

World Journal of *Gastrointestinal Oncology*

World J Gastrointest Oncol 2023 October 15; 15(10): 1675-1834



REVIEW

- 1675** Minimally invasive surgery for gastro-oesophageal junction adenocarcinoma: Current evidence and future perspectives
Birlă R, Hoara P, Achim F, Dinca V, Ciuc D, Constantinoiu S, Constantin A
- 1691** Systemic treatment for advanced pancreatic cancer
Leowattana W, Leowattana P, Leowattana T

MINIREVIEWS

- 1706** Role of inositol polyphosphate-4-phosphatase type II in oncogenesis of digestive system tumors
Han L, Chen S, Du SY

ORIGINAL ARTICLE

Basic Study

- 1717** Identification of tumor antigens and immune subtypes of hepatocellular carcinoma for mRNA vaccine development
Lu TL, Li CL, Gong YQ, Hou FT, Chen CW
- 1739** Deltonin enhances gastric carcinoma cell apoptosis and chemosensitivity to cisplatin *via* inhibiting PI3K/AKT/mTOR and MAPK signaling
Yang L, Liu YN, Gu Y, Guo Q
- 1756** Pomolic acid and its glucopyranose ester promote apoptosis through autophagy in HT-29 colon cancer cells
Liu LY, Yu TH, Liao TS, Xu P, Wang Y, Shi M, Li B

Retrospective Cohort Study

- 1771** Modified albumin-bilirubin predicted survival of unresectable hepatocellular carcinoma patients treated with immunotherapy
Navadurong H, Prasoppokakorn T, Siri Wong N, Phathong C, Teeyapun N, Tanasanvimon S, Thanapirom K, Komolmit P, Tangkijvanich P, Treeprasertsuk S, Chaiteerakij R
- 1784** Association between the Khorana risk score and all-cause mortality in Japanese patients with gastric and colorectal cancer: A retrospective cohort study
Zhang YF, Wang GD, Huang MG, Qiu ZQ, Si J, Xu MY

Retrospective Study

- 1796** Real-world clinical effectiveness of sorafenib among patients with unresectable hepatocellular carcinoma at two centers in the United States
Li D, Gruber SB, Iyer S, Gupta S, Tejani M

CASE REPORT

- 1807** Synchronous occurrence of gastric cancer and gastrointestinal stromal tumor: A case report and review of the literature
Liu J, Huang BJ, Ding FF, Tang FT, Li YM
- 1823** Comprehensive next-generation sequencing reveals double primary colorectal carcinoma missed by diagnostic imaging: A case report
Qu YJ, Zhang QS, Wang B, Zhang F, Pan E, Zhao CY, Liu SY, Fang LP
- 1829** Response to osimertinib in a colorectal cancer patient with an *EGFR* T790M mutation: A case report
Buzard B, Douglass L, Gustafson B, Buckley J, Roth M, Kujtan L, Bansal D

ABOUT COVER

Editorial Board of *World Journal of Gastrointestinal Oncology*, Claudio Casella, PhD, Assistant Professor, Surgeon, Scientific Sector MED/18 ("General Surgery"), University of Brescia-School of Medicine, Brescia I-25123, Italy. claudio.casella@unibs.it

AIMS AND SCOPE

The primary aim of *World Journal of Gastrointestinal Oncology* (WJGO, *World J Gastrointest Oncol*) is to provide scholars and readers from various fields of gastrointestinal oncology with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJGO mainly publishes articles reporting research results and findings obtained in the field of gastrointestinal oncology and covering a wide range of topics including liver cell adenoma, gastric neoplasms, appendiceal neoplasms, biliary tract neoplasms, hepatocellular carcinoma, pancreatic carcinoma, cecal neoplasms, colonic neoplasms, colorectal neoplasms, duodenal neoplasms, esophageal neoplasms, gallbladder neoplasms, *etc.*

