Review

Amyand’s hernia: a review

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Abstract

BACKGROUND: The presence of a vermiform appendix in an inguinal hernia sac is known as Amyand’s hernia. The aim of this systematic review was to gather information concerning its prevalence, clinical image, diagnosis, and treatment.

DATA SOURCES: The MEDLINE database was thoroughly searched using the keyword “Amyand’s hernia.” Additional articles were gathered and evaluated.

CONCLUSIONS: The true prevalence of Amyand’s hernia seems lower than classically described. Its usual clinical image is identical to that of an incarcerated hernia, and thus it is almost impossible to diagnose preoperatively, although ultrasound and computed tomography can help. Treatment includes hernioplasty with or without appendectomy and/or mesh repair depending on the vermiform appendix’s inflammation status, the patient’s general condition, and other factors. Amyand’s hernia generally has a good prognosis, although serious complications have been described. Surgeons should be prepared if they encounter Amyand’s hernia because appropriate treatment ensures hernia repair without complications and with avoidance of recurrence.

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Protrusion of a vermiform appendix in an inguinal hernia sac is known as Amyand’s hernia.1–3 Amyand’s hernia is named after Claudius Amyand, the first surgeon who described and treated it, performing simultaneously the first appendectomy.4 Amyand’s hernia is classically described to occur in 1% of all inguinal hernias, and appendicitis in an Amyand’s hernia accounts for .1% of all cases of appendicitis.1,2,5 Amyand’s hernia is thus a rare situation. Modern research indicates that its true prevalence is even smaller, between .4% and .6% of all inguinal hernias, while in children, its prevalence might reach 1%.3,6–8

The clinical image of Amyand’s hernia resembles that of an incarcerated hernia, and thus it is difficult to diagnose clinically.7,9,10 Amyand’s hernia can be diagnosed preoperatively using ultrasound and computed tomography (CT).11,12

The pathophysiology of this rare situation is not known, but the vermiform appendix is thought to herniate through a patent vaginal process. A fibrous band connecting the hernia sac and the testis has sometimes been found and possibly participates in the vermiform appendix’s attraction and guidance. The vermiform appendix can remain in the hernia sac without symptoms throughout a patient’s lifetime. It is possible that the neck of the hernia can strangle the vermiform appendix and cause vascular obstruction, appendicitis, perforation, and peritonitis.2,13
Left-sided Amyand’s hernia has also been described and is thought to occur because of situs inversus, intestinal malrotation, and floppy cecum. Floppy cecum is the single clinically confirmed situation.

Treatment of Amyand’s hernia includes appendectomy and hernia repair. Appendectomy is deemed necessary only if the vermiform appendix is inflamed, perforated, or gangrenous. The use of mesh should be avoided in the case of appendicitis or a contaminated surgical field, because it can cause surgical field infection, recurrence of hernia, or mesh sepsis.

Modern research has shown that Amyand’s hernia is a benign situation. Although some serious complications, including necrotizing fasciitis, have been described, morbidity and mortality after hernia repair are very low. Coexistence of appendiceal carcinoma and Amyand’s hernia has been described.

We hope that this report will help in clarifying the pathophysiology, clinical image, and treatment of Amyand’s hernia.

**History**

The existence of a vermiform appendix in an inguinal hernia was first described by Claudius Amyand (1660 to 1740), the eponym of Amyand’s hernia. The name “Amyand’s hernia” is used irrespective of the vermiform appendix’s situation (normal, inflamed, perforated, or gangrenous). Amyand was a French refugee in England, a military surgeon and surgeon to Kings George I and George II. He was a distinguished surgeon, a fellow of the Royal Society, first principal surgeon to the Westminster Hospital, and a founder and first principal surgeon of St George’s Hospital. He became first warden and then master of the company of barber surgeons.

