



Contents lists available at ScienceDirect

## International Journal of Surgery Case Reports

journal homepage: [www.casereports.com](http://www.casereports.com)

# Acute appendicitis in a patient with situs viscerum inversus totalis: Role of laparoscopic approach. A case report and brief literature review

Giuseppe Di Buono\*, Elisa Maienza, Salvatore Buscemi, Brenda Randisi, Giorgio Romano, Antonino Agrusa

Department of Surgical, Oncological and Oral Sciences, Section of General and Urgent Surgery, University of Palermo, Italy

## ARTICLE INFO

## Article history:

Received 5 July 2020

Received in revised form 13 October 2020

Accepted 13 October 2020

Available online 17 October 2020

## Keywords:

Acute appendicitis  
Situs viscerum inversus  
Midgut malrotation  
Laparoscopic surgery  
Urgent laparoscopy

## ABSTRACT

**INTRODUCTION:** Abdominal pain due to acute appendicitis in one of the most causes of access to Emergency Room requiring surgical consult and treatment. The occurrence of anatomical anomalies should be considered especially when clinical and imaging features are misleading. In these cases laparoscopic surgery can be a safe tool in order to confirm uncertain diagnosis.

**CASE REPORT:** We report a case of acute appendicitis in a 23-year-old Caucasian men with situs viscerum inversus detected on radiological investigation. Laparoscopic approach was used to confirm the diagnosis and to perform appendectomy. Trocars placement was tailored for this peculiar case.

**DISCUSSION:** One third of patient with acute appendicitis complains abdominal pain in an unexpected location due to various anatomical position of appendix. Left-sided acute appendicitis is a cause of misdiagnosis and it can occur in association with anatomical anomalies such as situs viscerum inversus and midgut malrotation. Laparoscopic surgery may represent a valuable approach in terms of differential diagnosis and treatment in these patients.

**CONCLUSION:** Left-sided acute appendicitis should always be considered in young male patients with left lower quadrant pain. Laparoscopic approach is useful and safe procedure both for diagnosis and treatment of these unclear clinical pictures.

© 2020 Published by Elsevier Ltd on behalf of IJS Publishing Group Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

Abdominal pain due to acute appendicitis is one of the most frequent causes of access to Emergency Room that requires surgical consult and treatment. We can use several scoring systems to increase the clinical diagnostic accuracy in patients with symptoms of suspected acute appendicitis. One of the most diffused is the Alvarado Score [1] which is useful to enable risk stratification in patients with acute abdominal pain. This score takes into consideration some clinical findings such as migration of pain, anorexia, nausea; objective signs like tenderness in right lower abdominal quadrant, rebound pain, body temperature, and laboratory exams as leucocytosis. Score results should be evaluated in order to help the decision making process towards discharge, observation or surgical procedure. Further investigations, like abdomen ultrasound