INDEXING/ABSTRACTING

The WJGO is now abstracted and indexed in PubMed, PubMed Central, Science Citation Index Expanded (SCIE, also known as SciSearch®), Journal Citation Reports/Science Edition, Scopus, Reference Citation Analysis, China National Knowledge Infrastructure, China Science and Technology Journal Database, and Superstar Journals Database. The 2023 edition of Journal Citation Reports® cites the 2022 impact factor (IF) for WJGO as 3.0; IF without journal self cites: 2.9; 5-year IF: 3.0; Journal Citation Indicator: 0.49; Ranking: 157 among 241 journals in oncology; Quartile category: Q3; Ranking: 58 among 93 journals in gastroenterology and hepatology; and Quartile category: Q3. The WJGO's CiteScore for 2022 is 4.1 and Scopus CiteScore rank 2022: Gastroenterology is 71/149; Oncology is 197/366.

RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: Xiang-Di Zhang; Production Department Director: Xiang Li; Editorial Office Director: Jia-Ru Fan.

NAME OF JOURNAL

World Journal of Gastrointestinal Oncology

ISSN

ISSN 1948-5204 (online)

LAUNCH DATE

February 15, 2009

FREQUENCY

Monthly

EDITORS-IN-CHIEF

Monjur Ahmed, Florin Burada

EDITORIAL BOARD MEMBERS

<https://www.wjgnet.com/1948-5204/editorialboard.htm>

PUBLICATION DATE

October 15, 2023

COPYRIGHT

© 2023 Baishideng Publishing Group Inc

INSTRUCTIONS TO AUTHORS

<https://www.wjgnet.com/bpg/gerinfo/204>

GUIDELINES FOR ETHICS DOCUMENTS

<https://www.wjgnet.com/bpg/GerInfo/287>

GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH

<https://www.wjgnet.com/bpg/gerinfo/240>

PUBLICATION ETHICS

<https://www.wjgnet.com/bpg/GerInfo/288>

PUBLICATION MISCONDUCT

<https://www.wjgnet.com/bpg/gerinfo/208>

ARTICLE PROCESSING CHARGE

<https://www.wjgnet.com/bpg/gerinfo/242>

STEPS FOR SUBMITTING MANUSCRIPTS

<https://www.wjgnet.com/bpg/GerInfo/239>

ONLINE SUBMISSION

<https://www.f6publishing.com>



Synchronous occurrence of gastric cancer and gastrointestinal stromal tumor: A case report and review of the literature

Jie Liu, Bin-Jie Huang, Fei-Fei Ding, Fu-Tian Tang, Yu-Min Li

Specialty type: Gastroenterology and hepatology

Provenance and peer review: Unsolicited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's scientific quality classification

Grade A (Excellent): A
Grade B (Very good): B, B
Grade C (Good): 0
Grade D (Fair): D
Grade E (Poor): 0

P-Reviewer: Baryshnikova NV, Russia; Moshref L, Saudi Arabia; Shah OJ, India; Sumi K, Japan

Received: May 31, 2023

Peer-review started: May 31, 2023

First decision: July 31, 2023

Revised: August 20, 2023

Accepted: September 14, 2023

Article in press: September 14, 2023

Published online: October 15, 2023



Jie Liu, Bin-Jie Huang, Fei-Fei Ding, Fu-Tian Tang, Yu-Min Li, Department of General Surgery, Lanzhou University Second Hospital, Lanzhou 730030, Gansu Province, China

Jie Liu, Bin-Jie Huang, Fei-Fei Ding, Fu-Tian Tang, Yu-Min Li, Key Laboratory of the Digestive System Tumors of Gansu Province, Lanzhou University Second Hospital, Lanzhou 730030, Gansu Province, China

Corresponding author: Yu-Min Li, MD, PhD, Chief Physician, Professor, Surgeon, Surgical Oncologist, Department of General Surgery, Lanzhou University Second Hospital, No. 80 Cuiyingmen, Lanzhou 730030, Gansu Province, China. liymin@lzu.edu.cn

Abstract

BACKGROUND

To evaluate the clinicopathological features and prognosis of gastric cancer (GC) occurring synchronously with gastrointestinal stromal tumor (GIST).