On December 6, 1735, at St George’s Hospital, Amyand treated an 11-year-old patient with a chronically inflamed appendix in an inguinal hernia. According to Amyand’s excellent report, the patient had “a fistula between the scrotum and thigh.” The “operation proved the most complicated and perplexing,” because the pathology consisted of a chronically inflamed appendix contained within the inguinal hernia sac and perforated by a previously swallowed pin. At surgery, the appendix was removed, the stump was ligated, and “so much of the hernia bag as had been detached from the skin, the Spermatics was cut off.” The patient recovered and was “discharged with a truss, which he was ordered to wear some time, to confirm the cure.” The patient survived, but the hernia recurred. The case was published in Philosophical Transactions of the Royal Society of London. The name “Amyand hernia” was first suggested by Creese in 1953, then by Hiatt and Hiatt in 1988, followed by Hutchinson in 1993, in recognition of Amyand’s early work.

Taking this description in consideration, Amyand was the first to perform an appendectomy. Other candidates for the origin of this operation are Mestivier (1757), Parker (1843), Hancock (1848), Tait (1880), Groves (1883), Symonds (1883), Kronlein (1884), Hall (1886), Morton (1887), and Treves (1887). However, Mestivier, Parker, and Hancock probably drained appendiceal abscesses without appendectomy, while Tait actually removed an inflamed appendix through an abdominal incision. Groves performed the first appendectomy in Canada in 1883 and Hall in the United States at Roosevelt Hospital in New York in 1886. Hall’s appendix was also perforated in a strangulated inguinal hernia: an Amyand’s hernia.

In 1937, Ryan reviewed all cases of Amyand’s hernia described and numbered them at 228. Since then, Amyand’s hernia has been described by a large number of case reports and a few original articles and reviews, making a large amount of information available. However, many of its characteristics remain obscure, as are questions over its pathophysiology, clinical image, and treatment. In this review, our aim is to gather knowledge on Amyand’s hernia and, if possible, answer some of these questions.

**Prevalence and characteristics**

Amyand’s hernia is classically described to account for 1% of inguinal hernias and .1% of cases of appendicitis. These numbers are based on older research. The rarity of this situation does not allow easy calculation of its true prevalence. Studying some of the largest series described in the literature (Table 1), it seems that the true prevalence is somewhat smaller, between .4% and .6%, while the prevalence of appendicitis in an Amyand’s hernia seems in fact to be .1%. This assumption has been also stated by other authors. In the pediatric population, Amyand’s hernia is about 3 times more common, and its prevalence can actually reach 1%, a difference probably based on certain anatomic characteristics. The latter are analytically discussed later.

Amyand’s hernia is, as expected, more common in male patients and presents a bimodal age distribution in neonates and in patients aged >70 years. It is commonly an indirect hernia, although direct Amyand’s hernia has been also described. The appendix can be accompanied by the cecum and/or right colon. This information was estimated in Ryan’s research, but since that time, it has not met with research interest, probably because it does not change treatment. Ryan stated that a vermiform appendix will be usually found alone in younger patients, accompanied by cecum and/or intestine in older patients.

**Clinical signs and symptoms**

The clinical image of Amyand’s hernia is that of an inguinal hernia and strongly depends on the situation of the vermiform appendix. Its usual appearance is that of a tender inguinal or inguinoscrotal lump. This is clinically indistinguishable from an incarcerated or strangulated inguinal hernia, so that a correct preoperative diagnosis
is rarely established. The usual duration of pain before admission to the hospital can be 24 hours in adults and 2 to 3 days in children. It has been stated that pain tends to be crampy and episodic and not dull, as is typical for hernia. Physical examination will usually reveal swelling in the right groin, pain, and tenderness. Depending on the vermiform appendix’s situation (normal, inflamed, perforated, or gangrenous) other symptoms that may appear are fever, vomiting, gastrointestinal symptoms, and bowel obstruction, but this connection is inconsistent, because the neck of the hernia will usually prevent the spread of inflammation and limit peritoneal irritation, making the clinical image duller than expected. Peritoneal irritation and older age are considered worse prognostic factors, while inflammation markers (white blood cell count, C-reactive protein) are inconsistently connected with the status of the vermiform appendix and thus are not considered reliable. Only 1 investigator has managed to diagnose Amyand’s hernia clinically before operation; diagnosis is usually made intraoperatively. The differential diagnosis includes strangulated hernia, strangulated omentocele, Richter’s hernia, inguinal adenitis, orchiepididymitis, incompletely descended testis, acute epididymitis, testicular tumor with hemorrhage, and acute hydrocele. Chronic appearance of Amyand’s hernia as chronic scrotal sinus has been described. Amyand’s hernia has also been referred to as recurrent hernia. Amyand’s hernia in pregnancy has been described. Description of Amyand’s hernia in a cadaveric specimen has proved that it can be asymptomatic during life. In older reports, mortality from Amyand’s hernia was 30% to 40%, but this seems exaggerated. In recent reports, Amyand’s hernia is not a cause of death, and all deaths are attributed to other comorbid situations. Necrotizing fasciitis as a dangerous and rare complication of Amyand’s hernia has also been described. In comparison with appendicitis, the prognosis of Amyand’s hernia is better because of earlier diagnosis and limitation of inflammation inside the hernia sac.

