

Gastric cancer with situs inversus totalis: does it really create difficulties for surgeons?

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Abstract

Introduction: Situs inversus totalis (SIT) is a very rare condition that is seen at a rate of one in about 6000–8000 births.

Aim: To offer a general view on the coexistence of SIT and gastric cancer, accompanied by a literature review.

Material and methods: Within the scope of this study, the case of a patient with gastric adenocarcinoma and SIT has been presented. Previous research on gastric cancer cases with SIT was reviewed through a comprehensive search of the PubMed, MEDLINE, and Google Scholar databases. The keywords used to conduct this research were “situs inversus totalis and gastric cancer,” “situs inversus totalis and gastric malignant,” and “situs inversus totalis and gastric resection.” The database search covered English studies published between 2000 and 2016.

Results: The results of our literature review revealed 20 studies of patients with gastric cancer and SIT, and 21 related cases. Overall, 12 of the patients were male, 9 were female, and their mean age was 61.8 ± 10.97 years. The vascular assessment data showed that three out of the 13 mentioned cases had vascular anomalies. Eleven of the patients had laparoscopic resections, and one of the patients that had a surgical procedure exhibiting a postoperative mechanical obstruction.

Conclusions: The coexistence of SIT and gastric cancer is a very rare condition, and a careful preoperative radiological assessment should be conducted because there can be accompanying vascular anomalies. Laparoscopies and robotic surgeries can be performed for suitable patients at experienced centres, consistent with oncological principles.

Introduction

Situs inversus totalis (SIT) is a very rare condition that is seen at a rate of one in about 6000–8000 births [1]. In this situation, the organs or organ systems are transposed to the opposite side of the body from their normal locations (mirror image of the normal), and it is most often detected during a radiological assessment [1–3]. The coexistence of SIT and gastric cancer in the literature is limited to a few case reports [4, 5]. In these cases, the research has shown that laparoscopic and open gastrectomies have been performed successfully. Moreover, the surgical procedure to be performed does not need to change, even though the anatomy of these patients is different.

Aim

Here we present the case of a patient diagnosed with gastric cancer and SIT, accompanied by a review of English studies on this subject.

Material and methods

Our study presents a case of gastric cancer with SIT and offers a discussion in light of the relevant literature. We searched for published studies of gastric cancer with SIT using different keyword combinations, including “situs inversus totalis and gastric cancer”, “situs inversus totalis and gastric malignant”, and “situs inversus totalis and gastric resection” in the PubMed, MEDLINE, and Google Scholar databases. Those studies published between January 1, 2000 and December 1, 2016 were reviewed, and any with full-text versions available and sufficient details on the patients were included in our study. Literature reviews and repeated reports were excluded from the study. The data recorded from the previous studies included the date of publication, age, sex, tumour location, existence of a vascular anomaly, surgical procedure performed, lymph node dissection, tumour/node/metastasis (TNM) staging, and postoperative complications.

Results

Case report

A 72-year-old female patient presented to our clinic with complaints of epigastric pain and burning. Her medical history showed no known comorbidities, and the abdominal and lymph node examinations did not reveal any problems. An oesophagogastrosocopy revealed a lesion of about 1 × 1 cm in size with an ulcerated surface, located in the antrum close to the pylorus, with a slight tumorous appearance. Her biopsy results showed that it was an adenocarcinoma. A pulmonary



Figure 1. X-ray of the chest taken, showing dextrocardia

radiograph showed dextrocardia (Figure 1), while the thoracoabdominal computerised tomography (CT) revealed SIT (Figures 2 A, B). There was no evidence of intra-abdominal acid, distant organ metastasis, peritoneal carcinomatosis, pathological lymph nodes, or vascular anomalies.

Endoscopic ultrasonography (EUS) was applied to the patient for endoscopic mucosal resection compliance. The EUS was evaluated as T1N0. An endoscopic mucosal resection was recommended for this patient, but a surgical procedure was planned since she and her family did not accept the recommendation. Subsequently, a distal subtotal gastrectomy and D1 lymph node dissection were performed via laparotomy. Billroth 2 gastroenterostomy anastomosis and Braun's enteroenterostomy was performed for reconstruction. The operating time was 150 min and blood loss was 100 ml. The patient was then discharged on the eighth post-operative day without any problems. The pathological analysis of this patient revealed a tumorous lesion of approximately 1.5 × 1 cm, compatible with well differentiated (G1) adenocarcinoma, which had involvement up to the submucosa. None of the excised 17 lymph nodes exhibited metastasis (T1bN0M0). In light of these results, the patient was taken into the follow-up program without any adjuvant therapy.

