

C A S E R E P O R T

Where have I lost my appendix? An unusual finding of acute appendicitis within an irreducible umbilical hernia sac. Case report

Tiziana Pilia^{1,2}, Valentina Murzi^{1,2}, Eleonora Locci^{1,2}, Emanuela Gessa^{1,2}, Federico Corronca^{1,2}, Federica Frongia^{1,2}, Mauro Podda^{1,2}, Adolfo Pisanu^{1,2}

¹Department of Surgical Science, University of Cagliari, Italy; ²Emergency Surgery Unit, Cagliari University Hospital “Dulio Casula”, Cagliari, Italy

Abstract. An umbilical hernia is the bulging of the omentum, preperitoneal fatty tissue, or bowel out of the abdominal cavity through the umbilical orifice. The incidence of umbilical hernia follows that of the inguinal and the crural hernia. It is frequent in women, obese patients, smokers, and patients with ascites. It is an often asymptomatic pathological entity, which, however, can become complicated by giving rise to bowel obstruction, irreducibility, and ischemia. The finding of the appendix within an inguinal or a femoral hernia is called Amyand’s hernia and De Garengeot’s hernia, respectively. The presence of the appendix inside an umbilical hernia is instead a rare event. To date, 11 cases of complicated umbilical hernia containing the appendix have been described in the literature. We present the case of a patient admitted to our surgical department for an acutely irreducible umbilical hernia. Due to the failure to reduce the hernia with taxis and the persistence of hernia incarceration, the patient underwent laparoscopic surgery. Intraoperatively, catarrhal appendicitis was found within the hernia sac. After the appendectomy and the reduction of the hernia content, a laparoscopic mesh repair (Intra Peritoneal Onlay Mesh, IPOM) was performed. The postoperative course was uneventful, and the discharge happened on the second postoperative day. This case report highlights the importance of promptly intervening in complicated umbilical hernias. The laparoscopic technique has shown to be safe and effective because, in the absence of intra-abdominal enteric leakage, mesh repair by laparoscopy offered the advantage of an early postoperative recovery and time to return to daily activities. (www.actabiomedica.it)

Key words: umbilical hernia, appendicitis, laparoscopy, mesh repair, IPOM

Introduction

Umbilical hernias are relatively common, especially among infants and young children, with an overall incidence of 5% of all anterior abdominal wall hernias. They are caused by the incomplete closure of the anterior abdominal wall following the establishment of the peritoneal cavity. It can occur in childhood or adults and is often asymptomatic. Umbilical hernia in adults occurs more frequently in females (3:1 ratio), obese people over 40 years, smokers, and

patients with ascites (1). The contents of the hernia sac can consist of the greater omentum, preperitoneal fat tissue, and small or large bowel (2, 3). Unlike inguinal and femoral hernias, which may contain the appendix in cases of lack of fixation of the right colon and which have been given the eponyms Amyand’s hernia and De Garengeot’s hernia, respectively, the presence of the appendix within an umbilical sac is an infrequent event. Similar to the previous ones, it is related to a defect in the fixation of the cecum, resulting in its particular mobility.

The diagnosis of umbilical hernia is mainly clinical. However, in large defects, a diagnostic completion with abdominal computed tomography (CT) is recommended to investigate the defect size and the vitality of the hernia content.

To date, 11 cases of acute appendicitis within an umbilical sac are described in the medical literature (4-14). The first author to describe a case of appendicitis in an umbilical hernia was Doig in 1970 (4). All cases reported have been treated by laparotomy except one (11) (Table 1).

In this report, we present the case of a patient with bowel obstruction due to incarcerated umbilical hernia and an intraoperative finding of acute catarrhal appendicitis. The patient was treated with laparoscopic appendectomy and anterior abdominal wall repair with the IPOM (Intra Peritoneal Onlay Mesh) technique.

Case report

A 69-year-old woman with a long-lasting umbilical hernia presented to the Emergency Department of our hospital, reporting abdominal distension and stinging pain in the umbilical area lasting from 48 hours. The pain was of high intensity and radiated to all abdominal quadrants. The patient did not report nausea, vomiting, or fever symptoms. Regarding bowel habits, she referred to being constipated for an unspecified time. Her pathological history included arterial hypertension, hypercholesterolemia, bronchial asthma, and nickel allergy. She also reported previous surgery for bilateral carpal tunnel and an acute myocardial infarction about 11 months before admission. She was on antiplatelet therapy (clopidogrel and cardio aspirin) at admission. The patient was neither a smoker nor an alcoholic drinker. She had a BMI of 33.3 Kg/m² (moderate risk obesity, II class).

