Acute appendicitis within an inguinal hernia, no abdominal sepsis | Appendicectomy through hernia, primary repair of hernia, no mesh |
| Type 3 | Acute appendicitis within an inguinal hernia, abdominal wall, or peritoneal sepsis | Laparotomy, appendicectomy, primary repair of hernia, no mesh |
| Type 4 | Acute appendicitis within an inguinal hernia, related or unrelated abdominal pathology | Manage as types 1 to 3 hernia, investigate or treat second pathology as appropriate |