Literature review

In total, 21 cases and 20 articles published in English between 2000 and 2016 were found through a comprehensive search of the PubMed, Google Scholar, and MEDLINE databases. Twelve (57.1%) of these patients were male, 9 (42.9%) were female, and their

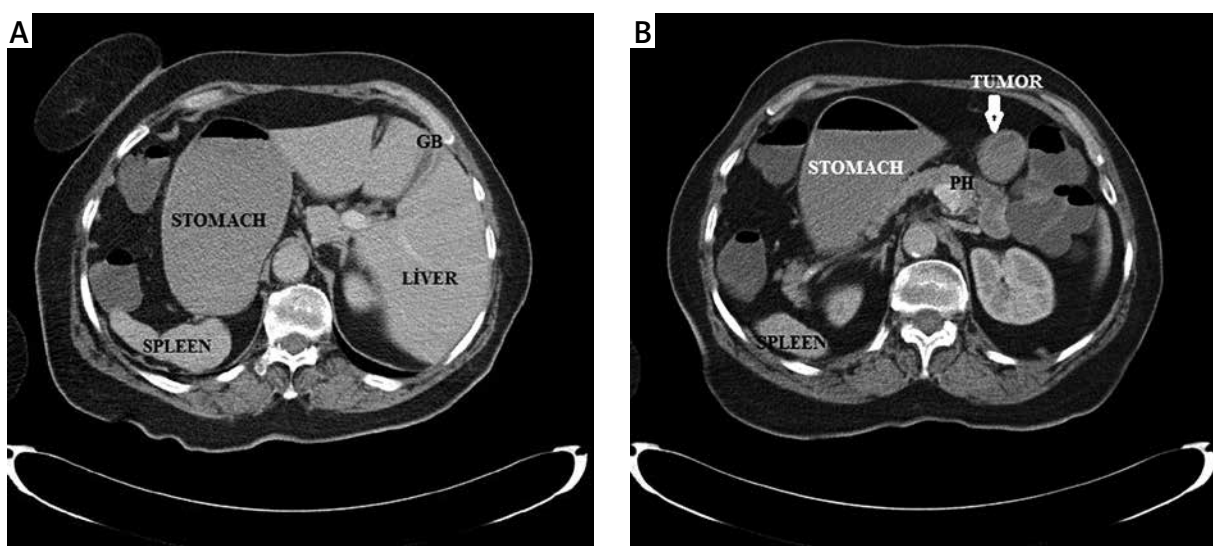


Figure 2. A – Abdominal computed tomography revealed a complete right-left reversal of the abdominal organs, B – thickened wall of gastric antrum without distant metastasis

mean age was 61.8 ± 10.97 years old. The tumour localisations were in the antrum in 13 (61.9%) patients, corpus in 2 (9.5%) patients, esophagogastric junction in 2 (9.5%) patients, corpus antrum junction in 2 (9.5%) patients, and cardia in 1 (4.8%) patient. In 1 (4.8%) of the patients the tumour localisation was not specified.

Although vascular anomalies were seen in 10 (47.6%) cases, they were not specified in 8 (38.1%) of them. In 1 out of the 3 (14.3%) patients with vascular anomalies the left hepatic artery exited from the superior mesenteric artery, in one the left gastric artery exited from the aorta, and in the final one the left gastric artery was double branching.

Nineteen of the patients received curative surgeries, with 11 of these having had laparoscopic resections. Two of the patients did not receive curative procedures; one of them received a palliative surgery, and no surgical procedure was performed on the other. Only 1 of these cases developed a mechanical obstruction. The demographic and clinical characteristics of the patients (20 studies, 21 patients) have been summarised in Table I [6–25].

Discussion

Situs inversus totalis is a congenital anomaly with an asymptomatic course, and it develops via the clockwise rotation of the embryonic midgut at 270° , instead of a counter-clockwise rotation at 270° . Thus, all of the thoracic and abdominal visceral organs are located symmetrically according to the midline in reverse. In other words, SIT is the mirror image of the normal [1]. Situs inversus can include both the thoracic and abdominal cavities (totalis), or only one cavity (partial). The term situs solitus, on the other hand, refers to the normal localisation of the bodily organs [1, 2].

The aetiology of situs inversus remains a controversial issue. It has been suggested that it is related to a genetic defect occurring during the second week of the embryonal period [2]. It can be accompanied by pathologies like bronchiectases (Kartagener syndrome), polysplenia, and genitourinary anomalies [3–5]. In addition, cancers of various organs have been seen in patients with situs inversus [26, 27]. Allen [28] first described a case of gastric carcinoma in a male patient with situs inversus in 1936; however, this condition has been limited to case reports in the literature [2, 17]. Generally, it has been suggested that there is no direct relationship between SIT and gastric cancer [15, 23].

In cases of SIT, the most significant preoperative stage, especially before performing laparoscopic procedures, is the careful and cautious assessment of anatomical variations using preoperative imaging methods [8, 16]. If possible, CT angiography is recommended for

the detection of accompanying vascular anomalies [29]. In our case, the CT was helpful in unveiling the local and vascular structures.

