

LAPAROSCOPIC TURNED TO OPEN CHOLECYSTECTOMY IN SITUS INVERSUS TOTALIS : A CASE REPORT

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Abstract

Situs inversus totalis (SIT) is a rare anomaly characterized by organ transposition to the opposite side of the body. We present the case of a 30-year-old woman who presented with a one-month history of intermittent epigastric and left upper quadrant pain. Clinical evaluation and radiological examinations confirmed the presence of cholelithiasis with SIT. The anatomical variation of the SIT can affect the localization of symptoms in patients with cholelithiasis, delaying diagnosis and treatment. Due to the underlying anatomical variation, numerous intraoperative modifications were made to overcome the technical difficulties encountered. The structures in Calot's triangle are difficult to outline, requiring more time than a normally located gallbladder. In cases of situs inversus, surgery can be technically challenging, particularly for right-handed surgeons. The patient underwent elective laparoscopic cholecystectomy but was converted to open cholecystectomy due to intra operative complications.

INTRODUCTION

Situs inversus totalis is a rare congenital condition in which the organs of the chest and abdomen are arranged in a mirror-image orientation to their normal positions. The incidence of situs inversus totalis is estimated to be 1 in 10,000 individuals in the general population and is more common in men: 1.5:1.^[1] Patients with situs inversus totalis pose a unique challenge for surgical interventions due to the reversed anatomy. Acute calculous cholecystitis is a common complication of gallstone disease and requires prompt management to prevent serious complications such as gallbladder perforation or empyema.^[2] Symptoms of calculous cholecystitis are similar in patients with and without situs inversus totalis, but the management of this condition in SIT cases presents a unique challenge. The gold standard for the management of acute calculous cholecystitis is laparoscopic cholecystectomy. However, in cases of SIT, the surgical approach requires modification to account for the reversed anatomy. Furthermore, if the gallbladder is ruptured, along with associated factors

such as the presence of adhesions, open cholecystectomy is preferred to avoid potential complications.^[3] The challenges in the management of these patients include the need for preoperative imaging to confirm the diagnosis and identify the location of the gallbladder and other abdominal organs, as well as the need for experienced surgical teams that are familiar with the unique surgical approach required for these cases.^[4]

In this case report, we describe a laparoscopic-turned-open cholecystectomy in a patient with situs inversus totalis and acute calculous cholecystitis. The purpose of this case report is to highlight the challenges and considerations in the management of acute calculous cholecystitis in patients with situs inversus totalis and to emphasize the importance of proper preoperative planning and communication among the surgical team to ensure successful outcomes.

CASE PRESENTATION

A 30 year old woman was presented to the surgical outpatient department complaining of diffuse and

recurrent left abdominal pain which was managed conservatively during the last four months. Other symptoms included bloating and loss of appetite.

Her blood panel was unremarkable, including normal transaminase, lipase, alkaline phosphatase and bilirubin.

Table 1: Lab Values

Liver function test		
Examination	Results	Units, ref
Alanine transaminase	30.1	U/L <45
CalciumTotal bilirubin	0.4	mg/dL <1.3
Direct bilirubin	0.1	mg/dL <0.4
Indirect bilirubin	0.3	mg/dL <1.3
Total protein	7.3	g/dL <6.4-8.3
Albumin	4.0	g/dL <3.5-5.2
Alkaline phosphatase	83	U/L 42-128
Electrolyte		
Sodium	139.37	mmol/L 136-145
Potassium	4.5	mmol/L 3.5-5.1
Renal function test		
Creatinine	0.8	mg/dL Male- 0.9-1.3 Female- 0.6-1.1
Calcium	9.8	mg/dL 8.6-10.2
Phosphorus	3.5	mg/dL 2.5-4.5
Albumin	4.0	g/dL <3.5-5.2

Table 2: Table used to demonstrate the various cases of laparoscopic cholecystectomy in SIT