CASE SUMMARY

We report 19 patients with concurrent GC and GIST (17 male and 2 female, median age 62 years). GC was most often located in the lower third of the stomach. GIST was diagnosed preoperatively in four patients. GIST was most often located in the gastric body ($n = 8$, 42%). The most common growth pattern in GIST was extraluminal ($n = 12$, 63%). The positive expression rates of CD117 and CD34 in GIST were 100% and 95%, respectively. Most patients with GIST ($n = 17$, 89%) were very low or low risk. There was no recurrence of GIST during follow-up. The 3-year cumulative survival rate was 73.9%, and the 5-year cumulative survival rate was 59.2%. The combined analysis of this study and literature reports (47 reports, 157 patients) found that GC and GIST were usually located in the lower third (42%) and middle third (51%) of the stomach. GC was usually early (stage I: 42%), poorly differentiated (42%) intestinal-type adenocarcinoma (51%). GISTs were primarily small in diameter (median: 1.2 cm) and very low or low risk (89%).

CONCLUSION

Synchronous GC and GIST may not be rare. They have specific clinicopathological characteristics, and may have mutual inhibition in pathogenesis and progression.

Key Words: Gastric cancer; Gastrointestinal stromal tumor; Synchronous occurrence; Diagnosis; Prognosis; Case report

Core Tip: We conclude that there are specific clinicopathological features in gastric cancer (GC) and gastrointestinal stromal tumor (GIST), as is often seen in older men; GC is usually a poorly differentiated enterotype early adenocarcinoma located in the lower third of the stomach. GIST is usually small in diameter, low or very low risk, and located in the body of the stomach. We hypothesized that GC and GIST might be affected by the same unknown carcinogen, leading to the simultaneous proliferation of epithelial and mesenchymal cells. GC and GIST may inhibit each other in the occurrence and development of the disease.

Citation: Liu J, Huang BJ, Ding FF, Tang FT, Li YM. Synchronous occurrence of gastric cancer and gastrointestinal stromal tumor: A case report and review of the literature. *World J Gastrointest Oncol* 2023; 15(10): 1807-1822

URL: <https://www.wjgnet.com/1948-5204/full/v15/i10/1807.htm>

DOI: <https://dx.doi.org/10.4251/wjgo.v15.i10.1807>

INTRODUCTION

Gastric cancer (GC) is a common malignant tumor originating from epithelial tissue. Gastrointestinal stromal tumor (GIST) accounts for 1%-2% of gastrointestinal tumors[1,2]. The prevalence of GC varies widely between western and eastern countries. However, there is no significant difference in GIST[3,4]. GIST is most common in the stomach (60%-70%) and small intestine (20%-30%)[5]. Nevertheless, it is rare for GIST and gastric epithelial tumors to co-occur in the stomach. Maiorana *et al*[6] first reported the synchronous occurrence of gastric epithelial and stromal tumors in 2000. Globally, most studies on concurrent GC and GIST are case reports[7-41]. Collision tumor formed by combined GC and GIST is also rare, a particular case of GC and GIST occurring synchronously[2,32,37-44]. At present, the etiology of GC occurring simultaneously with GIST is unclear. Several studies have reported the synchronous occurrence of GC and GIST with specific pathological features[45]. Some researchers believe that it is an accidental phenomenon[6,11]. Other researchers believe that several unknown carcinogens induce simultaneous proliferation and tumorigenesis of epithelial and stromal cells, such as gene mutation, nitrite, and *Helicobacter pylori*[6,7,9-11,18,30,34,37,38,46-49]. In addition, the impact of co-occurrence of GC and GIST on treatment options and prognosis is controversial.

