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Situs Inversus Totalis with Cholelithiasis Managed by Open Cholecystectomy: A Case Report

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ABSTRACT

Introduction: Situs inversus totalis (SIT) is a rare congenital anomaly where the thoracic and abdominal organs are transposed. Reversed hepatobiliary anatomy can result in nonclassical symptoms and creating problems in diagnosis and increasing technical complexity of cholecystectomy.

Case Presentation The case of a 33-year-old female patient was presented with gradually increasing pain in the left hypochondrium, accompanied by nausea without vomiting and without clinical evidence of peritoneal irritation. A physical examination showed that the left hypochondrium was tender to palpation and that a left-sided Murphy sign was positive. Laboratory studies were in normal range, such as renal study, coagulation studies and the pancreatic profile. Ultrasonography revealed a left-sided liver and a gallbladder with calculi, with a wall thickness of 3 mm. An open cholecystectomy was done using an incision of about 7 cm in the supraumbilical midline. The left liver and gallbladder were verified by operative exploration. The gallbladder was part intrahepatic, 4 x 5 x 6 cm, thick-walled, and had one calculus; the appearance of the operative specimen was graded as Parkland III. The cystic duct and cystic artery were identified, ligated and divided without any intraoperative complications by carefully dissecting the triangle of the reversed Calot.

Conclusion:During cholecystectomy in patients with SIT, it is important to have tested the reversed hepatobiliary anatomy and to be mindful of the cystic duct and the cystic artery. One size does not fit all; anatomical findings should be used to plan surgery, not vice versa.

Keywords: Situs Inversus, Cholelithiasis, Cholecystectomy, Congenital Abnormalities, Case Reports

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INTRODUCTION

SIT is a very uncommon congenital defect characterised by the transposition of thoracic and abdominal organs and is not suspected to predispose to the gallstone disease (1). But it can change the localisation of the symptoms and make the diagnosis and surgical treatment difficult. Even though the condition itself does not predispose to an increased risk of cholelithiasis, reversal of the hepatobiliary anatomy can render a traditional clinical interpretation unreliable and can postpone the identification of biliary disease (2). Under normal circumstances, the pain should be located in the right upper abdomen since liver and gallbladder are typically located on the right. Pain in patients with reversed hepatobiliary anatomy is usually in the left upper quadrant or left hypochondrium, but epigastric or right-sided pain has also been reported (3). About one in ten reported patient might report right-sided pain regardless of left-sided gallbladder. Therefore, location of pain should be considered along with imaging, and not as a way of ruling out biliary disease or the existence of an anatomical variation. There are surgical issues in the treatment of gallstone disease in SIT. In numerous case reports laparoscopic cholecystectomy has been done successfully, but with changes in the team positions, use of instruments and dissection technique. A systematic review and meta-analysis involving 121 patients corroborated procedural feasibility, but demonstrated that the evidence at hand was confined to single case studies and small case series as opposed to comparative studies (4). It has also been previously performed in patients with SIT through open cholecystectomy which should not be offered as a new or first measure (5). The case at hand is still clinically pertinent since reversed hepatobiliary anatomy was seen in conjunction with a partially intrahepatic gallbladder, necessitating the intentional exposure and localization of the structures in the triangle of Calot which was reversed. The intention of this manuscript is to present the clinical presentation, confirmed anatomical observation, operative treatment and reported immediate outcome of a patient with cholelithiasis, as well as put an accent on patient-specific anatomical examination and attentive identification of the cystic duct and cystic artery.

METHODOLOGY

This single-patient case report was prepared with the help of available clinical, laboratory, imaging, operative and immediate postoperative records. Reporting was evaluated in accordance with the CARE guidance, which suggests the open reporting of patient information, clinical findings, diagnostic assessment, intervention, outcomes, follow-up, patient perspective and informed consent (6). The patient was a 33-year-old female with no prior surgical history, who presented on 21 March 2026 with increasingly severe abdominal pain, mostly left hypochondrial, and was accompanied by nausea. The presenting symptoms, pertinent history, physical examination, lab tests, ultrasonographic results, surgery and the immediate postoperative period were reviewed in the available record. There is no personal information that is directly identifying in the manuscript. Due to the fact that this report is founded on a single clinical case and does not provide any group comparison, the sampling procedure or statistical analysis, its methodology is descriptive instead of experimental. Data not included in the provided record was defined as unavailable and was not recreated or considered a negative clinical finding.