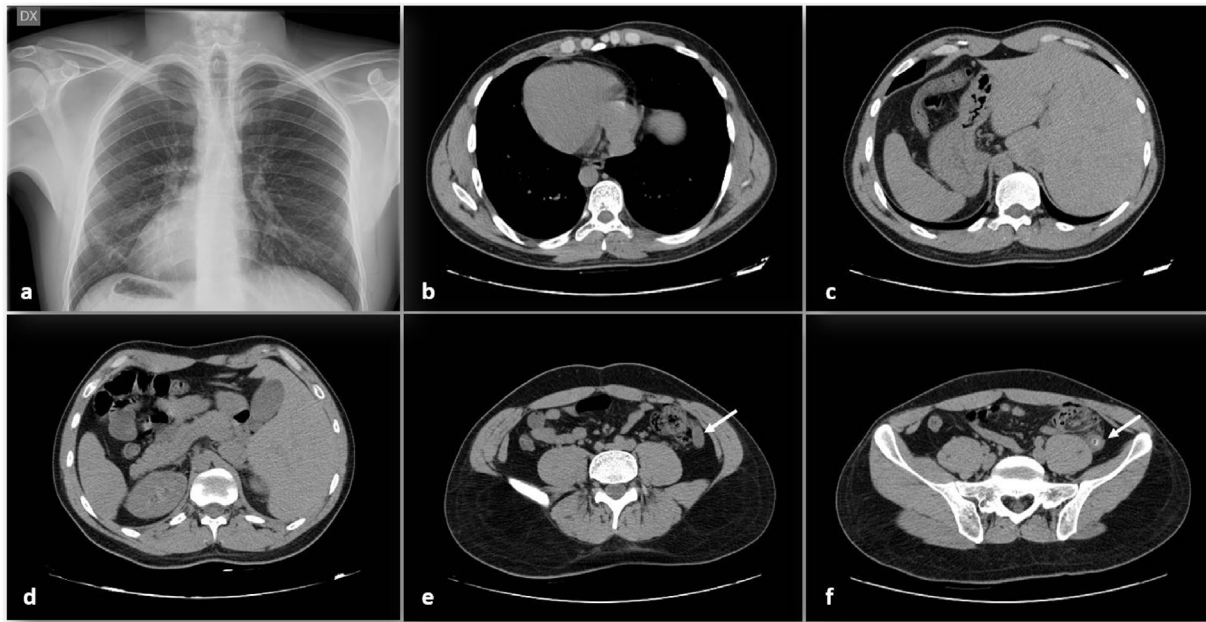
and CT scan can be required when the differential diagnosis based only on clinical findings is uncertain. Although the algorithm of diagnosis of appendicitis is well known worldwide, there can be some conditions that may still create misdiagnosis. Among these, certainly midgut malrotation and situs viscerum inversus can be challenging and represent a cause of delay of treatment because clinical features are unclear especially when these conditions are unknown. Laparoscopic management of patient with acute undifferentiated abdominal pain can be a safe and effective way to confirm uncertain diagnosis [2]. It reduces the possibility of a delayed diagnosis and it can be tailored for every patients since an experienced surgeon can modify trocars position in order to approach different clinical situations especially when anatomical anomalies are present. This case report is in line with the SCARE criteria [3,4].

## 2. Case presentation

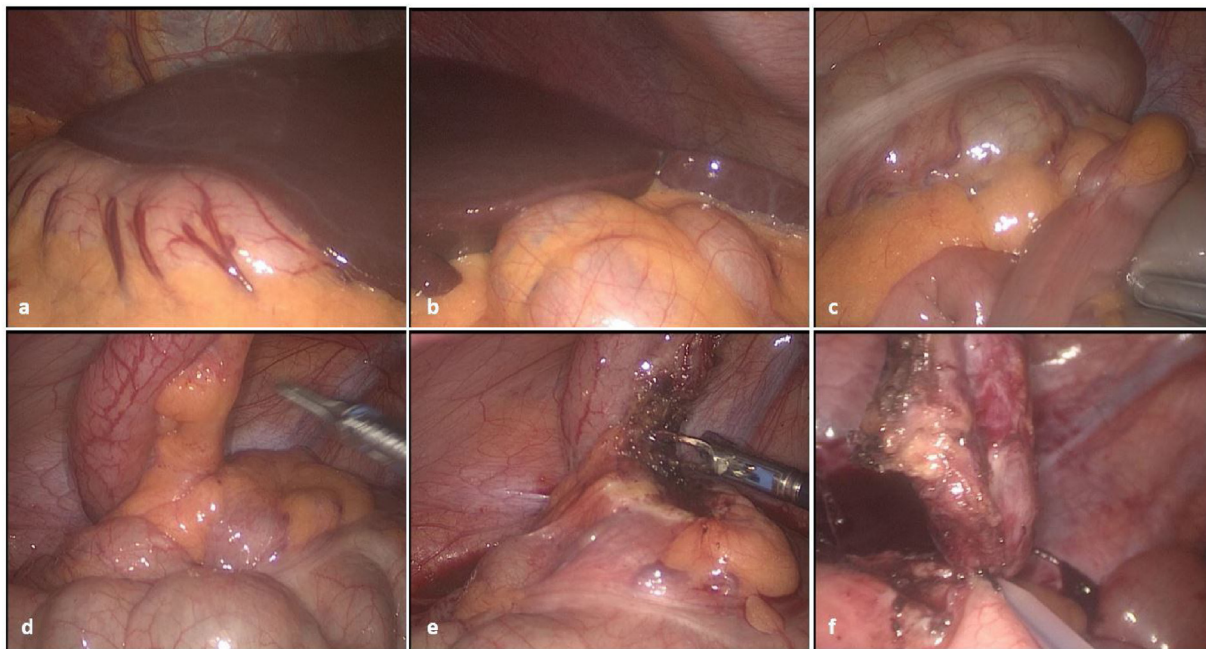
We report a case of acute appendicitis in situs viscerum inversus totalis that came to our attention at Department of General and Emergency Surgery of the University Hospital of Palermo. A 23-year-old male complained mild fever (38 °C) and persisting