On admission, her vital signs revealed a blood pressure of 145/90 mmHg, a heart rate of 110 bpm, a body temperature of 36.9°C, and a blood oxygen saturation of 91% in ambient air. The abdomen was distended due to fat and meteorism, with a roughly oval paraumbilical bulging of about 5 cm in diameter, covered by hyperemic and tense skin. The hernia was painful on palpation and could not be reduced lying in the supine position and with taxis. Peristalsis was

present, with typical characteristics, and the bowel transit was open to feces and gas. Clinical examination of the heart and chest was regular. At blood tests, neutrophilic leukocytosis (White Blood Cells, WBC 11440, Neutr %), C-reactive Protein (CRP) of 62.2 mg/dl (n.v. 0-5), and procalcitonin (PCT) < 0.02 ng/ml (n.v. <0.5 ng) were found. The chest X-ray was unremarkable, while the abdominal CT scan showed a paraumbilical hernia, with a maximum defect size of 17 mm, engaged by adipose tissue with intra and perilesional edematous suffusion, and a minimal amount of fluid effusion as for inflammation (Figure 1).

Given the patient's hemodynamic stability, the regular bowel movement, and the assumption of dual antiplatelet therapy, it was decided, in agreement with the cardiologist, to suspend clopidogrel and antibiotic therapy was established with endovenous Piperacillin/Tazobactam 4 g+500 mg 3 times a day.

After two days, the patient complained of persistent abdominal pain and irreducible umbilical hernia swelling. Finally, it was decided to proceed with exploratory laparoscopy, hernia reduction, and abdominal wall repair with the IPOM technique.

Pneumoperitoneum was induced with a Veress needle at Palmer's point until an intra-abdominal operative pressure of 12 mmHg was established. Trocars were introduced (12 mm optical trocar in the left hypochondrium, 12 mm in the left flank, and 5 mm in the left iliac fossa) (Figure 2).

An exploratory laparoscopy was performed, which reported, in the umbilical site, a 2 cm hernia defect with omentum and appendix engagement in the context of a mobile cecum. Blunt adhesiolysis of the omental tissue within the hernia sac was carried out until the appendix, which was in a catarrhal inflammatory status, and the ischemic mesoappendix were reduced. We then proceeded to appendectomy through mesenteric dissection and section of the cecal base between Hem-o-lok clips. The umbilical defect was prepared, and an 8 cm diameter dual mesh was placed centered on the hernia defect with an overlap >3 cm on each side (Figure 3).

The mesh was then fixed with a double crown of non-absorbable metallic tacks. The appendix was sent for histological examination, which confirmed catarrhal appendicitis.