Serial no. of cases in each series	Literature	Year of publication	Diagnosis	Gender	Age
1	Campos and Sipes et al.	1991	Chronic Cholecystitis	Female	39
2	Takei et al.	1992	Cholelithiasis	Female	51
3	Lipschutz et al.	1992	Cholangitis/ CBD calculi	Male	80
4	Goh et al.	1992	Empyema	Male	62
5	Drover et al.	1992	Chronic Cholecystitis	Female	29
6	Huang et al.	1992	Chronic Cholecystitis	Male	36
7	Schiffino et al.	1993	Chronic Cholecystitis	Female	53
8	Mc Dermott and Caushaj et al.	1994	Cholangitis/ CBD calculi	Male	66
9	Malatani et al.	1996	Acute Cholecystitis	Female	25
10	Crosher et al.	1996	Cholelithiasis	Male	63
11	D'Agata and Boncompagni et al.	1997	Chronic Cholecystitis	Female	72
12	Habib et al.	1998	cholecystectomy	Female	45
13/14	Demetriades et al.	1999	Acute Cholecystitis /Chronic Cholecystitis	Female	61/37
15	Djohan et al.	2000	Chronic Cholecystitis /appendectomy	Female	20
16	Wong et al.	2001	Chronic Cholecystitis /CBD calculi	Female	68
17	Dorthi et al.	2001	Chronic Cholecystitis	Female	43
18	Nursal et al.	2001	Chronic Cholecystitis	Female	42
19/20	Yaghan et al.	2001	Chronic Cholecystitis /Chronic Cholecystitis	Female	48/38
21	Al Jumaily and Hoche et al.	2001	Chronic Cholecystitis	Female	46
22	Singh and Dhi et al.	2002	Chronic Cholecystitis	-	-
23	Trongue et al.	2002	Chronic Cholecystitis	Female	28
24	Polychronidis et al.	2002	Chronic Cholecystitis	Male	68
25/26	Oms and Badia et al.	2003	Acute Cholecystitis	Female/ Male	70/65
27	Jesudason et al.	2004	Chronic Cholecystitis	-	-
28	Kang and Han et al.	2004	Chronic Cholecystitis /CBD calculi	Female	64
29	Docimo et al.	2004	Chronic Cholecystitis	Female	41
30	Pitiakoudis et al.	2005	Chronic Cholecystitis	Female	47
31	McKay and Blake et al.	2005	Acute Cholecystitis	Female	32
32	Kamitani et al.	2005	Chronic Cholecystitis	Male	76
33	Puglisi et al.	2006	Chronic Cholecystitis	Female	43
34	Bedioui et al.	2006	Chronic Cholecystitis	Female	58
35	Aydin et al.	2006	Chronic Cholecystitis	Male	35
36	Machado and Chopra et al.	2006	Chronic Cholecystitis	Female	65
37	Kumar and Fusai et al.	2007	Chronic Cholecystitis	Female	57
38	Fernandes et al.	2008	Chronic Cholecystitis	Female	43
39	Hamdi and Abu hamdan et al.	2008	Acute Cholecystitis	Male	41
40	Pavlidis et al.	2008	Acute Cholecystitis	Female	34

41	Taskin et al.	2009	Chronic Cholecystitis /Gastric banding	Female	20
42	Masood et al.	2009	Chronic Cholecystitis	Female	42
43	Pereira-Graterol et al.	2009	Chronic Cholecystitis	Female	70
44	Romano et al	2009	Cholelithiasis	Female	67
45	Eisenberg D et al	2009	Cholelithiasis	Male	61
46	Pataki et al.	2010	Chronic Cholecystitis	Female	68
47	Hall et al.	2010	Chronic Cholecystitis	Male	53
48	Gonzalez Valverde et al.	2010	Chronic Cholecystitis	Female	46
49	Sanduc and Toma et al.	2010	Chronic Cholecystitis	Female	64
50/51/52/53/ 54/55	Patle NM et al.	2010	5 Cholelithiasis/ 1 Acute Cholecystitis	5 Female/ 1 Male	36/43/ 27/48/59/33
56	Han et al.	2011	Chronic Cholecystitis	Male	45
57	Ozsoy et al.	2011	Chronic Cholecystitis	Female	65
58	Uludag et al.	2011	Cholelithiasis	Male	49
59	Borgaonkar et al.	2011	Cholelithiasis/ Appendicitis	Female	47
60	Seo KW et al.	2011	Cholelithiasis / Gastric cancer	Male	60
61	Evoli LP et al.	2011	Cholelithiasis	Female	48
62	Iusco el al.	2012	Cholelithiasis	Female	52
63	Elbeshry et al.	2012	Cholelithiasis	Female	24
64	Lochman et al.	2012	Acute Cholecystitis	Female	75
65/66	Demiryilmaz et al.	2012	Cholelithiasis/ Choledocholithiasis	Female/ Male	55 /51
67	de Campos Martins, Marcus Vinicius Dantas et al.	2012	Cholelithiasis	Female	59
68	Pahwa, Harvinder Singh et al.	2012	Cholelithiasis	Female	46
69	Bozkurt et al.	2012	Cholelithiasis	Male	49
70	Salama et al.	2013	Cholelithiasis	Male	10
71	Arya et al.	2013	Cholelithiasis	Female	35
72	Ali MS et al.	2013	Cholelithiasis	Female	43
73	Khiangte et al.	2013	Cholelithiasis	Male	65
74	Raghuveer et al.	2014	Cholelithiasis	Male	55
75	Reddy et al.	2014	Acute Cholecystitis/ Choledocholithiasis	Female	45
76	Fang el al.	2015	Gallbladder polyp / Rectal cancer	Female	39
77	Deguchi et al.	2015	Cholelithiasis	Male	66
78	Rosen H et al.	2015	Acute Cholecystitis	Male	36
79	Phothong et al.	2015	Cholelithiasis	Female	39
80	Alsabek et al.	2016	Cholelithiasis	Female	50
81/82/83	Zeeshan et al.	2016	Acute Cholecystitis/ Cholelithiasis / Cholelithiasis	Female	46/44/33
84	Jian-jun et al.	2017	Chronic Cholecystitis	Female	36
85	Rungsakulkij and Tangtawee et al.	2017	Biliary pancreatitis	Male	32
86	Fanshawe and Qurashi et al.	2017	Biliary pancreatitis	Female	53
87	Alam and Santra et al.	2017	Cholelithiasis	Female	20
88	El Hajj et al	2017	Cholangitis/ biliary pancreatitis	Male	61
89	Ying et al.	2017	Cholangitis/ Acute Cholecystitis	Female	51
90	Yogesh et al.	2018	Cholelithiasis / CBD calculi	Female	50
91	Jhobta RS et al.	2018	Cholelithiasis	Female	23
92	Reported Case	2018	Cholelithiasis	Male	40
93	Mohammed,Ayad Ahmed et al	2019	Cholelithiasis	Male	28
94	Du Tianli et al.	2020	Acute Cholecystitis	Female	56