For SIT patients, the treatment modality is no different than that for normal gastric cancer. The previous literature has shown that these patients most often received successful surgical treatments [6–24]. For example, open, assisted or total laparoscopic, and assisted robotic gastrectomy procedures have been performed successfully. Yamaguchi *et al.* [8] reported the first laparoscopy-assisted distal gastrectomy case in 2003. Following this case, 6 more cases of laparoscopy-assisted distal gastrectomies were reported. Min *et al.* [19] published the first case of a totally laparoscopic distal gastrectomy in 2013, followed by a 2015 study by Morimoto *et al.* [21] in which the authors presented the first totally laparoscopic total gastrectomy case. Moreover, Kim *et al.* [16] presented the first and only robot-assisted distal gastrectomy case in the literature in 2012.

Some of the cases in the literature also received additional organ resections alongside the gastric resections. Among these, it was reported that 2 patients had a splenectomy and cholecystectomy, 1 had a low anterior resection, and 1 had a cholecystectomy [6, 7, 14, 24].

Situs inversus totalis can pose a challenge during surgery because of the extraordinary anatomy of these patients. Some surgeons have recommended that the operator and assistant positions should be reversed, especially during laparoscopic surgeries [11, 13, 18]. However, there are other authors who have reported successful laparoscopic procedures in the normal positions [14]. In our case, the surgeon and assistant worked in their standard places, successfully completing the surgical procedure.

The structure of gastric cancer is complex. The lymph node status alone may not be sufficient to show the disease. Appropriate lymph node dissection should be performed in patients with all gastric cancers [30].

When the postoperative complications were investigated, it was seen that the rate of complications was very low, with a mechanical obstruction seen in only one case [15, 18].

Conclusions

The coexistence of SIT and gastric cancer is a very rare condition. Although it has been reported that surgeons might experience challenges because of the extraordinary anatomy of these patients, the cases presented in the literature were reported to have been treated successfully. A careful radiological assessment should be conducted preoperatively because there might be accompanying anomalies, especially vascular

Table 1. General characteristics of 21 gastric cancer cases with situs inversus totalis in English literature

Author	Year	Age	Gender	Tumour localisation	Vascular variation	Operation	Lymph node dissection	TNM	Stage	Post-operation complication
Iwamura [6]	2001	71	F	EGJ + rectal cancer	ND	TG + LAR	ND	T1bNOMO	1A	No
Murakami [7]	2003	51	F	Antrum	No	TG + splenectomy + cholecystectomy	D2	Malignant lymphoma	–	No
Yamaguchi [8]	2003	76	M	ND	ND	LADG	ND	ND	ND	ND
Jin [9]	2005	50	F	Antrum	ND	DG	ND	ND	ND	No
Benjelloun el [10]	2008	70	M	Antrum	ND	DG	D2	T3N2M0	3A	ND
Futawatari [11]	2010	53	M	Antrum	No	LADG	D1 + β	T1NOMO	1A	No
Haruki [12]	2010	81	F	Antrum	ND	Palliative operation	–	–	4	No
Kang [13]	2010	60	M	Antrum	No	LADG	D1 + β	T1bN1M0	1B	No
Seo [14]	2011	60	M	Antrum	No	LADG + cholecystectomy	D1 + β	T1NOMO	1A	No
Kim [15]	2011	71	F	Antrum	ND	DG	ND	T1aNOMO	1A	No
Kim [16]	2012	47	M	Antrum-corpus	No	RADG	D1 + β	T3N3M0	3B	No
Pan [17]	2012	52	M	Cardia	ND	PG	D2	ND	ND	No
Fujikawa [18]	2013	60	F	Antrum-corpus	No	LADG	D1+	T1smNOMO	1A	Mechanical obstruction, reoperation
Min [19]	2013	52	M	Antrum	Two-branched LGA	LADG	D1+	T2NOMO	1B	No
		68	M	Antrum	No	TLDG	D1+	T1aNOMO	1A	No
Sumi [20]	2014	42	M	Antrum	LHA from SMA	LADG	D1 + No 7, 8A, 9	T1bNOMO	1A	No
Morimoto [21]	2015	58	M	EGJ	No	TLTG	D1 + No 7, 8A, 9	T1bNOMO	1A	No
Ye [22]	2015	60	F	Antrum	No	LADG	D2	T4aNOMO	2B	No
Hassouni [23]	2015	71	M	Corpus	ND	No surgery	–	–	4	–
Isobe [24]	2015	79	F	Corpus	LGA from aorta	TG + splenectomy + cholecystectomy	D2	T4aN3bM0	3C	No
Zhu [25]	2015	66	F	Antrum	No	DG	D2	T4aN1M0	3A	ND

F – female, M – male, EGJ – oesophago-gastric junction, ND – not data, LGA – left gastric artery, LHA – left hepatic artery, LAR – low anterior resection, LADG – laparoscopic-assisted distal gastrectomy, DG – distal gastrectomy, RADG – robot-assisted distal gastrectomy, PG – proximal gastrectomy, TLDG – total laparoscopic distal gastrectomy, TLTG – total laparoscopic total gastrectomy.

ones. Overall, laparoscopies and robotic surgeries can be performed for suitable patients at experienced centres, consistent with oncological principles.

Conflict of interest

The authors declare no conflict of interest.

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