Table 1. Evidence synthesis from previous studies published in the literature

Author, Year, And Journal	Clinical Presentation	Radiological Findings	Treatment	Outcomes
<i>Doig, 1970, BMJ</i>	Red, painful, irreducible bulging in the umbilical region	None	Laparotomy, appendectomy, primary hernia repair	The patient was discharged after two weeks; follow-up at one month was unremarkable
<i>Arnatz, 2006, Abdom Imaging</i>	Erythematous, growing, and hot plaque in the anterior abdominal wall over the umbilical scar	Ultrasonography: irregular abscess in the umbilical region with an increase in peripheral vascularization, accompanied by edema in the subcutaneous tissue CT scan: a gas-forming abscess within an umbilical hernia sac with the cecum inside	Surgery (not specified)	None reported
<i>Huntington, 2015, Int J Colorectal Dis</i>	Sharp, non-radiating periumbilical pain and the appearance of a new periumbilical bulge	CT scan: small ventral hernia at the level of the umbilicus that contained a non-dilated appendix with inflammatory fat stranding	Antibiotic therapy (Ertapenem) + laparoscopic surgery (appendectomy and primary repair with absorbable sutures)	In the immediate postoperative period, the patient was taken intubated to the intensive care unit for respiratory fatigue and was extubated over the next few hours. The rest of the postoperative course was uneventful. The patient was discharged after three days
<i>Agarwal, 2013, Hernia</i>	2-day history of vomiting, severe pain, and irreducibility of a paraumbilical tender and erythematous swelling, tachycardia	Abdominal X-ray: did not reveal free air or air-fluid levels Ultrasonography: suggestive of aperistaltic bowel loops with wall thickening in the hernia sac	Laparotomy, appendectomy, and anatomical double-breasted repair of the fascial defect	The postoperative course was uneventful, and the patient was discharged after three days
<i>Lam, 2019, Ann R Coll Surg Engl</i>	Erythematous, incarcerated umbilical incisional hernia from previous laparoscopic sterilization. Nausea, not vomiting, and passing flatus	Abdominal X-ray: No bowel obstruction CT scan: demonstrated an incarcerated hernia with a 3-cm defect reported as containing small bowel	Appendectomy, open incisional hernia repair with an onlay prolene mesh secured with prolene sutures. A suction drain was placed over the mesh	The patient developed a wound infection that was managed successfully with antibiotics. The drain was removed, and she was discharged after four days
<i>Sigley, 2020, Cureus</i>	Painful, erythematous, umbilical mass, irreducible for four days	CT scan: large umbilical hernia, with suspected strangulated small bowel and intestinal pneumatosis	Laparotomy, appendectomy, hernia repair with biologic mesh	The patient did well in the postoperative period and was discharged home after three days

Table 1 continues

Table 1. Evidence synthesis from previous studies published in the literature. (continued)

Author, Year, And Journal	Clinical Presentation	Radiological Findings	Treatment	Outcomes
<i>Atabek, 2008, Ulus Trauma Acil Cerrahi Derg</i>	Fever, bilious vomiting, abdominal distension, and an erythematous irreducible periumbilical mass in an infant with a history of recent bilateral inguinal hernial repair in follow-up for an umbilical hernia	None	Appendectomy and primary closure of the umbilical defect	The postoperative course was uneventful
<i>Zormpa, 2019, BMJ</i>	One-day history of severe central abdominal pain associated with episodes of vomiting, and the presence of a palpable, irreducible mass over the umbilicus with erythema of the skin	CT scan: an inflamed appendix lying within the sac of a paraumbilical hernia, with no associated intra-abdominal free fluid or gas	Laparotomy, appendectomy, and a non-mesh repair of the hernia defect. Antibiotics for one week	The postoperative course was uneventful. At the six months follow-up no evidence of hernia recurrence
<i>Hudson, 2019, ANZ J Surg</i>	A 3-day history of increasing umbilical pain, with associated cellulitis and purulent discharge. One month later, worsening symptoms	CT scan: midline anterior wall hernia containing the appendix, with significant stranding CT scan (follow-up): Free air within the umbilical hernia sac consistent with features of a perforated appendix	Conservative management with intravenous antibiotics for the high anesthesiological risk Laparotomy, appendectomy, excision of the umbilicus, and primary repair of the umbilical hernia with the application of a negative pressure wound dressing	The patient was discharged after four days
<i>Pilgrim, 2014, West J Emerg Med</i>	A 2-day history of acutely worsening abdominal in the periumbilical region, where there was a moderately tender, firm umbilical hernia with overlying skin erythema	CT scan: bowel loop contained in umbilical hernia without evidence of strangulation or obstruction. The radiologist was unable to visualize the appendix	Open appendectomy with umbilical hernia repair without the use of mesh. The incision was left open to heal by secondary intention.	Uneventful postoperative course. The patient was discharged five days later with a wound vacuum-assisted closure (VAC) in place and given a 10-day course of antibiotics
<i>Galinanes, 2012, J Surg Case Rep</i>	Abdominal pain accompanied by nausea, vomiting, and anorexia for 24 hours; a soft abdomen with focal peritonitis in the right lower quadrant. Previous hysterectomy with right-sided oophorectomy through a low transverse Pfannenstiel incision for stage III cervical cancer.	CT scan: showed an elongated 5mm appendix	Exploratory laparoscopy, laparoscopic appendectomy. Iatrogenic injury to the bladder that was herniated into the defect. The bladder was repaired intracorporeally using running sutures. Herniorrhaphy with transfascial sutures to close the peritoneal defect	The patient did well postoperatively. She was discharged home with a Foley catheter, which was removed two weeks later