\* Corresponding author at: Department of Surgical, Oncological and Oral Sciences (Di.Chir.On.S.), University of Palermo, Via L. Giuffrè, 5, 90127, Palermo, Italy.

E-mail addresses: [giuseppe.dibuono@unipa.it](mailto:giuseppe.dibuono@unipa.it) (G. Di Buono), [elisa.maienza@yahoo.it](mailto:elisa.maienza@yahoo.it) (E. Maienza), [buscemi.salvatore@gmail.com](mailto:buscemi.salvatore@gmail.com) (S. Buscemi), [brenda.randisi91@gmail.com](mailto:brenda.randisi91@gmail.com) (B. Randisi), [giorgio.romano@unipa.it](mailto:giorgio.romano@unipa.it) (G. Romano), [antonino.agrusa@unipa.it](mailto:antonino.agrusa@unipa.it) (A. Agrusa).



**Fig. 1.** a–d) preoperative radiological findings with situs viscerum inversus totalis; e–f) dilated appendix in the left iliac fossa with calcic coprolites into the lumen and discrete pelvic effusion (arrows).



**Fig. 2.** Details of surgical procedure: a–c) exploratory laparoscopy confirmed situs viscerum inversus totalis with mirror images of stomach, liver and caecum; d) appendix was dilated and inflamed; e) we dissected mesoappendix and identified appendicular artery that was cauterized with bipolar forceps; f) the appendix was sectioned after using endoloop.

severe abdominal pain on the left lower quadrant for 2 days. He also referred progressive nausea and anorexia. There was no history of urinary symptoms nor diarrhea. The patient had no other comorbidities and his family history was negative for other diseases. On physical examination his abdomen was soft and flat, except for a severe and rebound tenderness at pressure in the left lower quadrant. Traditional McBurney sign was negative. The laboratory results showed WBC count  $14.5 \times 10^3/\mu\text{L}$  with 753% of neutrophils. CT abdominal scan was performed in order to identify the origin of abdominal pain [5,6]. CT scan showed a situs viscerum inversus and the presence of a dilated appendix in the left iliac

fossa with calcic coprolites into the lumen and discrete pelvic effusion (Fig. 1). Considering this unexpected radiological diagnosis and the age of the patient we decided for laparoscopic approach in urgent setting [7–9]. The surgical procedure was performed by a young ambidextrous surgeon experienced in laparoscopic and emergency surgery [10,11]. On the operating room we placed the monitor on the left side while the surgeon and the camera assistant were on the right side. We induced pneumoperitoneum with trans-umbilical open technique [12,13]. Exploratory laparoscopy confirmed the CT findings of situs viscerum inversus (Fig. 2). We used other two 5-mm trocars respectively in the suprapubic region