Diagnostic evaluation consisted of clinical evaluation, laboratory tests and abdominal ultrasound (7). The physical findings were taken into account along with the location, course and characteristics of the pain. The lab record available consisted of renal, coagulation, pancreatic profile, prothrombin time, international normalised ratio and blood glucose. The results were evaluated during the perioperative examination, although the normal laboratory results were not regarded as an independent indication of the absence of inflammation of the gallbladder. The ultrasonography was examined regarding the anatomical location of liver and gallbladder, the existence of gallstones and the gallbladder-wall thickness. It reported a left-sided liver, gallbladder calculi and wall thickness of 3 mm; it did not mention calculi in the liver. The provided clinical content did not include any thoracoabdominal-computed-tomography or magnetic-resonance results. Thus, the report is based on the mentioned ultrasonographic and operative abdominal results and does not present any new radiological characteristics, which were not reported.

The combined symptoms, physical examination and imaging results were used to make the clinical diagnosis. The clinical history reported the presence of cholelithiasis in the context of reversed abdominal anatomy and named the disease SIT. Operative exploration and abdominal ultrasonography confirmed a left sided liver and gallbladder. Nonetheless, in the provided documentation, there was no thoracic imaging that proved the presence of the mirror-image transposition of the thoracic organs. This difference is significant since SIT refers to total transposition of thoracic and abdominal viscera; confirmation of thoracic should thus be verified in original medical record prior to submission. The operative record was examined regarding the approach to the surgery, incision, location of the abdominal organs, size and appearance of the gallbladder, Parkland grade, estimated blood loss, drain placement and identification of the cystic duct and cystic artery. The dissection of the triangle of the reversed Calot was of particular interest since the direct identification of these structures was the key technical aspect that was reported during the operation.

The immediate postoperative record was reviewed for clinical stability, pain control, tolerance of oral intake, passage of flatus and documented complications. The record indicated stable vital signs, pain under control, oral tolerance and proper flatus passage, and no immediate complication. The material provided to prepare the report did not include histopathological findings, length of stay, discharge date, Penrose-drain output, date of drain removal and long-term follow-up and thus was

not inferred. In the same way, there was no laparoscopic attempt history, open surgery conversion, liver biopsy or other surgery recorded. These were handled as undocumented issues, as opposed to events that could be claimed to have happened or not. By doing so, this method maintains the difference between an explicitly documented negative result and data that is simply missing, thus restricting the findings to the confirmed perioperative data.

RESULTS

The patient was characterized by gradually increasing pain in the abdomen mainly located in the left hypochondrium with nausea but no vomiting or peritoneal irritation. Physical examination showed that on deep palpation of the left hypochondrium there was tenderness and a positive left-sided Murphy sign. The site of the symptoms corresponded to the later recorded left-sided hepatobiliary anatomy. Laboratory tests were reported within normal ranges. Prothrombin time was 11.8 seconds, international normalised ratio was 1.03 and blood glucose was 108 mg/dl. The rest of the coagulation tests and the pancreatic profile were also reported to be within normal limits, as well as renal function. Such findings give the biochemical context of the case at hand; but the source record lacked values of inflammatory-markers and adequate laboratory description to warrant or rule out acute cholecystitis alone. The results were thus combined with the clinical examination, ultrasonography and operative observations instead of being applied to give an inflammatory diagnosis that was not supported.