From December 1, 2011 to December 31, 2021, 5408 GC patients were treated at the Lanzhou University Second Hospital, China. We analyzed 19 patients with synchronously occurring GC and GIST in our institution and reviewed previous studies. The Ethics Committee of Lanzhou University Second Hospital approved this retrospective study (2021A-585). This study aimed to provide some auxiliary data for deepening the understanding of concurrent GC and GIST.

CASE PRESENTATION

Chief complaints

The chief complaints at initial admission were upper abdominal pain ($n = 8$, 42%), epigastric discomfort ($n = 6$, 32%), abdominal distension ($n = 4$), black stools ($n = 3$), acid reflux ($n = 2$) and progressive dysphagia ($n = 2$). Among them, two patients with the chief complaint of "acid reflux" had symptoms of heartburn and eructation. Some patients had more than one of these symptoms.

History of present illness

The disease duration ranged from 15 d to 4 years (median, 4 mo). The outpatients were admitted to the hospital for gastric malignant tumors.

History of past illness

Eight patients (42%) had weight loss (range: 1-20 kg) within the last year. Six patients (32%) had prior surgical history, including three cases of cholecystectomy, one of appendectomy, two of fracture surgery and one of cataract surgery. Six patients (32%) had comorbidities, including three with hypertension, two with type 2 diabetes, and one with both.

Personal and family history

None of the patients had a family history of GC or GIST.

Physical examination

Specialist physical examination showed eight cases (42%) with positive signs; all of which were mild tenderness under the xiphoid process. The median body mass index was 22.8 kg/m² (range: 13.1-27.9 kg/m²).

Laboratory examinations

Preoperative laboratory tests showed six (32%) patients with elevated tumor markers. The most frequently observed tumor markers with elevated reference values were CEA and CA72-4, followed by CA125 and CA199 (Table 1). Six patients (32%) with anemia (hemoglobin: No. 1 = 108 g/L; No. 7 = 102 g/L; No. 8 = 124 g/L; No. 10 = 129 g/L; No. 11 = 119 g/L; and No. 17 = 88 g/L). Four patients (21%) had positive occult blood tests.

Imaging examinations

The results of preoperative abdominal contrast-enhanced computed tomography (CT) and esophagogastroduodenoscopy (EGD) suggested that GC was most commonly located in the lower third of the stomach ($n = 7$, 37%), followed by the middle third ($n = 6$, 31%), upper third ($n = 5$, 26%) and multiple distributions in the stomach ($n = 1$, 5%). The median maximum diameter was 3.5 cm (range, 1.5-10.0 cm). The most common gross appearances were ulcerative type (Figure 1A) ($n = 10$, 53%) and ulcerative infiltrative type ($n = 4$). The detailed clinicopathological data of all GC patients are shown in Table 1. Preoperative CT found suspected GIST in three cases (15%) (Figure 1B and C). All 19 patients underwent EGD, and four (21%) were found to be suspicious of GIST (Figure 1D); of whom, three were diagnosed by endoscopic ultrasonography (Figure 1E). The clinicopathological data of GIST are shown in Table 2.

For the histological subtype, 18 cases were adenocarcinoma (Figure 2A) and one was high-grade intraepithelial neoplasia. Seven cases (39%) were classified as moderately to poorly differentiated, five were moderately differentiated, five were poorly differentiated, and one was well differentiated. For the Lauren classification, six patients (32%) were classified as diffuse type, five as intestinal type and three as mixed type. In pTNM staging, there was one stage 0, three stage IA, three stage IB, three stage IIA, three stage IIB, four stage IIIA, and two stage IIIC.