and in the right iliac fossa. The appendix was dilated and inflamed with pericecal free fluid. We dissected mesoappendix and identified appendicular artery that was cauterized with bipolar forceps. The appendix was sectioned after using endoloops. The surgical specimen was removed using an endobag via optical port. Postoperative course was free of complications and the patient was discharged on 2nd postoperative day. The patient was satisfied with the treatment received with typical advantages of laparoscopic surgery, rapid postoperative recovery and less postoperative pain. Histopathological examination confirmed acute appendiceal phlegmon.

### 3. Discussion

Among patients with abdominal pain, acute appendicitis is still one of the most common diagnosis that requires emergency surgery with an incidence of 4–8% [14–16]. In several of these cases diagnosis is not straightforward. It can be suspected on the basis of physical symptoms, imaging findings and clinical experience of the surgeon. Mortality and comorbidity rate of this condition can increase if surgical treatment is delayed because of misdiagnosis of acute appendicitis, which is more likely to occur in patients who present atypical symptoms. One third of patients with acute appendicitis complains abdominal pain in an unexpected location, due to the various anatomical position of the appendix [16,17] that is not constant (retrocecal, pelvic, subcecal, preileal, postileal, and more rarely subhepatic, mesocolic, left-sided, right-sided long appendix projecting into the left lower quadrant area) [18]. Left-sided acute appendicitis is a cause of misdiagnosis because left lower quadrant tenderness can be due to different conditions and the diagnosis can be challenging, especially when anatomical variations are present. Differential diagnosis of left lower abdominal pain includes diverticular disease, appendicitis, left-sided primary epiploic appendagitis, acute pancreatitis and mesenteric ischemia. Besides gastrointestinal disorders, a left-lower abdominal pain can be caused by genitourinary tract disorders such as PID (pelvic inflammatory disease); ovarian torsion, ectopic pregnancy; epididymitis; prostatitis; testicular torsion; cystitis [19–22]. Non-specific abdominal pain (NSAP) must also be considered in differential diagnosis [23,24]. Left-sided acute appendicitis occurs mainly in association with two uncommon clinical pictures: midgut malrotation and situs viscerum inversus totalis [25]. These two conditions complicate diagnosis and management of acute abdominal pain [16]. The midgut malrotation is a congenital anomaly characterized by non-rotation of the primitive intestinal loop around the axis of the superior mesenteric artery during fetal development. The incidence of this condition is around 0,03–0,5% [17] and can manifest itself in the first month of life (usually with bowel dysfunction and bilious vomiting), but in most of the cases it is a silent anomaly [16]. Situs viscerum inversus totalis (SVIT) instead is a rare autosomal recessive congenital pathology due to a defect localized on the long arm of chromosome 14 [18], in which there is a reverse anatomy and visceral organs are disposed in a mirror image [19,25]. The incidence of this condition is approximately of 1 per 10.000 [26] and most of patients with SVIT is asymptomatic and have a normal life expectancy. It may be associated with Kartagener syndrome characterised by the trilogy of dextrocardia, recurrent sinusitis and bronchiectasis with an incidence of 1 per 30.000–40.000 [26,27].

The incidence of acute appendicitis associated with SVIT is approximately between 0,016%–0,024% [14,24,28]. Laparoscopic appendectomy is the standard therapeutic procedure for the treatment of acute appendicitis. The advantages of this technique when compared to the open approach are well known with rapid postoperative progress, shorter hospital stay, less surgical stress and