An ultrasonography was performed in which the spleen was found to be located in the right hypochondrium, and the liver was in the left hypochondrium. Overall, the presentation was consistent with situs inversus. Findings further included a gallbladder that measured 10.5 centimeters in length and contained multiple calculi and sludge. One of the calculi, measuring approximately 1 millimeter, was impacted in the gallbladder's neck. The gallbladder wall thickness was measured at around 4 millimeters at the fundus, with a hypochoic mucosal component attached to the anterior wall of the gallbladder. An abdominal computed tomography (CT) was deemed necessary

for proper preoperative planning in order to observe the exact position of the gallbladder and the main biliary duct and rule out the possibility of gallbladder sinistroposition, which is a rare condition where there is a left-sided gallbladder without situs viscerum inversus. The diagnosis of situs inversus totalis was confirmed using contrast-enhanced CT [Figure 1, 2].

The CT findings also revealed acute calculus cholecystitis with surrounding inflammatory changes and rupture of the gallbladder at the fundus, along with a few (2 in number) areas of contained rupture of the gallbladder wall by the omentum.

There was a calculi that was impacted in the gallbladder's neck [Figure 3].

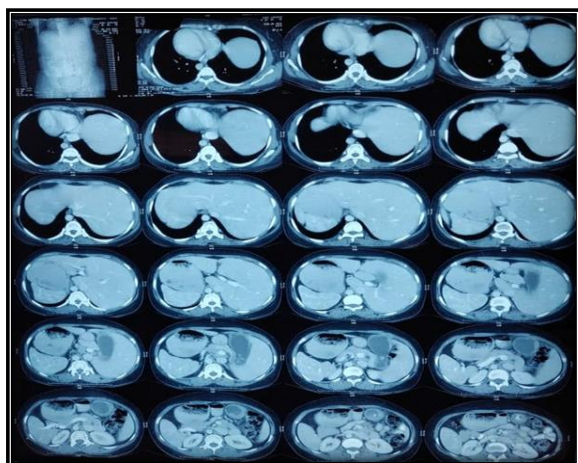


Figure 1: The CT chest shows a right-sided heart, and CT abdomen shows the mirror image orientation of the organs, confirming Situs inversus.