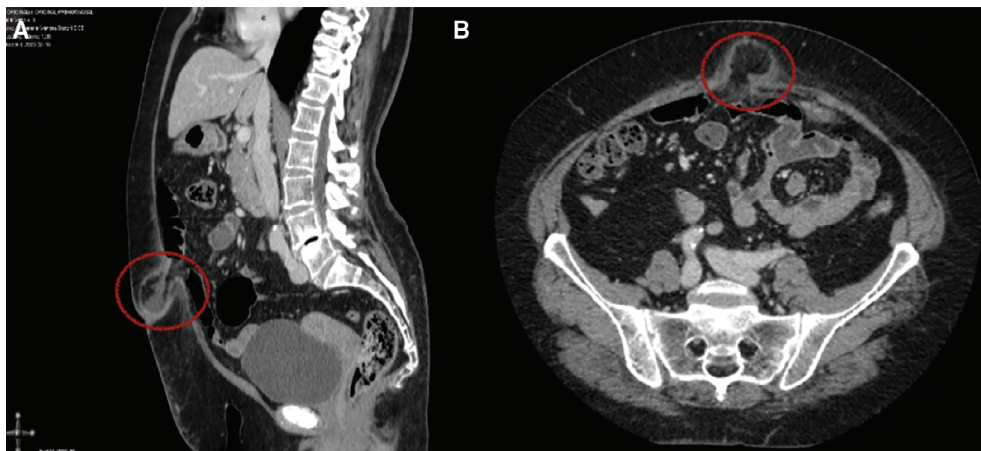


Figure 1. Preoperative CT scan (A. Sagittal plane image; B. Transversal plane image) showing umbilical hernia (red circles).

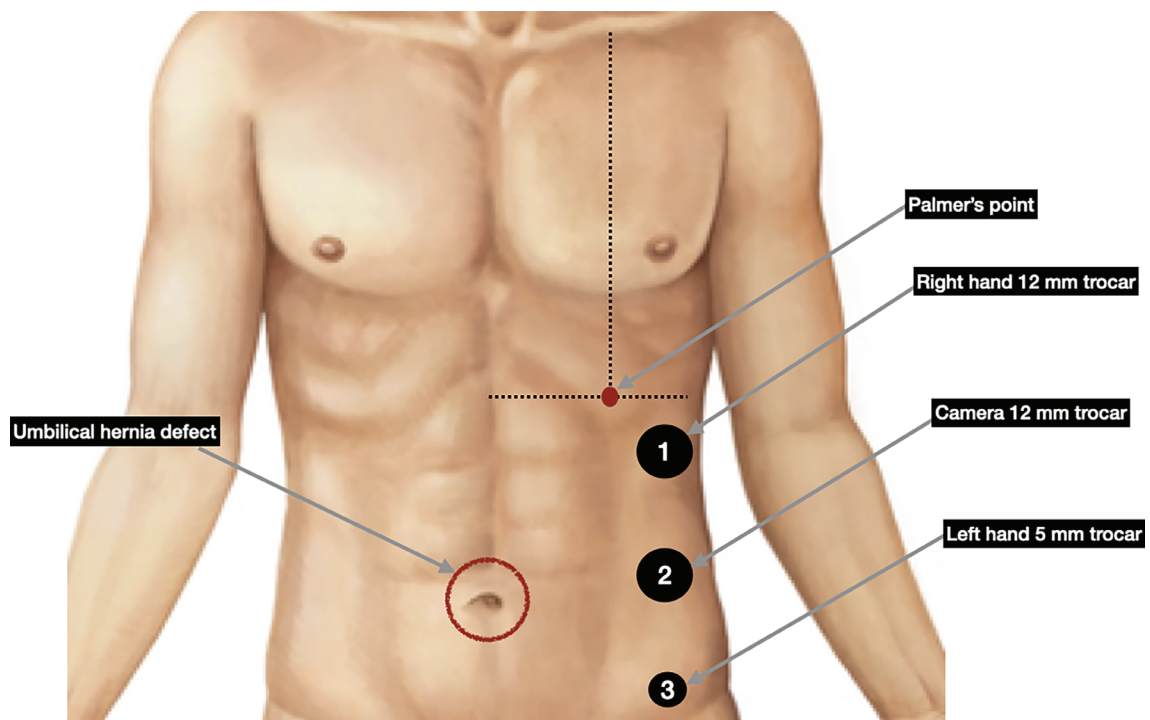


Figure 2. Trocars placement for laparoscopic IPOM hernia repair in our experience.