postoperative complications [29–31]. For these reason laparoscopic approach represents a valuable tool when clinical and radiological diagnosis is unclear. It allows to identify not only the appendix but also to inspect all abdominal cavity with certain advantages respect to the access provided by a McBurney's incision [18]. Laparoscopic management of acute abdominal pain is recommended for those cases where the diagnosis cannot be made by physical examination and noninvasive methods. Laparoscopy can confirm the initial diagnostic suspect of appendicitis and it also allows to recognize other pathological findings and to treat several clinical conditions at the same time [32,33]. Another advantage of laparoscopic approach is that it can be tailored for every patient with minimal modification of standard laparoscopic appendectomy technique and it can be useful both in terms of differential diagnosis and definitive treatment of appendicitis in patients with situs viscerum inversus or midgut malrotation [21,34,35]. We carried out a short literature review about acute appendicitis and laparoscopic approach in patients with SVIT or midgut malrotation (MM). Akbulut et al. [36] in 2010 reviewed 95 cases but laparoscopic approach was performed only in 8 cases. We used Pubmed, Scopus and ISI web of knowledge database to identify all studies that considered acute appendicitis in these specific patients since 2010. The search was done using the term “appendicitis” AND “situs inversus”. We evaluated only publications in English language and we excluded articles that did not consider surgical treatment but only radiological diagnosis or anesthesiologic management. Only 4 patients were treated with laparoscopic approach [20,37–39] and one patients with single-incision technique [40]. In these cases the authors described the advantages of laparoscopy in differential diagnosis and surgical treatment, but with several difficulty related to different operating field with “mirror image” and reverse laparoscopic view that can be represent a technical challenge also for experienced surgeon. There is no standard position for trocars insertion in these peculiar cases and the surgeon should modify port placement following the main principles of laparoscopy such as triangulation and ergonomics [41,42].

### 4. Conclusion

Left-sided acute appendicitis is a more and more frequent cause of misdiagnosis in acute appendicitis and it should always be considered in any patient with left lower quadrant pain especially in the younger population. Situs viscerum inversus and midgut malrotation should be taken into consideration in patients with findings of the physical examination suspicious for left-sided acute appendicitis. Laparoscopic approach is useful to identify and treat acute surgical emergency. It is a quick, safe and efficient procedure especially when clinical features and imaging studies are not quite clear and when situs anomalies are present. It can also be tailored in order to offer the best exposition of the operatory field for each single patient.

### Funding

Di Buono Giuseppe and other co-authors have no study sponsor.

### Ethical approval

Ethical Approval was not necessary for this study.

### Consent

We obtained written patient consent to publication.

**Author contribution**

Di Buono Giuseppe: study design, data collections, data analysis and writing.

Maienza Elisa: study design, data collections, data analysis and writing.

Buscemi Salvatore: data collections.

Randisi Brenda: data collection.

Romano Giorgio: study design, data collections, data analysis and writing.

Agrusa Antonino: study design, data collections, data analysis and writing.

**Registration of research studies**

Not applicable.

**Guarantor**

Di Buono Giuseppe.

Agrusa Antonino.

**Availability of data and materials**

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

**Provenance and peer review**

Not commissioned, externally peer-reviewed

**Declaration of Competing Interest**

The authors report no declarations of interest.

**Acknowledgement**

This article is part of a supplement entitled Case reports from Italian young surgeons, published with support from the Department of Surgical, Oncological and Oral Sciences – University of Palermo.