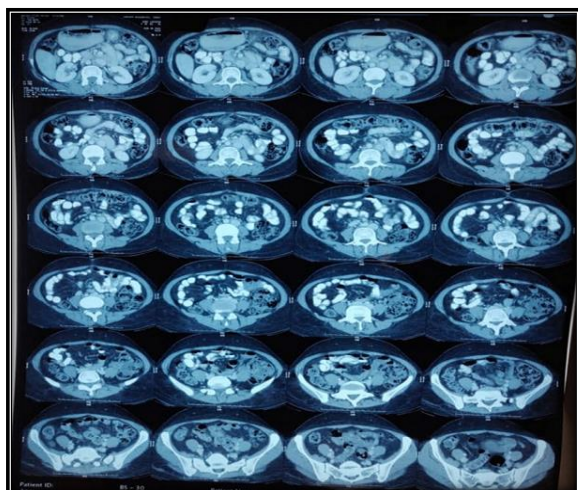


Figure 2: Lower abdominal CT findings consistent with Situs inversus totalis presentation

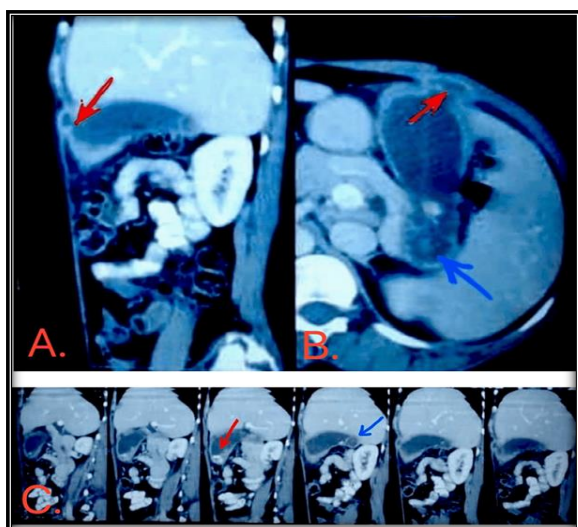


Figure 3: CT scan showing acute calculus cholecystitis with surrounding inflammatory changes and rupture of the gallbladder at the fundus.

A. Saggital CT scan- The red arrows point out to the gallbladder edema due to inflammatory changes and sludge.

B. Transverse CT- The red arrow points out to the point of rupture of gall bladder. The blue arrow points out to the 1 mm gallstone impacted at the gallbladder neck.

C. The red arrows point out the gallbladder edema due to inflammatory changes and sludge. The blue arrow points out to the 1 mm gallstone impacted at the gallbladder neck.

Both the cystic duct and the common bile duct appeared to be normal on CT scan, suggesting no signs of stone impaction and Choledocholithiasis. As a result, a thorough pre-operative workup including a chest X-ray, ECG, and physical examination was performed to rule out any underlying deformities. The decision was made to perform a laparoscopic cholecystectomy on the patient, as all pre-anesthetic testing and imaging were consistent with the possibility of a laparoscopic procedure.

With the difficulty of a mirror operation in mind, extensive literature research was conducted in order to evaluate trocar positioning and select the best option for the right-handed surgeon. It was reasoned that the primary surgeon, who is right-handed, would have trouble dissecting with the left hand through the epigastric port. As a result, it was decided to operate on the lithotomy with the surgeon between the patient's legs, the assistant on the patient's left side retracting the gallbladder fundus and infundibulum, and the camera operator on the patient's right. A 4-port laparoscopic cholecystectomy method was selected. A 10 mm optic port was put in the normal umbilical area, a second 10 mm port in the epigastric area 10 cm below the xiphoid process, a third 10 mm port on the midclavicular line 10 cm below the costal margin, and a fourth 5 mm trocar on the anterior axillary line on the left side [Figure 4].

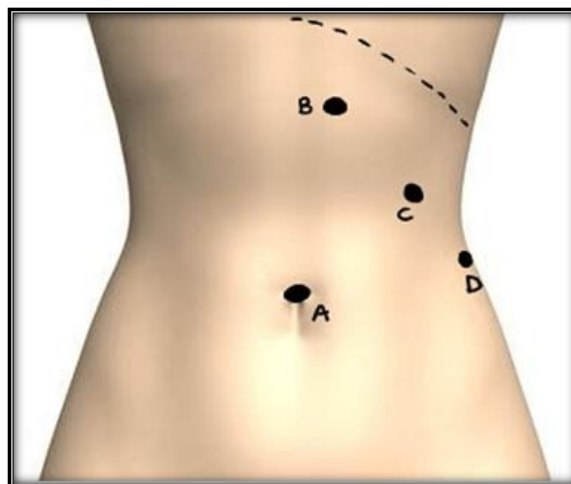


Figure 4: Schematic diagram of a 4-port laparoscopic cholecystectomy in case of Situs inversus totalis patient.