The ultrasonography of the abdomen revealed a left-sided liver and a gallbladder with calculi; no calculi were found in the liver. The gallbladder wall was 3 mm. A single measurement of 3 mm is not sufficient to diagnose acute cholecystitis, as the diagnosis must incorporate local signs, systemic inflammatory results and typical imaging results instead of depending on a single wall measurement (7). The patient also presented with a positive left-sided Murphy`s sign and operative exploration reported thickened gallbladder walls and Parkland grade III anatomy. However, inflammatory lab values, full range of diagnostic imaging findings and histopathology results were not provided in the provided record. Acute or chronic cholecystitis therefore cannot be categorically either confirmed or excluded in the given documentation. The report rightfully maintains cholelithiasis as the supported diagnosis and offers the operative descriptors as findings but does not translate them to an unproven pathological diagnosis. This difference prevents exaggeration of what can be determined based on the evidence we have.

The open cholecystectomy was done using a supraumbilical midline incision with a length of about 7 cm. There was no prior laparoscopic attempt or conversion reported. Surgical exploration revealed that the liver and gallbladder were on the left. The gallbladder measured 4 × 5 × 6 cm, partially intrahepatic, thickened wall and contained one calculus. The operative appearance was graded as Parkland grade III. These results outline the confirmed abdominal anatomy and the complexity of the operation without suggesting that the operation had started laparoscopically or that the gallbladder had several stones. Open cholecystectomy was the selected operative approach.

Moving into the anatomical reversal entailed a conscious adjustment in the orientation of the surgeon in the dissection process. Exposing the reversed Calot's triangle was carefully performed to identify the cystic duct and the cystic artery. They were both identified, ligated and divided without any reported intraoperative complications. This was done with an estimated blood loss of 50 mL. A Penrose drain was placed at the end of the operation.

The operative report revealed a left-sided liver and gallbladder complex, a partially intrahepatic gallbladder and one gallbladder calculus. It did not report liver calculi, a liver biopsy or an additional anomalous junction. The clinically significant difference was the inverted hepatobiliary orientation with the partial embedding of the gallbladder within the liver. Once the cystic duct and cystic artery were identified, ligated and divided, the cholecystectomy was done without any reported intraoperative complication. The loss of blood was estimated at 50 mL, and a Penrose drain was inserted to prevent complications. The patient was clinically stable, her pain was satisfactorily controlled, she was able to tolerate oral intake and pass flatus during the documented immediate postoperative period. No acute complication was reported. These results indicate a good early outcome following the open procedure, though they do not prove the lack of delayed complications beyond the time frame of the record.

The available clinical documentation did not include any histopathological report, length of stay, date of discharge, Penrose-drain output, date of drain-removal or long-term follow-up. In line with this, the findings are limited to the intra-operative and immediate postoperative periods and cannot be taken as the indication of long term benefit. The patient was reported to be stable during the recorded recovery, and her pain was manageable, she could tolerate oral food and flatus. There was no postoperative complication right after the operation. During the operation, the cystic duct and cystic artery were found, ligated and divided with no reported adverse event, and the estimated loss of blood was 50 mL. A Penrose drain was placed at the end of surgery. Adhesions, delayed haemorrhage, bile leakage, drain-related events or other late outcomes were not recorded in the record; thus, the manuscript neither confirm nor excludes these late outcomes. This wording clearly distinguishes the favourable documented immediate course from outcomes that could not be assessed.

The reported results reveal a positive immediate postoperative outcome following open cholecystectomy, yet the data is not enough to conclude on the overall outcome of the postoperative period. Histopathology results of the gallbladder specimen were also not provided; therefore, histopathology cannot be used to confirm or exclude acute or chronic cholecystitis. The

fact that the dataset does not include a report does not prove that histopathological examination was not conducted. Similarly, the documentation that can be used to prepare the manuscript does not allow evaluating the specific duration of stay, the date of discharge, subsequent laboratory results, Penrose-drain volume or the date of drain removal. There was also no long-term clinical follow-up. These restrictions do not allow evaluation of delayed postoperative complications, recurrent biliary symptoms, wound outcomes, drain-related issues or other clinically significant events post-discharge. The given outcome is thus confined to the stable vital condition, sufficient pain management, the possibility to consume orally, the presence of flatus and the lack of complications observed in the immediate postoperative observation period.

