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Our experience with surgery in situs inversus: Open peptic perforation repair and laparoscopic cholecystectomy in 1 patient and 3 patients respectively



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ABSTRACT

INTRODUCTION: Situs inversus is a rare autosomal recessive condition associated with complete transposition of abdominal +/- thoracic organs. Surgical diagnosis and surgical procedures in patients with situs inversus is tricky because of the mirror image anatomy of intra-abdominal organs.

MATERIALS AND METHODS: A retrospective analysis of 2152 and 1497 patients who underwent laparoscopic cholecystectomy and open peptic perforation repair respectively from June 2014–June 2016 was done. 1 patient and 3 patients with situs inversus underwent open peptic perforation repair and laparoscopic cholecystectomy respectively. A 10 mm left para-median port 5 cm caudally from xiphoid was used for grasping the infundibulum. Two 5 mm ports placed 10 cm caudally from costal margin in the mid-clavicular and anterior axillary line were used for dissecting and retracting fundus respectively. A 10 mm supra-umbilical camera port was used.

RESULTS: A 40 year male with situs inversus totalis underwent open peptic perforation repair. Laparoscopic cholecystectomy was done in 3 female patients with situs inversus aged 33–46 year (mean 41 year). Mean operative time for laparoscopic cholecystectomy was 59 min (39–93). There were no intraoperative or post-operative complications. Histopathology revealed chronic inflammation in peptic perforation and cholecystitis.

CONCLUSION: Perforation peritonitis in situs inversus can cause diagnostic confusion with free gas under the left hemi diaphragm. Laparoscopic cholecystectomy in situs inversus is ergonomically inconvenient and technically difficult for right handed surgeons. We describe an ergonomically convenient port placement for right handed surgeons in situs inversus.

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1. Introduction

Situs inversus is an autosomal recessive condition involving mirror image transposition of abdominal and thoracic organs and an incidence of 1/10,000 to 1/20,000 [1]. When the heart is also transposed towards the right, it is called situs inversus totalis. Situs inversus partialis is a much rarer condition where the heart remains on the normal side [1]. Surgical diagnosis and procedures

can be tricky in these patients due to mirror image transposition of intraabdominal organs. Perforation peritonitis can present as gas under left hemidiaphragm [2] or the fundus air shadow on right side can be mistaken for free gas under right hemidiaphragm [3]. Laparoscopic cholecystectomy for symptomatic gall stone disease in situs inversus can be problematic for right handed surgeons. Many of them adapt by using the left midclavicular port for dissection instead of the epigastric port [4]. But, this technique is ergonomically inconvenient as the surgeon has to extend his dissecting arm across the patient's body. We describe a modified 4 port technique in 3 patients with situs inversus which is ergonomically more convenient for right handed surgeons. This technique can also be used by left handed surgeons in conventional right sided laparoscopic cholecystectomy. This article has been written in line with the SCARE criteria as described by Agha et al. for the SCARE group. 'The SCARE Statement: Consensus-based surgical case report guidelines. International Journal of Surgery 2016' [5].

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Table 1

Patient demographic and clinical characteristics. M (Male); F(Female); LUQ(Left upper quadrant); POD(Post-operative day); SIP(Situs inversus partialis); SIT(Situs inversus totalis).

Patient No.	Age/Sex	Presenting complaints	Duration of symptoms	Diagnosis	Management	Operative time	Complications	Discharge	Histopathology
1.	40/M	Epigastric pain followed by diffuse abdominal pain	4 days	Perforation peritonitis with SIT	Exploratory laparotomy with peptic perforation repair and appendectomy	65 min	–	POD 6	Chronic inflammation
2.	46/F	LUQ pain with fever and vomiting	5 days	Acute cholecystitis with SIP	Conservative followed by interval laparoscopic cholecystectomy after 6 weeks	93 min	–	POD 2	Cholecystitis
3.	44/F	Recurrent LUQ pain	6 months	Cholelithiasis with SIT	Elective laparoscopic cholecystectomy	39 min	–	POD 1	Cholecystitis
4.	33/F	Recurrent LUQ pain	3 months	Cholelithiasis with SIT	Elective laparoscopic cholecystectomy	45 min	–	POD 1	Cholecystitis