- A- 10 mm optic port was put in the normal umbilical area
- B- 10 mm port in the epigastric area 10 cm below the xiphoid process
- C- 10 mm port on the midclavicular line 10 cm below the costal margin
- D- 5 mm trocar on the anterior axillary line on the left side

The dispersal of the operating team in this manner allowed for better movement with no concerns about hands or instruments interlocking. Due to right-left inversion, there were some difficulties manipulating surgical or endoscopic instruments. It was discovered intraoperatively that the gallbladder was densely adherent to the adjacent tissues as well as the omentum [Figure 5,6].

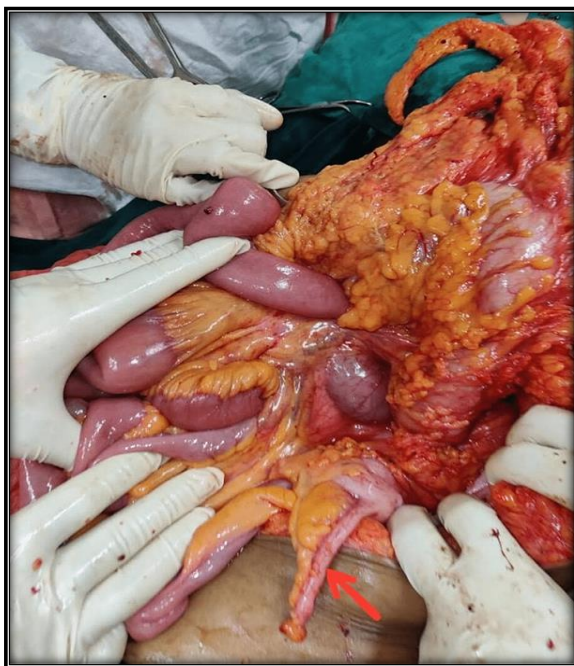


Figure 5: Open cholecystectomy- Abdominal organs involving the appendix are in mirror image orientation.

Red arrow points to the appendix.

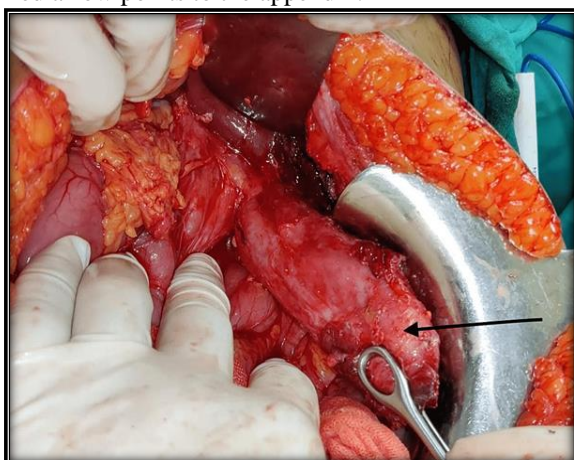


Figure 6: Gallbladder on the left-hand side is densely adherent to the adjacent tissue (arrow points to gallbladder)

The original plan for laparoscopic cholecystectomy was changed to an open procedure, and the vertical midline incision was maintained. A dissection was performed on the area surrounding the gallbladder. The gallbladder was opened and found to be ruptured, the gallstones were then extracted. A dissection was performed all the way around the bladder's neck. Calot's triangle was identified as being formed by the boundaries of the cystic duct, hepatic duct, and cystic artery. In addition to removing the gallbladder, the cystic duct and the cystic artery were ligated and cut. The abdominal closure was performed layer by layer.

The patient was discharged from the hospital on the fourth postoperative day after the surgery, as there were no significant postoperative complications. She was prescribed necessary antibiotics, including Tablet Metronidazole 400 mg thrice per day and Tablet Cefixime 200mg twice a day for 7 days. The surgical site was healing properly on follow-up, with no infection, pus, or drainage.