The postoperative history records that the surgical procedure was done with no intraoperative complication and that the patient was stable clinically, was able to take oral food, was able to control pain and had flatus. It does not record a bowel movement, lactate concentration or an evaluation of hypovolaemic shock; this should not be included. The confirmed results show positive short-term outcome but not an evidence of long-term treatment success. As demonstrated in the case, open cholecystectomy was possible in this case even with reversed hepatobiliary anatomy and a partially intrahepatic gallbladder. Its interpretation should fall within the scope of a single-patient case report. There is no comparative information on the relative safety or efficacy of open and laparoscopic cholecystectomy, and no information on long-term morbidity or quality of life can be determined without the follow-up data. Clearly defining these limits gives the report more strength because the conclusions will be based on the clinical evidence recorded and not on missing measurements or speculations regarding the later recovery.

DISCUSSION

Reversed hepatobiliary anatomy is concerning because it is very important to recognise this anomaly when assessing patients with atypical biliary symptoms (8). Left hypochondrial pain may be an important clinical clue to SIT when the liver and gallbladder are located on the left. However, symptom location is not sufficiently specific to establish the diagnosis because patients with SIT may present with epigastric, right-sided or other non-classical symptoms (9). In the present patient, the left-sided symptoms were consistent with the left-sided liver and gallbladder subsequently identified by ultrasonography and confirmed during surgical exploration. One of the main difficulties in doing SIT is changing the familiar anatomical relationships. The surgeon uses known associations between the liver, gallbladder, cystic duct, cystic artery and Calot's triangle during standard cholecystectomy. Thus, conscious adaptation of the anatomical and visuomotor orientations is essential for a safe dissection in SIT, and the exposure and identification of the cystic duct and the cystic artery is a crucial step (10).

Various case reports have reported successful laparoscopic cholecystectomy in SIT. Alam and Santra reported that the operation is possible when the position of trocars, team position and instrument handling are adjusted to mirror-image anatomy (11). A larger systematic review also supported feasibility, but was originally based on case reports and small series, thus cannot prove superiority to open surgery (4). The operative methodology must be based on the anatomy of the patient, clinical conditions, experience of the surgeon, resources at hand and perceived safety and not the perceived universal preference. The present patient had an open cholecystectomy, with no immediate complication reported. Nevertheless, the provided document does not mention the reason why the open method was chosen over laparoscopy. It would then be improper to retrospectively attribute this decision on technology constraints, preference of the surgeon, institutional practice or expected complexity. The prior reports indicate that open cholecystectomy also plays a recognised role in the selected SIT cases especially where the technical or anatomic conditions dictate that an open operation is suitable (12).

This case cannot be referred to as the first open cholecystectomy in a patient with SIT since the open procedures in such a situation have been already reported (5,12). Its clinical significance rather consists in the combination of reversed hepatobiliary anatomy, partially intrahepatic gallbladder and meticulous dissection of the inverted Calot triangle. Localisation, mobilisation and exposure of the gallbladder may be complicated by a partial intrahepatic location which can be complex to locate and may need further preoperative or intraoperative anatomical evaluation when detected (13). In the current case, the recorded variation necessitated deliberate reorientation of the reversed anatomy. Pre-ligation and pre-division identification of the cystic duct and cystic artery and no reported intraoperative complication. This contributes to the principle that safe biliary dissection relies on direct identification of significant structures as opposed to assuming that they are placed in their characteristic locations. The literature that discusses the critical view of safety also focuses on the identification of an aberrant anatomy and total exposure prior to the division of ductal or vascular structures (14).

Diagnostic interpretation is to be cautious. Positive Murphy sign is a warning sign of inflammation of the gallbladder, but not enough to make a diagnosis of acute or chronic cholecystitis. Here, the laboratory tests that were obtained were within normal limits, ultrasonography showed a 3-mm gallbladder wall and the inspection at the operation reported thickened walls and Parkland grade III anatomy. There were no histopathological results, and thus, acute or chronic cholecystitis cannot be either confirmed or ruled out pathologically. Operative grade is a description of operative appearance and difficulty; it is not intended to replace a complete clinicoradiological or histopathological diagnosis. The anatomy of the SIT has been recorded as such, and the abdominal ultrasonography and operative findings only show the left liver and gallbladder. Since SIT is specifically used to refer to mirror-image transposition of both thoracic and abdominal viscera, the original record must be

verified with chest imaging or other documentation of thoracic involvement prior to publication (15). Unverified thoracic findings must not be put forward to corroborate the terminology.

