

Case Report

Laparoscopic sleeve gastrectomy in a patient with Situs Inversus Totalis: A case report and literature review

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ABSTRACT

Introduction: & Importance: Laparoscopic sleeve gastrectomy (LSG) is a widely accepted and effective bariatric surgery for achieving weight loss in patients with extreme obesity. Performing this surgical procedure in patients with congenital anatomical changes including situs inversus (SI) is a challenge for the surgical team. In this condition, the orientation of intra-abdominal organs is the mirror image of those in normal populations.

Case presentation: Herein, we present a 29-year-old female with situs inversus totalis who successfully underwent an LSG surgery with proper weight loss post-operatively and no early and late complications.

Clinical discussion: By reviewing the literature for patients with SI undergoing the same procedure, all patients achieved significant weight loss. Three out of nineteen cases experienced complications which were controlled without significant morbidity or mortality.

Conclusion: we concluded that LSG will be a safe and effective surgery for the treatment of extreme obesity in SI patients, if the condition is diagnosed preoperatively.

1. Introduction

Obesity is increasingly a major public health concern in the developed and developing world. According to the World Health Organization (WHO), more than half a billion adults are struggling with obesity in 2016 [1]. Obesity is associated with numerous health consequences that are potentially preventable, including diabetes mellitus, hypertension, metabolic syndrome, and reduced life expectancy [2]. Currently, bariatric surgery is considered the most efficient treatment in patients with extreme obesity. Among different bariatric surgery procedures, laparoscopic sleeve gastrectomy (LSG) is becoming more widely accepted as a primary bariatric intervention [3]. Since the prevalence of obesity is increasing, many patients with rare congenital conditions such as situs inversus totalis (SIT), are seeking surgical consultation for treatment of obesity.

SIT first described by Fabricius in 1600, is a rare congenital condition. SIT is anatomically described as a reversal of the placement of the body's visceral organs, also known as mirror-image rotation [4]. The prevalence of SIT is estimated to be one in 10,000 to one in 20,000 cases

[5]. Although SIT alone does not seem to have negative consequences on normal health or life expectancy [4], the rotation of visceral organs may cause technical difficulties when performing surgical procedures and it requires the surgeon's cognitive and manual dexterity to do the surgical procedures properly.

In the current study, we report a successfully performed laparoscopic sleeve gastrectomy in a patient with situs inversus totalis and extreme obesity and introduce a literature review of the subject. This case report was performed in accordance with surgical case report (SCARE) guidelines [6].

2. Case presentation

We report a 29-year-old female patient with extreme obesity, a weight of 105 kg and a height of 162 cm. The calculated body mass index (BMI) was 40 kg/m². She reported being overweight since the age of 20, which she said had weakened her self-confidence in social occasions. The patient was a candidate for bariatric surgery since she failed to lose weight using dietary and lifestyle modification and pharmaceutical

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treatments over a three-year period prior to referring for bariatric surgery. She reported a history of situs inversus totalis and had no history of bronchiectasis, chronic infection, sinusitis, hearing loss, or infertility. She denied any previous surgical and habitual history or using any medications recently. Family history was negative for any genetic disorders or similar conditions. After evaluation, she was elected to have LSG. However, the patient's SIT imposed unique challenges to the surgical team.

Preoperatively, the patient was evaluated by a multidisciplinary bariatric surgery, cardiology, and anesthesiology team. A full assessment including a physical exam, biochemical profile, complete blood count, thyroid function test, and an electrocardiogram was conducted. Additionally, a computed tomography (CT) scan of the chest, abdomen, and pelvis was performed. The blood tests were normal, the electrocardiogram confirmed right axis deviation, and the imaging studies showed evidence of SIT (Fig. 1).

A general surgeon with nine years of experience in general surgery and two years of expertise in laparoscopic surgery was in charge of operation. Intraoperatively, after administration of general anesthesia, we performed LSG with the patient in the reverse Trendelenburg and French position and the surgeon stood between the legs. We planned the insertion site of the trocars according to the mirror image of anatomic locations of visceral organs and accessed the abdomen with an optic trocar from superior-lateral right side approximately 10 cm away from the umbilicus. Diagnostic laparoscopy confirmed the reverse orientation of all abdominal organs.