**References**

- [1] A. Alvarado, A practical score for the early diagnosis of acute appendicitis, *Ann. Emerg. Med.* 15 (5) (1986) 557–564.
- [2] Adam Q. Maggio, Alex M. Reece-Smith, Tjun Y. Tang, Umar Sadat, Stewart R. Walsh, Early laparoscopy versus active observation in acute abdominal pain: systematic review and meta-analysis, *Int. J. Surg.* 6 (2008) 400–403.
- [3] R.A. Agha, A.J. Fowler, A. Saetta, I. Barai, S. Rajmohan, D.P. Orgill, for the SCARE Group, The SCARE statement: consensus-based surgical case report guidelines, *Int. J. Surg.* 34 (2016) 180–186.
- [4] R.A. Agha, M.R. Borrelli, R. Farwana, K. Koshy, A. Fowler, D.P. Orgill, For the SCARE Group, The SCARE 2018 statement: updating consensus surgical CARE REport (SCARE) guidelines, *Int. J. Surg.* 60 (2018) 132–136.
- [5] M. Galia, D. Albano, A. Bruno, A. Agrusa, G. Romano, G. Di Buono, F. Agnello, G. Salvaggio, L. La Grutta, M. Midiri, R. Lagalla, Imaging features of solid renal masses, *Br. J. Radiol.* 90 (August (1077)) (2017) 20170077, <http://dx.doi.org/10.1259/bjr.20170077>, Epub 2017 Jul 13. Review.
- [6] D. Albano, F. Agnello, F. Midiri, G. Pecoraro, A. Bruno, P. Alongi, P. Toia, G. Di Buono, A. Agrusa, L.M. Sconfienza, S. Pardo, L. La Grutta, M. Midiri, M. Galia, Imaging features of adrenal masses, *Insights Imaging* 10 (January (1)) (2019) 1, <http://dx.doi.org/10.1186/s13244-019-0688-8>.
- [7] A. Agrusa, G. Romano, M. Galia, G. Cucinella, V. Sorce, G. Di Buono, F. Agnello, G. Amato, G. Gulotta, Appendiceal mucinous neoplasms: an uncertain nosological entity. Report of a case, *G. Chir.* 37 (March–April (2)) (2016) 86–89, <http://dx.doi.org/10.11138/gchir/2016.37.2.086>.
- [8] A. Agrusa, G. Romano, L.J. Dominguez, G. Amato, R. Citarrella, L. Vernuccio, G. Di Buono, V. Sorce, L. Gulotta, M. Galia, P. Mansueti, G. Gulotta, Adrenal cavernous hemangioma: which correct decision making process? *Acta Med. Mediterr.* 32 (2016) 385–389.
- [9] A. Agrusa, G. Romano, G. De Vita, G. Frazzetta, D. Chianetta, G. Di Buono, G. Gulotta, Adrenal gunshot wound: laparoscopic approach. Report of a case, *Int. J. Surg. Case Rep.* 5 (2014) 70–72.
- [10] G. Di Buono, S. Buscemi, A.I. Lo Monte, G. Geraci, V. Sorce, R. Citarrella, E. Gulotta, V.D. Palumbo, S. Fazzotta, L. Gulotta, D. Albano, M. Galia, G. Romano, A. Agrusa, Laparoscopic adrenalectomy: preoperative data, surgical technique and clinical outcomes, *BMC Surg.* 18 (April (Suppl 1)) (2019) 128, <http://dx.doi.org/10.1186/s12893-018-0456-6>.
- [11] G. Romano, A. Agrusa, G. Frazzetta, G. De Vita, D. Chianetta, G. Di Buono, G. Amato, G. Gulotta, Laparoscopic drainage of liver abscess: case report and literature review, *G. Chir.* 34 (May–June (5–6)) (2013) 180–182, <http://dx.doi.org/10.11138/gchir/2013.34.5.180>.
- [12] A. Agrusa, G. Di Buono, S. Buscemi, G. Cucinella, G. Romano, G. Gulotta, 3D laparoscopic surgery: a prospective clinical trial, *Oncotarget* 9 (April (25)) (2018) 17325–17333, <http://dx.doi.org/10.18632/oncotarget.24669>, eCollection 2018 Apr 3.
- [13] A. Agrusa, G. Romano, G. Di Buono, G. Frazzetta, D. Chianetta, V. Sorce, V. Billone, G. Cucinella, G. Gulotta, Acute appendicitis and endometriosis: retrospective analysis in emergency setting, *GIOG* 35 (2013) 728–732.
- [14] M.T. Umut Gulacti, Male with left lower quadrant pain, *Ann. Emerg. Med.* 70 (6) (2017) 49–50.
- [15] Y.S. Alparslan Koç, Anaesthetic management for appendectomy in a patient with situs inversus totalis, *Turk. J. Anaesth. Reanim.* 44 (2016) 105–107.
- [16] S.A. Yagmur, Left-sided acute appendicitis with situs inversus totalis: review of 63 published cases and report of two cases, *J. Gastrointest. Surg.* 14 (2010) 1422–1428.
- [17] E. Zengin, A. Turan, A.S. Calapoglu, E. Nalbant, G. Altuntas, Intestinal nonrotation and left-sided perforated appendicitis, *Ulus. Travma Acil Cerrahi Derg.* 24 (2018) 178–180.