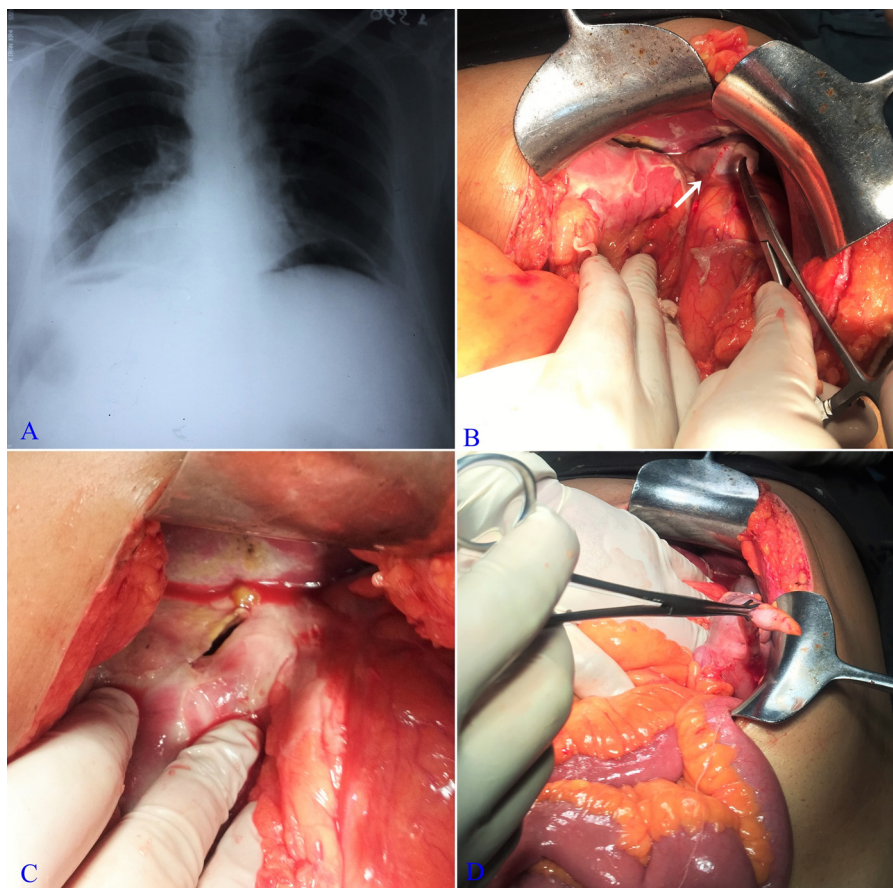


Fig. 1. in Patient 1 (A) Chest X-ray erect PA view showing dextrocardia with fudus air shadow of right side with free intra-peritoneal air under left hemidiaphragm. (B) Liver and gall bladder (white arrow) on the left side. (C) A 2.5 cm × 0.5 cm antral perforation on anterior wall of stomach. (D) Appendix on left side.

2. Patients and methods

This study was a retrospective analysis of all patients who underwent laparoscopic cholecystectomy and exploratory laparotomy for perforation peritonitis at SMS Hospital, Jaipur from June

2014 to June 2016. Patients with situs inversus and symptomatic cholelithiasis or perforation peritonitis were included.

All patients presenting with acute upper abdominal pain and tenderness on abdominal examination were investigated with a Chest X-ray (CXR) erect and an Ultrasound (USG) abdomen.

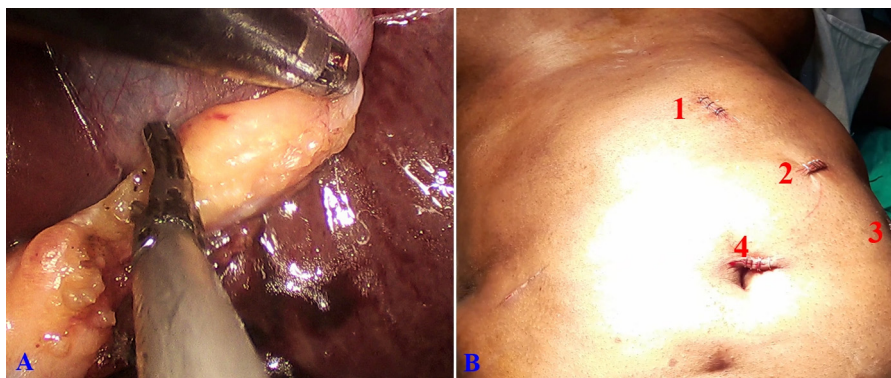


Fig. 2. in Patient 3 (A) Grasper from the left paramedian port being used to retract the infundibulum and the left mid clavicular line port being used to dissect the Calot's triangle. (B) 1. Left paramedian port 5 cm below the xiphoid for grasping the infundibulum. 2. Left mid-clavicular line port 10 cm below costal margin for dissecting the Calot's triangle. 3. Left anterior axillary line port 10 cm below costal margin for retracting the fundus. 4. Supraumbilical camera port.