Pneumoperitoneum was established successfully at 13 mmHg of intra-abdominal pressure, using veress needle inserted in the right upper quadrant at a mirror image of the palmer's point. A 15 mm port was then inserted in the superior-lateral left side, 10 cm away from the umbilicus and 2 cm above the optic port. A 5 cm trocar was inserted in the left

lateral sternal line, 5 cm inferior to the costal margin to localize a liver retractor. Two 5 mm trocars were also inserted in the right midclavicular and anterior axillary lines (Fig. 2). Using 5-mm abdominal Ligasure device, the greater omentum along the great curvature was dissected. This procedure was started at 4 cm from the antrum toward the angle of His, and dissection of the short gastric vessel was also performed safely. This was followed by the insertion of an intragastric bougie of 36 Fr size to give the new formation to the stomach. Then, the laparoscopic staplers were used to resect and resize the stomach. The first two staplers were 4.1 mm green, and the other four staplers were 3.5 mm blue. Sleeve gastrectomy was completed after gastric resection. Using 5 mm clips, suture line clipping was performed to control oozing from the staple line. A Penrose drain was inserted. The leak test was not performed according to our protocol for LSG. Through the 15 mm port incision, the removal of the stomach stump was performed. We gradually evacuated the pneumoperitoneum and closed the skin with 4–0 vicryl subcuticular stitches (Supplemental Video). The patient was extubated and transferred to the recovery room for monitoring. No surgical or anesthetic complications were emerged during or after the operation. The total duration of the surgery was 75 min. On day 1 postoperatively, the patient started the bariatric clear liquid diet and was discharged on day 2 after removing the drain. She was on a full bariatric diet by then and showed good progress with her weight loss. Overall, she had no specific complaints and was satisfied with her general well-being and the outcomes of the surgery.

3. Discussion

We searched PubMed for English-language studies on bariatric surgery in patients with situs inversus from the first date available to March 2020. The used keywords were as follow Situs Inversus, Kartagener syndrome, bariatric surgery, sleeve gastrectomy, and extreme obesity. After screening, a total of 18 studies were found with 19 reported cases. The characteristics of included studies are summarized in Table 1. The majority of the cases (15 cases) were female and 4 cases were male. The mean age of the cases was 39.26 (SD:11.57), and mean BMI was 45.94 (SD: 8.79). Five of 19 cases had no comorbidities and the remaining 14 cases had at least one comorbidity including hypertension, diabetes, and asthma. All the cases were SIT, except two cases which were diagnosed with partial situs inversus and another with situs ambiguous. Preoperative workups in most of the cases were ECG, CXR, and abdominal CT scans. The surgical position in 9 of the cases was a French position with the surgeon between the legs, in six cases the position was supine with the surgeon on the left side of the patient in four cases and on the right side in one case. In Two cases the surgery position was not specified. Among these 19 cases, only two of them needed additional trocars. Complications were reported in three of the cases including suture/staple line leak, intraoperative infarction of multiple mini-spleens in a case of polysplenia (2 large spleens remained intact), and, upper GI bleeding in postop day 5 (managed non-operatively). Among the 14 cases that reported postoperative weight loss, all of them achieved variable but significant postoperative weight loss.

Situs Inversus is a congenital condition that the inheritance pattern that may vary from case to case. In many cases, this condition is due to sporadic mutations. SI alone does not cause any health consequences [4]. Hence, SI can remain undiagnosed even through adulthood. It may be incidentally diagnosed while performing a routine ECG or imaging study.

Performing surgery on a patient with SI is challenging for the surgery team and the team should be aware of this condition before the surgery. There are some conditions that can trigger the clinical suspicion of SI and further workup for diagnosis including a family history of SI, ambiguous localization of the symptoms, or heart sound prominent at the right side. The preoperative diagnosis of this condition is particularly important for planning of surgical approach. Besides, SI may also be associated with other conditions such as conditional heart diseases,



Fig. 1. The insertion site of different trocars.