The postoperative course was uneventful. The patient began to mobilize and eat a soft diet on the evening of the operation. On the first postoperative day, WBC returned to normal, intestinal transit was open to gas, and the patient was mobilized with reasonable postoperative pain control. She was discharged on the

second postoperative day with no spontaneous abdominal pain, slightly tender at the site of surgical wounds, normal peristalsis, and on a light diet. The outpatient follow-up after one week documented the complete healing of the surgical wounds and the expected resumption of the patient's daily activities.

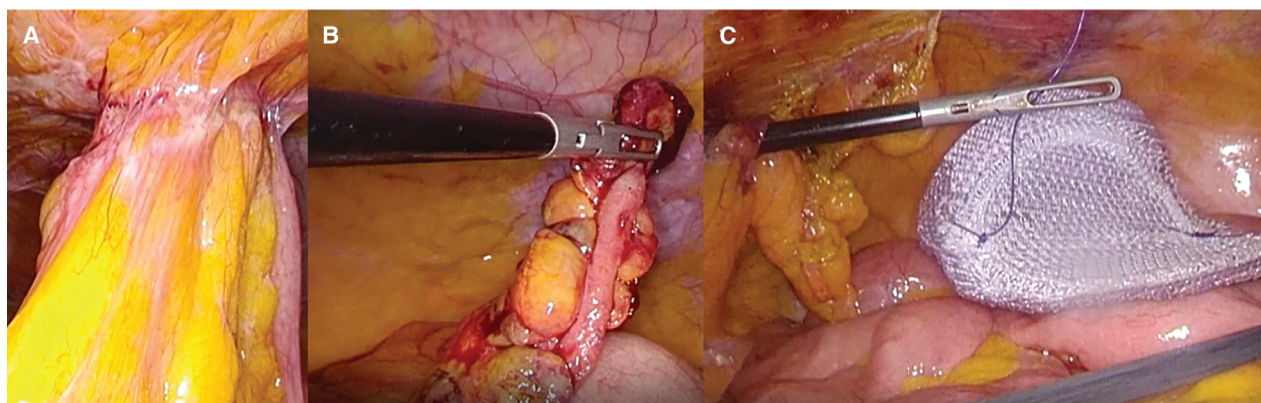


Figure 3. Laparoscopic intraoperative view (A. Hernia sac containing the appendix with its mesoappendix; B: Appendectomy in progress; C: Intraperitoneal mesh positioning in progress).

Discussion

The clinical case presented was the first report described in the literature on acute appendicitis within an umbilical hernia sac treated with laparoscopic appendectomy and anterior abdominal wall reconstruction with intraperitoneal mesh placement.

Although umbilical hernias are relatively common, particularly in infants and young children, acute appendicitis in an umbilical hernia is a rare but potentially severe condition (10-12). It can lead to several serious complications, including peritonitis, sepsis, and even death. Symptoms of acute appendicitis in an umbilical hernia may include abdominal pain, fever, nausea, vomiting, and a tender, swollen lump at the hernia site. Diagnosing acute appendicitis in an umbilical hernia may be challenging, as the symptoms can be similar to those of ischemic contents inside the hernia sac. However, a thorough physical examination and imaging studies, such as ultrasound or CT scan, can help to confirm the diagnosis. Treatment for acute appendicitis in an umbilical hernia typically involves surgery to remove the inflamed appendix and repair the hernia. Previous cases of appendicitis within a small incisional hernia arising in Pfannenstiel incision (15), upper median laparotomy (16), and on a 5 mm trocar incision in the right iliac fossa after laparoscopy have been described

(17). The possibility that the appendix may be located in an umbilical hernia sac is due to the variable course and position of this organ, the presence of any post-operative adhesions associated with the presence of a mobile cecum, and the possible relaxation of the cecum with consequent twisting (18). In our clinical case, acute appendicitis was due to the pressure of the hernia neck on the appendix and its mesoappendix, which caused an ischemic inflammation of the same. Fortunately, the condition was treated early, which prevented the formation of an abscess or a free perforation in the abdominal cavity, allowing the positioning of a mesh. Only one case of acute appendicitis with an abscess inside an umbilical hernia diagnosed preoperatively by a CT scan of the abdomen has been described in the literature (19). In our case, however, the diagnosis was intraoperative, and acute appendicitis was not complicated.