- [18] R.B. Hukkeri, Laparoscopic appendectomy in a patient with situs inversus totalis, *Indian J. Surg.* 75 (Suppl 1) (2013) S41–S43.
- [19] A.E.O. Adeniyi, C.O. Akisanya, A.S. Ogah, T.O. Ankiemi, C.A. Erinkle, Appendicitis and situs inversus viscerum in a 32-year-old female Nigerian: a case report, *Ann. Ib. Postgrad. Med.* VI (1) (2008) 84–86.
- [20] Joo Suk Oh, Ki Wook Kim, Hang Joo Cho, Left-sided appendicitis in a patient with situs inversus totalis, *J. Korean Surg. Soc.* 83 (September (3)) (2012) 175–178, <http://dx.doi.org/10.4174/jkss.2012.83.3.175>, Published online 2012 Aug 27.
- [21] G. Cucinella, A. Perino, G. Romano, G. Di Buono, G. Calagna, V. Sorce, L. Gulotta, M. Triolo, V. Billone, G. Gulotta, A. Agrusa, Endometrial cancer: robotic versus laparoscopic treatment. Preliminary report, *GIOG* 37 (November–December (6)) (2015), 283–273.
- [22] G. Cucinella, G. Calagna, G. Romano, G. Di Buono, G. Gugliotta, S. Saitta, G. Adile, M. Manzone, G. Accardi, A. Perino, A. Agrusa, Robotic versus laparoscopic sacrocolpopexy for apical prolapse: a case-control study, *G. Chir.* 37 (May–June (3)) (2016) 113–117.
- [23] D.S. Sanders, I.A.F. Azmy, D.P. Hurlstone, A new insight into non-specific abdominal pain, *Ann. R. Coll. Surg. Engl.* 88 (2) (2006) 92–94.
- [24] A.M. Prada Arias, A.S. Barreira, M.M. Sanchez, et al., Appendicitis versus non-specific acute abdominal pain: paediatric appendicitis score evaluation, *An. Pediatr. (Barc.)* 88 (1) (2018) 32–38.
- [25] C.S. Ahmad, Pitfalls of diagnosing left lower quadrant pain causes: making the uncommon common again, *Am. J. Case Rep.* 20 (2019) 78–82.
- [26] H.S. MD, Acute left-sided appendicitis with situs inversus totalis: a case report, *Am. J. Emerg. Med.* 28 (2010) 1058.e5–1058.e7.
- [27] J. Versluis, H.M. Suliman, Appendicitis in a patient with situs inversus totalis, *JBR–BTR* 97 (2014) 182–183.
- [28] M. Shivakumar, H.S. Channabasappa, A patient with situs inversus totalis presenting for emergency laparoscopic appendectomy: consideration for safe anaesthetic management, *Anesth. Essays Res.* 7 (1) (2013) 127–129.
- [29] S.M. Huang, C.C. Yao, T.P. Tsai, G.W. Hsu, Acute appendicitis in situs inversus totalis, *J. Am. Coll. Surg.* 207 (2008) 954.
- [30] N.V. Agresta, A brief review of laparoscopic appendectomy: the issues and the evidence, *Tech. Coloproctol.* 15 (2011) 1–6.
- [31] S. Kumar, A. Jalan, B.N. Patowary, S. Shrestha, Laparoscopic appendectomy versus open appendectomy for acute appendicitis: a prospective comparative study, *Kathmandu Univ. Med. J. (KUMJ)* 14 (55) (2016) 244–248.
- [32] Y. Liu, Z. Cui, R. Zhang, Laparoscopic versus open appendectomy for acute appendicitis in children, *Indian Pediatr.* 54 (2017) 938–941.
- [33] L.I. Partecke, W. Bernstorff, A. Karrasch, K. Cziupka, A. Glitsch, A. Stier, C.D. Heidecke, J. Tepel, Unexpected findings on laparoscopy for suspected acute appendicitis: a pro for laparoscopic appendectomy as the standard procedure for acute appendicitis, *Langenbecks Arch. Surg.* 395 (8) (2010) 1069–1076.
- [34] S. Contini, R. Dalla Valle, R. Zinicola, Suspected appendicitis in situs inversus totalis: an indication for a laparoscopic approach, *Surg. Laparosc. Endosc.* 8 (5) (1998) 393–394.
- [35] R.S. Djohan, H.E. Rodriguez, I.M. Wiesman, J.A. Unti, F.J. Podbielski, Laparoscopic cholecystectomy and appendectomy in situs inversus totalis, *JLS* IV (2000) 251–254.
- [36] S. Akbulut, A. Ulku, A. Senol, M. Tas, Y. Yagmur, Left-sided appendicitis: review of 95 published cases and a case report, *World J. Gastroenterol.* 16 (November (44)) (2010) 5598–5602, <http://dx.doi.org/10.3748/wjg.v16.i44.5598>, Published online 2010 Nov 28.
- [37] C. Saliba, S.H. Diab, G. Nicolas, J.S. El Sayegh, D. Osman, J.M. Azzo, A. Dabbous, H. Hmadeh, A. Wehbe, H.H. Ahmad, Pitfalls of diagnosing left lower quadrant pain causes: making the uncommon common again, *Am. J. Case Rep.* 20