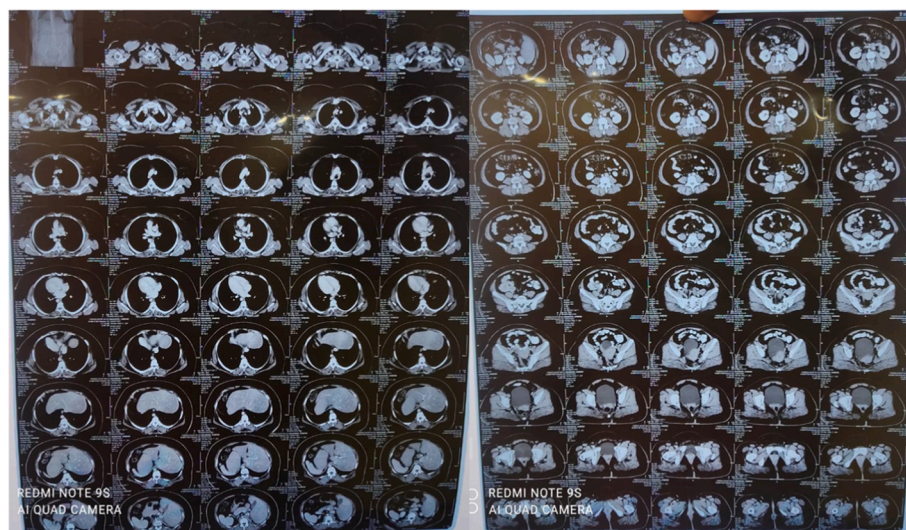


Fig. 2. Chest and abdomino-pelvic CT scan of the patient.

pulmonary diseases, and chronic infection. Congenital heart diseases include ventricular septal defects, an anomaly of great vessels, and valve defects [7]. Therefore, cardiac workups such as ECG and echocardiogram are essential before any intervention. This condition is easily diagnosed by imaging techniques such as ultrasonography, CXR, and CT scan [8]. However, if the condition is partial or ambiguous, the diagnosis will be more challenging and it requires more time and attention by clinicians and radiologists to be diagnosed. Preoperative diagnosis is also important for patient positioning during the surgery, proper team orientation, and providing the required instruments, which all in all reduce technical challenges during the surgery. The non-availability of an expert surgeon is a crucial risk that is associated with the intraoperative diagnosis of SI. Longer operative time due to surgeon position changes and slow adaptability is another risk of intraoperative diagnosis since the hand-eye synchronization is opposite to the common sleeve gastrectomy procedure [9].

In our case, we adapted the French position with the surgeon between the legs. We believed that this position allows us to adapt more easily and decreases the time for adaptability. In some cases, more trocars may be added, particularly if there is a need for concomitant cholecystectomy [9], although it was not necessary in our case. In patients with Kartagener syndrome, lower insufflation pressure may be needed, which was not the case for this case. Our patient did not develop any early or late postoperative complications, which is similar to the results reported in most of the studies conducting LSG in SI patents. Taken all together, if SI is diagnosed before surgery, the patient undergoes a full pre-operative work-up and adequate preparation for surgery, it is not a risk factor for increased surgery complications. Given the technical challenges in surgical procedure, due to the rotation of visceral organs the risk would be decreased if it is performed by an experienced surgeon and especially via laparoscopic surgery.

4. Conclusion

In conclusion, LSG could be safely and effectively performed in a patient with SI if the condition is preoperatively diagnosed. Diagnosis of this condition prior to surgery is particularly important for planning of surgical approach. SI could be easily diagnosed with imaging studies, unless SI is partial or ambiguous.

Ethical approval

The patient presented in this case report gave fully-informed written

consent to publication of this report.

Funding for your research

No particular funding was received for this research.

Consent

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

Author contribution

A.A. and F.E. contributed to data collection and interpretation; A.A., F.A., and F.E. contributed to writing the paper; A.A. and F.E. contributed to study concept and design; A.A. and F.E. supervised the project; All authors read and approved the final draft.

Consent

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

Registration of research studies

NA (case report).

Guarantor

Alireza Amirbeigi.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Declaration of competing interest

The authors declare no conflicts of interest.

Table 1
Characteristics of included studies.