In this case, the clinical presentation of appendicitis was subtle, typical of an incarcerated umbilical hernia. The clinical picture was characterized by acute abdominal pain of a stabbing characteristic, high intensity, spread over all abdominal quadrants, and accompanied by a hernia swelling of a tense consistency, painful to palpation, and covered by hyperemic skin. The intestinal transit was open to feces and gas, so we argued that the contents of the sac consisted only of omentum rather than bowel loops, as confirmed by the abdominal CT scan (5, 20).

Since the picture of irreducibility did not resolve with taxis, and the bleeding risk was reduced with the suspension of the antiplatelet therapy, surgery was planned. In agreement with recent multicenter studies that affirm the superiority of the laparoscopic approach to open hernia repair in reducing recurrences and surgical site infections for wall defects between 2-4 cm (21), the operation was performed with a laparoscopic technique. In our case, the laparoscopic approach was advantageous because it played a dual role: diagnostic and therapeutic. It allowed us to reduce the hernia content and promptly identify appendiceal inflammation, facilitating timely treatment. Consequently, it enabled an early recovery of the patient with less wound site pain, shorter hospital stay, and no surgical wound infection.

Furthermore, the laparoscopic approach allows us to explore the abdomen for other hernia defects or diseases and can highlight the possible presence of ischemic suffering of the bowel. To date, all cases of acute appendicitis within an umbilical hernia sac have been treated by standard open repair with appendectomy and direct abdominal wall reconstruction with the Mayo technique, described as the standard procedure for umbilical hernia repair since 1901 (22). Only one case was treated laparoscopically, but the authors decided not to place a mesh due to necrosis of the appendix and peritoneal contamination (23). In our case, the inflammation of the appendix was at the catarrhal stage. There was no necrotic, purulent, or fecal material inside the abdominal cavity, so it was decided to place a synthetic mesh to decrease the risk of hernia recurrence. It was not decided to close the hernia defect before mesh placement (IPOM plus technique) as the wall defect was less than 2 cm in diameter (24, 25). We opted for a laparoscopic approach because the patient was obese, had several comorbidities, and was over 60 years old. As suggested by the Italian national guidelines (26), for obese, elderly patients who need an emergency surgical operation for primary or incisional ventral hernia repair, laparoscopic surgery shows several advantages compared with the open approach.

Moreover, since the preoperative imaging did not indicate the type of hernia content, the laparoscopic

approach could provide a better view of the abdominal viscera with the possibility of performing intestinal resection and identifying additional obstruction causes, if necessary. Additionally, the laparoscopic approach reduces the risk of surgical site infections and, consequently, hernia recurrence. The choice was made following the guidelines for the treatment of ventral hernias in an emergency setting (27, 28), and, in our case, the laparoscopic IPOM approach proved safe and made it possible to reduce recovery times, postoperative pain, and hospital stay.

In conclusion, an inflammatory process of the appendix within the umbilical hernia is a rare but possible occurrence. An abdominal CT scan can help in some cases, but often, the diagnosis is intraoperative, especially when the fascia defect is small. Therefore, laparoscopy would be desirable to treat this disease, as the minimally-access technique reduces postoperative complications and facilitates the patient's recovery. In this case report, it has been highlighted how important it can be to intervene promptly as soon as the clinical conditions allow for operative intervention in order to prevent the evolution of appendicitis towards gangrene due to hernia strangulation. Indeed, the absence of peritoneal contamination from pus and fecal material allows mesh positioning, significantly reducing hernia recurrences.

Ethical Approval: This study was not conducted with research intervention. Therefore, ethics committee approval was not necessary.