There are a number of strengths of the case. It gives definite operative measurements, describes the left-sided liver and gallbladder, records the partially intrahepatic location and explains intentionally identifying the cystic duct and cystic artery. It also documents the reported immediate postoperative outcome without providing a single case as a comparative evidence. These facts provide a useful illustration of how direct anatomical identification may be useful in cholecystectomy when the standard orientation is inverted. Important limitations remain. An individual patient report will not be sufficient to provide comparative effectiveness and evidence the superiority of open versus laparoscopic cholecystectomy (16). There was no histopathology available, so it is unable to further characterise the gallbladder specimen or clear up whether it was acute or chronic inflammation. The provided documentation does not include the full discharge course, drain-management details and long-term follow-up as well. In addition, the explanation of why an open approach was chosen was not documented and thoracic imaging to confirm complete situs inversus was not provided. The conclusions should be limited thus to the confirmed abdominal anatomy, operation and good immediate recovery.

One of the most important reporting problems is the difference between an absence of information and a negative finding recorded. The lack of histopathology, long-term follow-up or drain-management records of the material provided does not indicate that an examination or subsequent care was not performed; it merely indicates that the information could not be obtained to complete this report (17). To this end, the manuscript presents these items as limitations and not transform them into unfavorable clinical outcomes. This is the same rule as the choice of open cholecystectomy. The decision should not be hindsight excused as being due to equipment unavailability, preference of the surgeon, institutional practice or expected complexity of the operation. Clear distinction of observed results, negative results and unreported data enhance the validity of a case report and allow readers to know precisely what the case can substantiate. The justified conclusions in the current report are related to the clinical appearance, left-sided hepatobiliary anatomy, partially intrahepatic gallbladder, reported open operation and immediate postoperative history.

The CARE guidance suggests full reporting of the clinical course, diagnostic evaluation, treatment intervention, outcome, follow-up, informed consent and, where feasible, the patient perspective (6,18). Informed consent to publication should be clearly written and not implied based on presence of a case report. In case the viewpoint of the patient was not taken, the manuscript ought to indicate the same instead of making one on behalf of the patient. The target journal also requires declarations related to ethics approval or ethics exemption, publication consent, conflict of interest, funding, author contributions, data availability and acknowledgements, which should also be included in the final submission. They do not replace clinical evidence, but they are required in order to report in a transparent and ethically complete manner. They are particularly significant here as the case reports about a rare anatomical arrangement and an operative method where the rationale of the initial decision and the long-term follow-up had not been provided. Unambiguous statements and evidentiary limits will enable the practical surgical lesson in the report to be interpreted without exaggerating the diagnosis, management reason or result.

The general healthcare studies show that the implementation of new clinical technologies is conditional upon the willingness of clinicians, their professional knowledge and institutional preparedness. Such considerations might be invoked in the event that artificial intelligence, electronic health records or electronic decision-support systems are implemented in future to recognize unusual anatomical deviations and aid preoperative planning [19,20,21]. However, these technologies are not to substitute but to supplement direct imaging, clinical judgement and careful intraoperative identification.

CONCLUSION

Situs inversus should be considered when a patient presents with biliary symptoms in an unusual location, including the left hypochondrium. Reversed hepatobiliary anatomy was central to the diagnosis and operative management in the present case. After careful exposure of the reversed Calot's triangle, the cystic duct and cystic artery were directly identified, ligated and divided without a reported intraoperative complication. Open cholecystectomy was completed, and the documented immediate postoperative course was favourable, with stable vital signs, adequate pain control, tolerance of oral intake and passage of flatus. The partially intrahepatic location of the gallbladder represented an additional variation that could complicate exposure and mobilisation. This finding shows why patients with reversed anatomy should not be managed by simply applying a mirror image of assumed normal relationships. Instead, the anatomy actually encountered should guide dissection and operative decisions. The principal lesson is that careful preoperative and intraoperative assessment, optimal exposure and direct identification of the cystic duct, cystic artery and Calot's triangle are essential when hepatobiliary orientation is reversed. This case demonstrates feasibility of open cholecystectomy in one patient; it does not establish that open surgery is superior to laparoscopy. The conclusion is therefore limited to the value of recognising anatomical variation and performing meticulous, structure-based dissection.