Routine hematological and biochemical investigations were done in all patients. All the patients diagnosed with situs inversus on USG and CXR were further investigated with Electrocardiography and Echocardiography. Patient demographic and clinical characteristics are presented in [Table 1](#).

Patient 1 presented with signs and symptoms suggestive of perforation peritonitis. Chest X-ray revealed dextrocardia with fundus air shadow on right side of diaphragm and free air under left hemidiaphragm ([Fig. 1](#)). An emergency ultrasonography of the abdomen showed free fluid in the abdomen with situs inversus. A definitive diagnosis of Perforation peritonitis with situs inversus totalis was made. On emergency exploratory laparotomy through upper mid line abdominal incision, a 2.5 cm × 0.5 cm antral perforation on the anterior wall of the stomach was found ([Fig. 1](#)). After thorough abdominal wash, the perforation was repaired with omentopexy. Additionally, appendectomy was done to prevent diagnostic confusion in the future ([Fig. 1](#)). Patients 2–4 underwent elective laparoscopic cholecystectomy under general anesthesia. Patient 2 underwent interval elective laparoscopic cholecystectomy 6 weeks after the acute episode of acute cholecystitis while patients 3 and 4 were operated for symptomatic gall stone disease. The operation was performed with 4 ports ([Fig. 2B](#)). Pneumoperitoneum was created using a Veress needle. A 10 mm supraumbilical port was created for a 30° laparoscope. Position of liver and gall bladder on the left side was confirmed ([Fig. 3A](#)). A 10 mm left paramedian port 5 cm caudally from xiphoid was used for grasping the infundibulum. Two 5 mm ports placed 10 cm caudally from costal margin in the mid-clavicular and anterior axillary line were used for dissecting and retracting fundus respectively ([Fig. 2A](#)). The surgeon and the first assistant stood on the right side of the patient with the monitor on the patient's left side. Fundus was retracted by the second assistant standing on the patient's left side. The operating surgeons being right handed used the left paramedian port for grasping the infundibulum with the left hand and used the left midclavicular line port for dissecting the Calot's triangle, clipping of cystic duct and artery and removing the gall bladder from its bed ([Fig. 3B](#)). This technique was adopted in all three patients.

3. Results

From June 2014 to June 2016, 2152 patients and 1497 patients underwent laparoscopic cholecystectomy and emergency exploratory laparotomy respectively at the General surgery department of SMS Hospital, Jaipur. Out of these, 3 patients (1, 3 and 4) were diagnosed as situs inversus totalis and patient 2 was diagnosed as situs inversus partialis. The patients' demographic and clinical characteristics are described in [Table 1](#). Patient 1 had a