Amyand’s hernia can rarely appear on the left side. Approximately 16 such cases have been described. Preoperative diagnosis of Amyand’s hernia, although almost impossible clinically, is feasible with ultrasound and CT. Akfirat et al were the first to report ultrasound diagnosis, while Luchs et al were the first to diagnose Amyand’s hernia on CT. The ultrasound image is that of a blind-ended

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<th>Study</th>
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Amyand’s hernia with concomitant pathology of vermiform appendix
Pathophysiology

With respect to the pathophysiology of Amyand’s hernia, there are 2 cardinal questions: first, whether the entrance of the appendix to the inguinal sac is an accidental event and, second, whether appendicitis is related to the hernia or just a coincidence.

Concerning the first question, some authors have reported a fibrous connection between the vermiciform appendix and testis. That, in combination with a patent vaginal process, could lead to the vermiciform appendix’s guidance and passage through the inguinal canal. Amyand’s hernia has been seen in neonates and also in 2 premature twins, indicating a congenital situation.

Most authors believe that there exists a connection between hernia and appendicitis. A hypothesis that cannot be proved because of the rarity of the situation, but is logically assumed, is that a retrocecal appendix enters a patent vaginal process and crosses the inguinal canal, probably by reaching the scrotum. In this case, because of muscle contraction and decrease of bowel pressure, appendicitis and ischemia of the appendix can occur. The appendix can be perforated or gangrenous. Luckily, because of the neck of the hernia sac, inflammation does not usually spread to the abdominal cavity but remains in it. Inflammation can also occur primarily or invade the cecum, if inside the hernia. Appendicitis can also be triggered by a foreign body in the appendix.

The advantage of this hypothesis is that it could explain differences in the prevalence and clinical image of Amyand’s hernia in children. Inguinal hernia is a common situation in neonates, because of greater patency of the vaginal process, but appendicitis is rare. Incarceration, if it occurs, will do so during first 6 months of life. In fact, almost one-third of all cases of appendicitis (a rare situation in neonates) are intrahernial, and 50% are premature. This clinical situation is justified by the fact that the inguinal orifice is large in younger patients, and thus the vermiciform appendix can easily herniate but not so easily incarcerate. Also, the vermiciform appendix’s orifice is wider in neonatal, meaning that it is more difficult for a foreign body to block the vermiciform appendix’s orifice and cause appendicitis. Still, at older ages, a lack of lymphoid tissue might prevent compression of the appendix.

It is worth mentioning that appendicitis can occur at a variety of anatomic sites in the abdomen, including the femoral hernia sac (De Garengeot’s hernia), obturator hernia, umbilical hernia, spigelian hernia, laparoscopic port site hernia, incisional site hernia, and diaphragmatic hernia.

Treatment

Classical treatment of Amyand’s hernia includes appendectomy, drainage of abscesses if existent, reduction of hernia, and hernioplasty through the same incision. In cases of inflammation, dissemination and peritonitis or cecum incarceration and ischemic right hemicolecotomy might be necessary. The first laparoscopic repair without mesh of an Amyand’s hernia was performed in 1999 by Vermillion et al and the first preperitoneal repair with mesh by Saggar et al in 2004. However, debate exists regarding 2 interesting issues: when prophylactic appendectomy should be performed and whether mesh repair is appropriate for Amyand’s hernia repair.