Consent: Written informed consent was obtained from the patient to publish this case report and any accompanying images. A copy of the written consent is available for review by the Editor of this journal.

Competing Interests: The authors declare that there are no competing interests regarding the publication of this paper.

Contributions of Authors: TP, VM, EL, EG, FC, FF, MP, AP contributed equally to the conception, design, draft of the paper, and final revision. All authors read and approved the final manuscript.

References

1. Bedewi MA, El-Sharkawy MS, Al Boukai AA, Al-Nakshabandi N. Prevalence of adult paraumbilical hernia. Assessment by high-resolution sonography: a hospital-based study. *Hernia*. 2012 Feb;16(1):59-62. doi: 10.1007/s10029-011-0863-4.
2. Kaufmann R, Halm JA, Eker HH, et al. Mesh versus suture repair of umbilical hernia in adults: a randomised, double-blind, controlled, multicentre trial. *Lancet*. 2018 Mar 3;391(10123):860-869. doi: 10.1016/S0140-6736(18)30298-8.
3. Liang MK, Holihan JL, Itani K, et al. Ventral Hernia Management: Expert Consensus Guided by Systematic Review. *Ann Surg*. 2017 Jan;265(1):80-89. doi: 10.1097/SLA.0000000000001701.
4. Doig CM. Appendicitis in umbilical hernial sac. *Br Med J*. 1970 Apr 11;2(5701):113-4. doi: 10.1136/bmj.2.5701.113-b.
5. Arnáiz J, Ortiz A, Marco de Lucas E, et al. Unusual perforated appendicitis within umbilical hernia: CT findings. *Abdom Imaging*. 2006 Nov-Dec;31(6):691-3. doi: 10.1007/s00261-005-8009-8.
6. Agarwal N, Goyal S, Kumar A, Garg A, Kaur N, Gupta A. Appendicitis in paraumbilical hernia mimicking strangulation: a case report and review of the literature. *Hernia*. 2013 Aug;17(4):531-2. doi: 10.1007/s10029-013-1118-3. Epub 2013 May 26. PMID: 23708684.
7. Lam A, Black J, Parnell B, West CT. Appendicitis due to incarceration within a laparoscopic umbilical port-site hernia secondary to a degree of intestinal malrotation. *Ann R Coll Surg Engl*. 2019 May;101(5):e119-e121. doi: 10.1308/rcsann.2019.0034. Epub 2019 Mar 11. PMID: 30854864; PMCID: PMC6513357.
8. Sigley K, Russo T, Welch S. Umbilical Hernia Containing Appendicitis. *Cureus*. 2020 May 12;12(5):e8075. doi: 10.7759/cureus.8075. PMID: 32542130; PMCID: PMC7290121.
9. Atabek C, Sürer I, Deliağa H, et al. Appendicitis within an umbilical hernia sac: previously unreported complication in children. *Ulus Travma Acil Cerrahi Derg*. 2008 Jul;14(3):245-6. PMID: 18781423.
10. Zormpa A, Alfa-Wali M, Chung A. Appendicitis within the contents of an incarcerated paraumbilical hernia. *BMJ Case Rep*. 2019 Aug 10;12(8):e228915. doi: 10.1136/bcr-2018-228915.
11. Huntington JT, Mansfield SA, Drosdeck JM, Zhang G, Evans DC. A case of a strangulated umbilical hernia causing gangrenous appendicitis. *Int J Colorectal Dis*. 2016 May;31(5):1075-1076. doi: 10.1007/s00384-015-2412-6.
12. Hudson D, Thirunavukkarasu P. Case of perforated appendicitis within an umbilical hernia. *ANZ J Surg*. 2020 Jul;90(7-8):1496-1497. doi: 10.1111/ans.15561.
13. Pilgrim A, Russo R, Moulin A. A gut feeling: an extremely rare case of missed appendicitis. *Western Journal of Emergency Medicine*. 2014 Nov;15(7):852.
14. Galiñanes EL, Ramaswamy A. Appendicitis found in an incisional hernia. *J Surg Case Rep*. 2012 Aug 1;2012(8):3. doi: 10.1093/jscr/2012.8.3. PMID: 24960761; PMCID: PMC3649585.