DISCUSSION

In this case report we have gone through a case of situs inversus totalis in a planned case of cholecystectomy. There has been considerable literature on these cases as almost 50 cases have been documented since 1991 and in most of these cases, a laparoscopic approach was preferred in lieu of considerable anatomical variations present in these patients. These cases can have significant variations in the symptomatology as well including pain in the left hypochondrium which could potentially be misleading without relevant investigations.^[5] Situs inversus by itself can present various systemic anomalies and this can lead to slightly more challenging operative procedures. Upto 25 percent of cases of situs inversus can present with Kartagener syndrome which additionally presents with paranasal sinusitis and bronchiectasis.^[6] We should also be aware of cases of situs inversus that have presented with other complaints such as perforated peptic ulcer and intestinal obstruction as these are potential differential diagnoses although whether the rates of these complications in such cases are higher is yet to be seen.^[7,8]

In addition to all the surgical obstacles faced in these cases, there are significant anesthetic challenges as well which tend to arise as a result of potential spinal deformities that could be present in these cases along with possible cardiac anomalies such as transposition of the great vessels and ventricular septal defect. If Kartagener's is found to be associated in such cases, ciliary dyskinesia is found to play a major role as an anesthetic challenge. Another point to be wary of is the placement of defibrillators in the event of a cardiac arrest where great care is to be taken to ensure correct placement of the pads.^[9] These were integral

things we looked for in our patient as part of the pre-anesthetic checkup and were the points we had kept in check during pre-operative arrangements.

While pain in the left hypochondrium should be suspected in such cases, about 10% of patients with left-sided cholelithiasis present with right-sided abdominal pain. Hence radiological investigations help towards the correct diagnosis. To avoid errors such as intervention on the wrong side of the patient, the surgeon has to pay close attention to image labeling. SIT is occasionally indicated by an apical beat in the right fifth intercostal space, dullness on the opposite side of the liver, and the right testicles hanging lower than the left.^[10]

Below is a table (in appendix) we have compiled to demonstrate the various cases of laparoscopic cholecystectomy. The findings of Omar et al,^[11] Mohammed AA et al,^[12] Du T et al,^[13] were considered.

There have been various techniques utilized in these procedures wherein the positioning of the surgeon and the camera ports play a huge role in the overall task performance.^[14] In our case, we had positioned a total of 4 trocars in a mirror-image fashion. In most of laparoscopic cases, surgeons have a coaxial image, in which the camera aligns with the surgeon's field of vision that is, the camera and the surgeon tend to be on the same side of the operating table. However, it is extremely difficult for the surgeon to perform laparoscopic tasks if the camera is placed on the side which is opposite the surgeon. This situation is called as a mirror image (reverse alignment) and is one of the obstacles in patients with SIT.^[15] In a particular study while there were no significant changes noticed in operative techniques, significantly better outcomes have been achieved in cases involving a left-handed surgeon along with the type of imaging that has been utilized prior to the operative procedure.^[16] This leads to the possibility that a clear delineation of the anatomy pre-operatively leads to better patient recovery and outcomes. A few procedures have also been performed using single trocar access. Although this technique is not predominantly utilized, it could spell a new direction in terms of laparoscopic access and truly minimal access surgery.^[17] This procedure has led right-handed surgeons to adopt a few innovative techniques of their own to mirror the anatomy. Many surgeons have used the epigastric port for grasping the infundibulum and the left midclavicular line subcostal port for dissecting. Patle et al,^[18] successfully operated using this configuration with the patient in the lithotomy position and the surgeon standing between the legs, whereas Hall et al,^[19] used this technique while standing on the right side of the patient. While there have been a few cases of open cholecystectomy that have been performed in the past for situs inversus, the majority of cases have been performed laparoscopically.^[20] In this particular case, due to the severity of the adhesions, a decision was made to convert to an open method.

CONCLUSION

Our patient had a medical history significant for situs inversus totalis, a rare congenital condition in which the organs of the thorax and abdomen are arranged in a mirror image reversal of their normal positions. Laparoscopic cholecystectomy is the gold standard treatment for cholelithiasis. However, the anatomical variations present in patients with situs inversus totalis can make this procedure more challenging. In this instance, the port placements and surgical team positions were an exact mirror image of the conventional procedure. We, therefore, believe that, with these minor modifications, a right-handed surgeon can perform this technically challenging procedure with nearly the same level of expertise as a left-handed surgeon. While the laparoscopic approach in our patient failed we were able to turn into an open cholecystectomy procedure and ultimately help our patient. Our case report highlights the importance of careful preoperative planning and attention to detail in the management of patients with SIT undergoing laparoscopic cholecystectomy. Regrettably in our case due to the emergent nature caused by a ruptured gallbladder and the lack of resources to perform more detailed investigations such as MRCP, we were unable to be as thorough as we could. We hope this serves as a reminder of the constant challenges faced in settings without adequate financial resources and pushes to try and improve the availing facilities to help deal with such complicated anatomy. Surgeons and anesthesiologists should be aware of the potential challenges associated with this condition and prepare accordingly to ensure optimal outcomes.

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