Author (year)	Age	Sex	Situs Type	Kartagener Syndrome	BMI (Kg/m ²)	Co-morbidities	Preoperative Workup	Surgical Position	Additional ports	Operative Time (minutes)	Complications	Weight loss
Catheline et al. (2006) [10]	19	Male	SIT	No	76	Asthma, Enuresis, Arthritis	ECG, CXR, Echocardiogram, EGD, Abd US	French/ between legs	Yes	NA	No	EWL 39% in 9 months
Borude et al. (2012) [11]	32	Female	SIP	No	41.4	None	Barium follow-through, Abd CT, Chest CT	Supine/Left side	NA	90	No	New BMI 28 in 1–2 years
Deutsch et al. (2012) [12]	39	Female	SIT	No	42	HTN, DM, OSA, Hypothyroidism	Abd CT	Supine/NA	No	NA	Suture/staple line leak	EWL 60% in 2 years
Stier et al. (2014) [13]	51	Female	SIT	No	54.2	HTN, DM	ECG, CXR, EGD, Abd US	French/ Between legs	No	61	No	New BMI 40.3 in 2 years
Genser et al. (2015) [14]	52	Female	SIT	Yes	49	OSA, liver steatosis, H. Pylori Gastritis	ECG, CXR, Abd CT	French/ Between legs	No	45	No	NA
Yazar et al. (2016) [15]	21	Female	SIT	No	41.8	No	ECG, CXR, EGD	French/ Between legs	No	78	No	New BMI 29.8 in 8 months
Watanabe et al. (2016) [16]	46	Female	SIT	No	40.3	HTN, DLD, DM, OSA, NAFL, Mental disorders, H. Pylori Gastritis	ECG, EGD, CT	French/ Right side	Yes	202	No	New BMI 24.5 in 1 year
Shaheen et al. (2016) [17]	38	Female	SA	No	55.8	Polysplenia	Cardiac workup, CXR, EGD, Abd US, Abd CT	Supine/Left side	No	NA	intraoperative infarction of multiple mini-spleens (2 large spleen remained intact)	EWL 49.9% in 6 months
Aziret et al. (2016) [18]	54	Female	SIT	No	48	DM, Arthritis	CXR, Abd CT	French/ Between legs	No	105	No	EWL 51.7% in 4 months
Salerno et al. (2017) [19]	41	Male	SIT	No	46.4	No	NA	French/ Between legs	No	45	No	NA
Taha et al. (2018) [20]	33	Female	SIT	No	42.7	No	ECG, CXR, Barium swallow	Supine/Left side	NA	50	No	NA
	41	Female	SIT	No	41.7	Asthma	ECG, CXR, Barium swallow	Supine/Left side	NA	75	No	NA
Froylich et al. (2018) [21]	47	Female	SIT	No	51	Asthma, HTN, DM	CXR, UGI	Semi-lithotomy/ NA	No	62	No	NA
Villalvazo et al. (2018) [22]	59	Female	SIT	No	38	Pre-diabetic, OSA, Degenerative joint disease, liver steatosis	Abd XR, Echocardiogram, EGD, UGI, Abd US, Abd CT, PFT	Supine/Left side	No	108	No	New BMI 29 in 3 months
Burvill et al. (2019) [23]	25	Female	SIT	Yes	40	Lactose intolerance	NA	NA/Left side	No	35	No	EWL 125% in 1 year
Ali et al. (2019) [24]	48	Female	SIT	No	41	No	EGD, Abd CT, Chest CT	Supine/ Right side	NA	75	No	NA
Mosquera et al. (2020) [25]	47	Male	SIT	Yes	40.9	HTN, DM, OSA, Arthritis, Chronic Sinusitis, nasal polyps	CXR, Echocardiogram, EGD, Nasosinuscopy	NA/Right side	No	NA	Upper GI bleeding in postop day 5 (managed non operative)	New BMI 29.7 in 1 month
Bawahab et al. (2020) [9]	30	Female	SIT	No	36	DM	ECG, CXR, Echocardiogram, Barium swallow, Abd US	French/ Between legs	No	28	No	New BMI 24 in 1 year
Amussallam et al. (2021) [26]	23	Male	SIT	Yes	46.7	Chronic sinusitis, Bronchiectasis	ECG, CXR, Echocardiogram, Abd US, Abd CT, Chest CT, Sinuses CT, PFT	French/ Between legs	No	68	No	EWL 41.1% in 2 months

NA=Not Available, SIT=Situs Inversus Totalis, SIP=Situs Inversus Partialis, SA=Situs Ambiguous, BMI=Body Mass Index, HTN=Hypertension, DM = Diabetes Miletus, OSA=Obstructive Sleep Apnea, DLD = Dyslipidemia, NAFL=Non-Alcoholic Fatty Liver, EKG = Electrocardiogram, CXR=Chest X-ray, EGD = Esophagogastroduodenoscopy, Abd US = Abdominal Ultrasound, Abd = Abdominal, CT=Computed tomography, UGI=Upper Gastrointestinal Series Study, PFT=Pulmonary Function Test, Postoperatively, GI = Gastrointestinal, EWL = Excess Weight Loss.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2022.104101>.

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