REFERENCES

1. Mohammadi Tofigh A, Nematihonar B, Azimi B, Haghbin Toutounchi A, Khoshnoudi H, Kouchak Hosseini SP, et

al. Three surgical cases of Situs Inversus Totalis with individual challenges; Case report and literature review. International Journal of Surgery Open [Internet]. 2023 Sept 22 [cited 2026 Aug 18];59:100689. Available from: https://www.sciencedirect.com/science/article/pii/S240585722300102X
2. Eitler K, Bibok A, Telkes G. Situs inversus totalis: A clinical review. International Journal of General Medicine [Internet]. 2022 [cited 2026 Aug 18];15:2437–49. Available from: https://pubmed.ncbi.nlm.nih.gov/35264880/
3. Faraci J, Kalayilparampil S, Daniels L. Technical considerations in cholecystectomy in the patient with situs inversus. The American SurgeonTM. 2025 Aug 6;92(1):254–7. https://pubmed.ncbi.nlm.nih.gov/40767976/
4. Enciu O, Toma EA, Tulin A, Georgescu DE, Miron A. Look beyond the mirror: laparoscopic cholecystectomy in situs inversus totalis—A systematic review and meta-analysis (and report of new technique). Diagnostics (Basel) [Internet]. 2022 May 19 [cited 2026 Aug 19];12(5):1265. Available from: https://doi.org/10.3390/diagnostics12051265
5. Bajwa SJS, Kulshrestha A, Kaur J, Gupta S, Singh A, Parmar SS. The challenging aspects and successful anaesthetic management in a case of situs inversus totalis. Indian Journal of Anaesthesia [Internet]. 2012 [cited 2026 Aug 19];56(3):295–297. Available from: https://doi.org/10.4103/0019-5049.98781
6. Riley DS, Barber MS, Kienle GS, Aronson JK, von Schoen-Angerer T, Tugwell P, et al. CARE guidelines for case reports: explanation and elaboration document. Journal of Clinical Epidemiology [Internet]. 2017 [cited 2026 Aug 19];89:218–235. Available from: https://doi.org/10.1016/j.jclinepi.2017.04.026
7. Yokoe M, Hata J, Takada T, Strasberg SM, Asbun HJ, Wakabayashi G, et al. Tokyo Guidelines 2018: diagnostic criteria and severity grading of acute cholecystitis (with videos). Journal of Hepato-Biliary-Pancreatic Sciences [Internet]. 2018 [cited 2026 Aug 19];25(1):41–54. Available from: https://doi.org/10.1002/jhbp.515
8. Iqra Khanzada, Taj S, Ghafoor Dalwani, Syed Raheel, Talpur AK, Mohammad JG. Overcoming mirror anatomy: Surgical strategies for laparoscopic cholecystectomy in situs inversus totalis: A case report. Journal of Medical Case Reports. 2025 Sept 1;19(1). https://pubmed.ncbi.nlm.nih.gov/40890843/
9. lsabek MB, Arafat S, Aldirani A. A case report of laparoscopic cholecystectomy in situs inversus totalis: technique and anatomical variation. International Journal of Surgery Case Reports [Internet]. 2016 [cited 2026 Aug 19];28:124–126. Available from: https://doi.org/10.1016/j.ijscr.2016.09.004
10. Perdikakis M, Liapi A, Kiriakopoulos A, Schizas D, Menenakos E, Lyros O. Anatomical variations of the cystic artery and laparoscopic cholecystectomy: A persisting surgical challenge. Cureus [Internet]. 2024 [cited 2026 Aug 18];16(8):e67948. Available from: https://pubmed.ncbi.nlm.nih.gov/39328651/
11. Alam A, Santra A. Laparoscopic cholecystectomy in a case of situs inversus totalis: a review of technical challenges and adaptations. Annals of Hepato-Biliary-Pancreatic Surgery [Internet]. 2017 [cited 2026 Aug 19];21(2):84–87. Available from: https://doi.org/10.14701/ahbps.2017.21.2.84