15. Pickhardt PJ, Bhalla S. Intestinal malrotation in adolescents and adults: spectrum of clinical and imaging features. *AJR Am J Roentgenol*. 2002 Dec;179(6):1429-35. doi: 10.2214/ajr.179.6.1791429.
16. Kler A, Hossain N, Singh S, Scarpinata R. Vermiform appendix within incisional hernia. *BMJ Case Rep*. 2017 Aug 20;2017:bcr2017221216. doi: 10.1136/bcr-2017-221216.
17. Sugrue C, Hogan A, Robertson I, Mahmood A, Khan WH, Barry K. Incisional hernia appendicitis: A report of two unique cases and literature review. *Int J Surg Case Rep*. 2013;4(3):256-8. doi: 10.1016/j.ijscr.2012.12.006.
18. Hassan TA, Shalaby H, Eskander A. Incarcerated appendicitis in port-site hernia: a rare case report. *Egyptian J Radiol Nuclear Med*. 2015;3:569-571.
19. Jones MW, Lopez RA, Deppen JG: Appendicitis. *StatPearls [Internet]*. StatPearls Publishing, Treasure Island, FL; 2020.
20. Park JS, Jeong JH, Lee JI, Lee JH, Park JK, Moon HJ. Accuracies of diagnostic methods for acute appendicitis. *Am Surg*. 2013 Jan;79(1):101-6.
21. Frey S, Jurczak F, Fromont G, et al. Are the relative benefits of open versus laparoscopic intraperitoneal mesh repair of umbilical hernias dependent on the diameter of the defect? *Surgery*. 2022 Feb;171(2):419-427. doi: 10.1016/j.surg.2021.08.003.
22. Mayo WJ. VI. An Operation for the Radical Cure of Umbilical Hernia. *Ann Surg*. 1901 Aug;34(2):276-80. doi: 10.1097/00000658-190107000-00021.
23. Choi JJ, Palaniappa NC, Dallas KB, Rudich TB, Colon MJ, Divino CM. Use of mesh during ventral hernia repair in clean-contaminated and contaminated cases: outcomes of 33,832 cases. *Ann Surg*. 2012 Jan;255(1):176-80. doi: 10.1097/SLA.0b013e31822518e6.
24. Cassie S, Okrainec A, Saleh F, Qureshy FS, Jackson TD. Laparoscopic versus open elective repair of primary umbilical hernias: short-term outcomes from the American College of Surgeons National Surgery Quality Improvement Program. *Surg Endosc*. 2014 Mar;28(3):741-6. doi: 10.1007/s00464-013-3252-5.
25. Christoffersen MW, Westen M, Rosenberg J, Helgstrand F, Bisgaard T. Closure of the fascial defect during laparoscopic umbilical hernia repair: a randomized clinical trial. *Br J Surg*. 2020 Feb;107(3):200-208. doi: 10.1002/bjs.11490.
26. Campanile FC, Podda M, Pecchini F, et al. Italian Laparoscopic Ventral Hernia Guideline Group. Laparoscopic treatment of ventral hernias: the Italian national guidelines. *Updates Surg*. 2023 Aug;75(5):1305-1336. doi: 10.1007/s13304-023-01534-3.

27. Birindelli A, Sartelli M, Di Saverio S, et al. 2017 update of the WSES guidelines for emergency repair of complicated abdominal wall hernias. *World J Emerg Surg.* 2017 Aug 7;12:37. doi: 10.1186/s13017-017-0149-y. PMID: 28804507; PMCID: PMC5545868.
28. Henriksen NA, Montgomery A, Kaufmann R, et al. Guidelines for treatment of umbilical and epigastric hernias from the European Hernia Society and Americas Hernia Society. *Br J Surg.* 2020 Feb;107(3):171-190. doi: 10.1002/bjs.11489. Epub 2020 Jan 9. PMID: 31916607.

Correspondence:

Received: 16 April 2023

Accepted: 19 December 2023

Tiziana Pilia MD

Department of Surgical Science, University of Cagliari
Emergency Surgery Unit, Policlinico Universitario
"D. Casula", Azienda Ospedaliero-Universitaria di Cagliari
SS 554, Km 4,500, 09042 Monserrato (Italy)

E-mail: tiziana.pilia@alice.it

ORCID ID: 0000-0003-4072-6730