Intraoperative exploration revealed suspicious GIST in 12 cases (63%). The location of GIST was most commonly in the gastric body ($n = 8$, 42%), followed by gastric fundus ($n = 3$, 15%), gastric antrum ($n = 2$), gastric cardia ($n = 2$), duodenum ($n = 2$), and jejunum ($n = 2$). The median maximum diameter of GIST was 1.4 cm (range: 0.2-12.0 cm), and the diameters of two were 9 cm (Figure 1B) and 12 cm (Figure 1C), respectively. Seven cases (50%) of GIST were subserosal, five were muscular, and two were submucosal. For the growth pattern of GIST, 12 (63%) were extraluminal, two were intraluminal, of which one caused pyloric obstruction (Figure 1B), four were intramural, and one was both intraluminal and extraluminal, with compression of the spleen and left kidney (Figure 1C). Eighteen GISTs had a mitotic index $< 5/50$ HPF. According to the risk category for malignant behavior of GIST, 17 (89%) patients were classified as low or very low risk, and two as high risk. Sixteen GISTs were composed of spindle cells (Figure 2B), and one of spindle and epithelial cells. All GISTs were positive for CD117 (Figure 2C), 18 were positive for CD34 (Figure 2D), 18 for Dog-1 (Figure 2E), and nine for vimentin. S-100 protein was negative in 17 cases, and SMA protein was negative in 15 cases.

MULTIDISCIPLINARY EXPERT CONSULTATION

Xiao Chen, Professor, Chief of Gastroenterology; Ai-Lin Song, Professor, Chief of Gastroenterology; Ying-Xin Kang, Professor, Chief of Gastroenterology.

FINAL DIAGNOSIS

Synchronous occurrence of GC and GIST.

TREATMENT

According to the Japanese Classification of Gastric Cancer, all GC patients underwent D2 Lymphadenectomy and postoperative chemotherapy. Complete resection or local resection with adequate margins was performed for all GIST, and oral imatinib mesylate (IM) was administered postoperatively for medium- or high-risk GIST. All 19 patients received radical gastrectomy combined with complete stromal tumor resection, including four (21%) with laparotomy and 15 cases (79%) with laparoscopy. For GC, total gastrectomy was performed in six cases (31%), distal gastrectomy in 11 (58%) and proximal gastrectomy in two (11%). For postoperative treatment of GIST, two patients were given oral IM because GIST was classified as high risk, but the rest were not treated.

OUTCOME AND FOLLOW-UP

Patients were followed up by outpatient review or telephone; the primary event was death, and the last follow-up date was March 2022. During follow-up, two patients were lost, 12 survived, and five died of GC recurrence or distant metastasis (Table 1). No recurrence of GIST was found in 17 patients who were successfully followed up. The 3-year cumulative survival rate of 19 patients with synchronously occurring GC and GIST was 73.9%, and the 5-year cumulative survival rate was 59.2% (Figure 3A).

Table 1 Clinicopathological features, treatment and outcome of gastric cancer in 19 patients