12. Puglisi F, Troilo VL, De Fazio M, Capuano P, Lograno G, Catalano G, et al. Cholecystectomy in situs viscerum inversus totalis: does laparoscopy increase the pitfalls? Chirurgia Italiana. 2006;58(2):179–183. Available from: https://pubmed.ncbi.nlm.nih.gov/16734166/ (Accessed: 19 August 2026).
13. Monib S, Mahapatra P, Habashy HF. Intrahepatic gallbladder. European Journal of Case Reports in Internal Medicine [Internet]. 2019 May 27 [cited 2026 Aug 19];6(6):001123. Available from: https://doi.org/10.12890/2019_001123
14. Papagoras D, Douridas G, Panagiotou D, Toutouzas K, Charalabopoulos A, Lykoudis P, et al. Aberrant anatomy in the context of the critical view of safety. Surgical Endoscopy. 2024 Dec 18;39(2):1086–100. https://pubmed.ncbi.nlm.nih.gov/39694950/
15. Suvarna R, Gupta A, Amtul N. Left-sided cholecystitis in a patient with situs inversus totalis, complicated by portal venous malformations. Journal of Surgical Case Reports [Internet]. 2023 Nov 20 [cited 2026 Aug 19];2023(11):rjad627. Available from: https://doi.org/10.1093/jscr/rjad627
16. Zhao JJ, Syn NL, Chong C, Tan HL, Ng JYX, Yap A, et al. Comparative outcomes of needlescopic, single-incision laparoscopic, standard laparoscopic, mini-laparotomy, and open cholecystectomy: A systematic review and network meta-analysis of 96 randomized controlled trials with 11,083 patients. Surgery. 2021 May https://pubmed.ncbi.nlm.nih.gov/34023139/
17. Mencarini L, Vestito A, Zagari RM, Montagnani M. The diagnosis and treatment of acute cholecystitis: a comprehensive narrative review for a practical approach. Journal of Clinical Medicine [Internet]. 2024 May 3 [cited 2026 Aug 19];13(9):2695. Available from: https://doi.org/10.3390/jcm13092695
18. Gagnier JJ, Kienle G, Altman DG, Moher D, Sox H, Riley D; CARE Group. The CARE guidelines: consensus-based clinical case reporting guideline development. Journal of Clinical Epidemiology [Internet]. 2014 [cited 2026 Aug 19];67(1):46–51. Available from: https://doi.org/10.1016/j.jclinepi.2013.08.003
19. Abu-Farha RK, Alzoubi KH, Al Safadi A, Alsous MM, Nawasreh A, El-zubi MK, et al. Exploring physicians' willingness to integrate artificial intelligence in clinical practice: ethical and practical insights from a Jordanian cross-sectional survey. Health Science Reports [Internet]. 2026 [cited 2026 Aug 19];9(3):e71994. Available from:

https://doi.org/10.1002/hsr2.71994

20. Alkasasbeh AM, Jarrah SS, Alhusamiah BK, Tarawneh FS. Factors influencing the utilization and adoption of electronic health records among nurses in Jordanian hospitals. Jordan Journal of Nursing Research [Internet]. 2025 [cited 2026 Aug 19];4(1):68–80. Available from: https://doi.org/10.14525/JJNR.v4i1.08

21. Assaf EA, Alkhresheh R, Al Sabbah H, Al-Akash H. Transforming care: a study on physicians' awareness, attitudes, and barriers to pressure injury prevention in medical wards in Jordan. Frontiers in Public Health [Internet]. 2025 May 14 [cited 2026 Aug 19];13:1582074. Available from: https://doi.org/10.3389/fpubh.2025.1582074