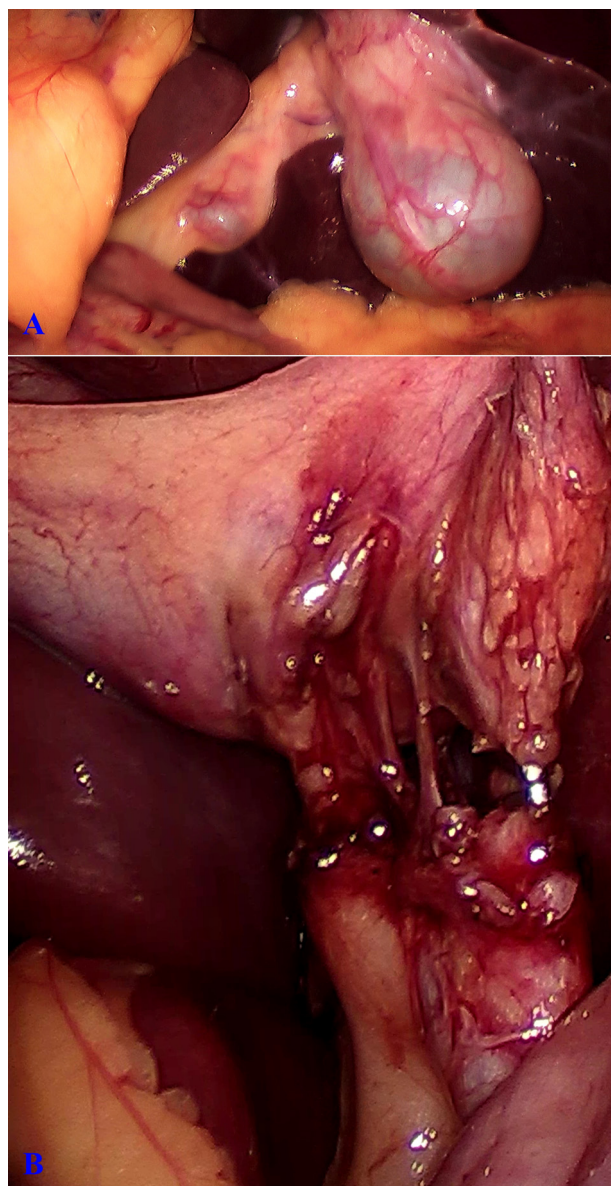


Fig. 3. in Patient 4 (A) Gall bladder and liver on left side. (B) A completely dissected Calot's triangle with the cystic duct clipped.

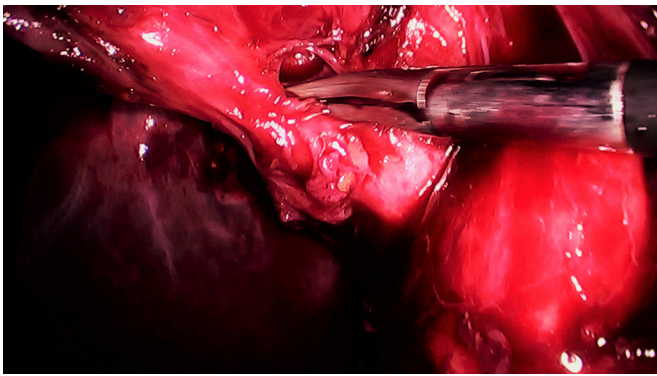


Fig. 4. in Patient 2 showing ongoing dissection of the Calot's triangle.

2.5 cm × 0.5 cm prepyloric perforation on the anterior stomach wall for which he underwent Graham's patch repair with appendectomy. Biopsy from ulcer was suggestive of chronic inflammation.

Using mirror image conventional 4 port placement for laparoscopic cholecystectomy in situs inversus is inconvenient for right hand handed surgeons who have to use their non-dominant left hand for dissecting through the epigastric port. Many surgeons adapt to this situation by using the midclavicular port for Calot's triangle dissection using their left hand. This is ergonomically inconvenient since the surgeon standing on the patient's right side has to reach across the patient's body to the left side and leads to surgeon fatigue. A left midclavicular line port placed 10 cm caudally from the costal margin was used for dissection and the left paramedian port placed 5 cm caudally from the xiphoid was used for grasping the infundibulum was found to be ergonomically more convenient for right handed surgeons. The mean operating time for laparoscopic cholecystectomy was found to be 48 min (39–93). The operative time in patient 2 was longer relative to the other 2 patients due to presence of dense adhesions between duodenum and gall bladder fundus (Fig. 4). There were no intraoperative or post-operative complications. Biopsy was suggestive of cholecystitis in all 3 cases.

4. Discussion

The abnormal location of intraabdominal organs and/or intrathoracic organs in situs inversus can lead to diagnostic confusion and technical difficulties during surgery [6]. Fundus gas shadow on the right side can masquerade as gas under right hemi-diaphragm [3] and acute cholecystitis presents as left upper quadrant or epigastric pain predominantly (30%) and rarely right upper quadrant pain in 10% of cases [7]. Preoperative diagnosis can be suspected by dextrocardia on chest X-ray as in 3 of our cases. The diagnosis of can be further established by Ultrasonography, Barium contrast studies and CT(Computed Tomography) scans and MRI(Magnetic resonance imaging) scans [8].

Perforation peritonitis is one of the commonest surgical emergencies and peptic perforation peritonitis is the commonest cause of perforation peritonitis in India [9]. Perforation peritonitis in situs inversus is extremely rare with one case of gall bladder perforation [3], one case of appendicular perforation [10] and two cases of peptic perforation peritonitis described in literature [2,11].