- (2019) 78–82, <http://dx.doi.org/10.12659/AJCR.912226>, Published online 2019 Jan 19.
- [38] Rb Patel, K. Bhadreshwara, S. Hukkeri, Laparoscopic appendectomy in a patient with situs inversus totalis, *Indian J. Surg.* 75 (June (Suppl 1)) (2013) 41–43, <http://dx.doi.org/10.1007/s12262-011-0311-9>, Published online 2011 Jun 2.
- [39] S. Bertaud, S. Sara Badvie, Contrary to expectation—a case of left-sided acute appendicitis, *BMJ Case Rep.* 2012 (2012), <http://dx.doi.org/10.1136/bcr-2012-00655>, bcr2012006552. Published online 2012 Jul 27.
- [40] J.S. Rajkumar, A. Syed, Jr Anirudh, Cm Kishor, D. Deepa, Single-incision multi-port appendectomy for a patient with situs inversus totalis: first case report, *Sultan Qaboos Univ. Med. J.* 16 (May (2)) (2016) e242–e245, <http://dx.doi.org/10.18295/squmj.2016.16.02.018>, Published online 2016 May 15.
- [41] V. Golash, Laparoscopic management of acute appendicitis in situs inversus, *J. Minim. Access Surg.* 11 (4) (2006) 220–221.
- [42] C. Palanivelu, M. Rangarajan, S.J. John, R. Senthilkumar, M.V. Madhankumar, Laparoscopic appendectomy for appendicitis in uncommon situations: the advantages of a tailored approach, *Singap. Med. J.* 48 (8) (2007) 737–740.

#### Open Access

This article is published Open Access at [sciencedirect.com](https://www.sciencedirect.com). It is distributed under the [IJSCR Supplemental terms and conditions](#), which permits unrestricted non commercial use, distribution, and reproduction in any medium, provided the original authors and source are credited.