Appendectomy versus no appendectomy

In cases of appendicitis or perforated appendix, it is commonly accepted that appendectomy should be performed. Concerning the patient’s treatment, the presence of an inflamed appendix increases hospital stay and is inconsistently related to elevated inflammation markers.

Most authors believe that when the appendix is incidentally found and shows no signs of inflammation, prophylactic appendectomy is not necessary, whereas others choose to treat all their patients with appendectomy. Supporters of appendectomy claim that the appendix is prone to reherniate and that in younger patients, it might cause future appendicitis. On the contrary, others believe that appendectomy adds to operative risk and might disseminate an otherwise clean surgical field, leading to unnecessary risk for superficial or deep infection. Also, dissection of the base of the appendix might enlarge the incision, leading to weakening of tissues and probability of recurrence. Finally, possible use of the vermiciform appendix in a later operation (eg, urinary diversion) makes its conservation an option.

Mesh repair versus no mesh repair

In cases of appendicitis of perforated appendix, some authors suggest that mesh should not be used in hernia.
repair, because it increases the chance of wound infection, sepsis, and fistula formation and might lead to hernia recurrence. However, in noninflamed cases, many authors suggest the use of mesh.

Some others have placed mesh in perforated or mildly inflamed cases without any complications. Mesh repair has been reported for recurrent hernia, but its use is known to increase hospital stay. Repair of Amyand’s hernia with the BIO-A plug (W. L. Gore & Associates, Newark, DL) has also been referred. In special cases such as necrotizing fasciitis, alternative options can be used, such as trauma healing by itself of the use of skin grafts.

The above drove Losanoff and Basson to create an Amyand’s hernia classification and staging system (Table 3). According to those authors, hernia can be divided into 4 subtypes: (1) Amyand’s hernia with a normal-appearing appendix in the inguinal sac, (2) Amyand’s hernia with inflamed appendix, (3) Amyand’s hernia with a perforation of the vermiform appendix, and (4) complicating intra-abdominal pathology (eg, abscess or malignancy).

**Special cases**

There are some cases of Amyand’s hernia whose treatment raises discussion. For the coexistence of appendiceal malignancy and Amyand’s hernia, only a few case reports have been published, and authors followed guidelines referring to underlying malignancy. Neoplasms of the appendix are rare and found in <1% of appendix specimens. Most are carcinoid tumors (80%). It is worth mentioning that a number of mucoceles will be associated with colonic cancer of the left colon. In these cases, complete diagnostic staging should be performed. Mucoceles associated with cystadenomas are very rare and account for only .2% to .3% of all appendectomies.

Left-sided Amyand’s hernia is the second case requiring special consideration. Authors have been more prone to perform prophylactic appendectomy because a mobile vermiform appendix on a mobile cecum might reherniate or lead to atypical symptoms in a future appendicitis.

**Conclusions**

Amyand’s hernia is a rare situation. Although it has caused some concern in the past, recent reports show that if treated properly, it does not add morbidity or mortality beyond that of a typical inguinal hernia. Surgeons should examine carefully the vermiform appendix before proceeding with appendectomy and estimate the necessity of mesh repair depending on the vermiform appendix’s situation, characteristics of the hernia, and the patient’s demographics and special characteristics. In doubtful cases, appendectomy could be more justified in a child, carrying a high risk for appendicitis during life in comparison with an older patient. Although its prevalence is too low to enter in “first-line” differential diagnosis, pediatric surgeons should be more aware, because it seems more common in children.

Apart from its clinical importance, Amyand’s hernia is an interesting entity. Its long history, its rarity, the fact that it combines 2 common situations of general surgery, and last but not least the fact that it is an eponymous condition (always a cause of interest) will always make it a topic of discussion among surgeons and residents on surgical wards and during exams. It is certain that Amyand’s hernia has not revealed all its secrets. Questions remain regarding its true prevalence, its pathophysiology, its clinical appearance, and its treatment. More research and evidence are needed, which will be difficult because of its rarity. Until then, a high level of cooperation among surgeons, gastroenterologists, pediatrics, radiologists, and paramedical personnel is necessary to ensure optimal patient care.

**References**