Patients with peptic perforation usually present with short duration of epigastric pain followed by generalized tenderness [9]. Surgical repair depends on the size of the defect. Defects < 1 cm can be repaired primarily with overlying patch omentopexy [12,13]. Larger defects can also be closed with either omentopexy or omental plugging [14]. Laparoscopic repair has been also tried resulting

in overall lower post-operative complications (high quality evidence), similar reoperation rate (moderate evidence) [15].

Approximately 60 cases of laparoscopic cholecystectomy in patients with situs inversus have been described in literature till date [16]. Various techniques have been described to overcome these difficulties.

Laparoscopic cholecystectomy in situs inversus is intrinsically advantageous to left handed and ambidextrous surgeons who can use the epigastric port to dissect the Calot's triangle with their left hand. Eisenberg et al. used a four port 'mirror-image' configuration with a 12 mm camera port, a 5 mm epigastric port for dissection and two 5 mm ports below the subcostal margin in the mid-clavicular and anterior axillary line [17]. Fernandez used a three port technique with a 12 mm subumbilical port, a 10 mm epigastric port for dissection and a 5 mm subcostal port for retraction [18].

Strongly right handed surgeons have adapted their technique to the mirror image anatomy in innovative ways. Many surgeons have used the left mid-clavicular line subcostal port as the dissecting and the epigastric port for grasping the infundibulum. Hall et al. used this technique while standing on the right side of the patient while Patle et al. successfully operated using this configuration with the patient in the lithotomy position and surgeon standing between the legs [4,19]. One of the disadvantage of this technique is that the surgeon's dissecting right hand has to move across the patient's body which results in early fatigue. Phothong et al. moved the position of the left midclavicular line dissecting port 5 cm caudally to make it more ergonomically friendly [7]. A few surgeons have used the right epigastric port as the dissecting port while the assistant grasped the infundibulum [20,21].

We decided to move the epigastric and mid-clavicular line ports caudally by 5 cm and 10 cm respectively to make it more ergonomically friendly for right handed surgeons. We believe this technique can also be adopted by left handed surgeons doing conventional right sided laparoscopic cholecystectomy.

5. Conclusion

Perforation peritonitis in situs inversus can cause diagnostic confusion with free gas under the left hemi diaphragm. Laparoscopic cholecystectomy in situs inversus is ergonomically inconvenient and technically difficult for right handed surgeons. We describe an ergonomically convenient port placement for right handed surgeons in situs inversus.

Patient consent

Written informed consent was obtained from the patients for publication of this case series and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contributions

Zeeshan Ahmed helped in conception and design of study, analysis and interpretation of data, drafting the article and final approval of the version to be submitted. Sami A Khan helped in analysis and interpretation of data, revising the article critically for important intellectual content and final approval of the version to be submitted. Sanjeev Chhabra helped in analysis and interpretation of data, revising the article critically for important intellectual content and final approval of the version to be submitted. Rahul Yadav helped in acquisition of data, revising the article critically for important intellectual content and final approval of the version to be submitted. Nitin Kumar helped in acquisition of data, revising the article critically for important intellectual content and final approval of

the version to be submitted. Vikesh Vij helped in acquisition of data, revising the article critically for important intellectual content and final approval of the version to be submitted. Dhananjay Saxena helped in acquisition of data, revising the article critically for important intellectual content and final approval of the version to be submitted. Devender Talera helped in acquisition of data, revising the article critically for important intellectual content and final approval of the version to be submitted. Jeevan Kankaria helped in analysis and interpretation of data, revising the article critically for important intellectual content and final approval of the version to be submitted. Shalu Gupta helped in analysis and interpretation of data, revising the article critically for important intellectual content and final approval of the version to be submitted. Rajendra P Bugalia helped in analysis and interpretation of data, revising the article critically for important intellectual content and final approval of the version to be submitted. Amit Goyal helped in analysis and interpretation of data, revising the article critically for important intellectual content and final approval of the version to be submitted. Bhanwar L Yadav helped in conception and design of the study, revising the article critically for important intellectual content, and final approval of the version to be submitted. Raj K Jenaw helped in analysis and interpretation of data, revising the article critically for important intellectual content and final approval of the version to be submitted.

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Conflict of interest

The authors report no conflicts of interest.

Guarantor

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