No.	Age in yr	Sex	BMI	Chief complaint	Disease duration (mo)	Comorbidities in yr	Tumor marker	Primary site	Size (cm)	pTNM	Gross appearance	Differentiation	Lauren type	Outcome
1	66	M	17.9	Epigastric discomfort	12.0	HBP/20	(-)	Pylorus	1.5	T3N0M0/IIA	Ulcerativeinfiltrative	M-P	Mixed	38 m, PFS
2	56	M	24.2	CT found by accident	2.0	No	(-)	Cardia, body, antrum	10.0	T3N1M0/IIB	Diffuse infiltrative	P, SRCC	Diffuse	NA
3	53	M	19.5	Upper abdominal pain	0.5	No	CA72-4↑	Body	4.5	T3N0M0/IIA	Ulcerative infiltrative	P, SRCC	NA	48 m, PFS
4	71	M	21.5	Epigastric discomfort	6.0	No	(-)	Body	2.0	T2N0M0/IB	NA	M-P	Mixed	53 m, PFS
5	45	M	21.8	Bloating, acid reflux	6.0	No	(-)	Pylorus	3.5	T3N2M0/IIIA	Ulcerative	M-P, SRCC	Diffuse	48 m, DOD
6	55	M	25.5	Epigastric discomfort	2.0	No	(-)	Antrum	4.0	T1bN0M0/IA	Ulcerative	M-P, SRCC	Intestinal	6 m, PFS
7	79	F	22.2	Heartburn, abdominal pain, black stools	2.0	HBP/10, DM/10	(-)	Antrum	3.0	TisN0M0/0	NA	HGIEN	NA	27 m, PFS
8	58	M	27.9	Upper abdominal pain	4.0	No	(-)	Antrum	5.0	T4aN0M0/IIB	Ulcerative	P	Diffuse	26 m, PFS
9	71	M	23.8	Epigastric pain, acid reflux	1.0	HBP/10	(-)	Antrum	3.5	T1bN0M0/IA	NA	M	Intestinal	23 m, PFS
10	56	M	23.2	Upper abdominal pain, choking eating, black stools	1.0	No	(-)	Cardia	1.5	T2N0M0/IB	Ulcerative infiltrative	M	Intestinal	NA
11	55	M	23.7	Abdominal distension	9.0	No	CEA↑	Fundus	3.0	T4aN3bM0/IIIC	Ulcerative	M	Intestinal	10 m, DOD
12	59	M	23.1	Abdominal distension, black stools	1.0	DM/6	(-)	Body	5.0	T2N0M0/IB	Ulcerative	P	Diffuse	20 m, PFS
13	62	M	22.9	Upper abdominal pain	12.0	No	CEA↑, CA724↑	Body	2.0	T3N0M0/IIA	Ulcerative	P, SRCC	Diffuse	9 m, PFS
14	49	M	13.1	Epigastric discomfort	12.0	No	(-)	Cardia, fundus	5.0	T4bN0M0/IIIA	Ulcerative	M-P	Mixed	45 m, PFS
15	65	F	23.6	Epigastric discomfort, abdominal distension	12.0	No	(-)	Cardia, body	2.5	T4aN1M0/IIIA	Ulcerative	M	NA	5 m, DOD
16	73	M	21.3	Epigastric discomfort	48.0	No	CA724↑	Body	5.0	T4aN3bM0/IIIC	Ulcerative	M-P	Diffuse	12 m, DOD
17	62	M	22.8	Upper abdominal	6.0	DM/6	CEA↑,	Antrum	3.5	T4aN0M0/IIB	Ulcerative infiltrative	M	Intestinal	70 m, PFS

				pain			CA125↑							
18	62	M	21.2	Progressive dysphagia	3.0	HBP/30	CA199↑	Cardia	4.5	T4aN2M0/IIIA	Ulcerative	M-P	Mixed	12 m, DOD
19	72	M	22.4	Upper abdominal pain	0.5	No	(-)	Body	1.5	T1bN0M0/IA	NA	W	NA	63 m, PFS

M: Male; F: Female; HBP: High blood pressure; DM: Diabetes Mellitus (Type 2); TG: Total gastrectomy; DG: Distal gastrectomy; PG: Proximal gastrectomy; pTNM: Pathological tumor-node-metastasis; SRCC: Signet-ring cell carcinoma; HGIEN: High-grade intraepithelial neoplasia; NA: Not assessed; PFS: Progression-free survival; DOD: Dead of disease; M-P: Moderately to poorly differentiated; M: Moderately differentiated; P: Poorly differentiated; W: Well differentiated.

DISCUSSION

It has been reported that the incidence of GC accompanied by GIST is 0.29%-0.53% [6,30,52]. As the diagnostic criteria for GIST have changed and awareness has increased, data surveys in the United States and the Netherlands showed that the incidence of GIST has increased year by year [4,53]. Kawanowa *et al* [54] found that microscopic GIST was found in 35% of GC patients undergoing resection. In our series, the incidence of synchronous GC and GIST was 0.35% (19/5408). It is possible that the incidence of GC simultaneously occurring with GIST is higher because most GISTs are small ($68\% \leq 2$ cm, Table 3) and it is easy to miss diagnosis [7-41]. In addition to the small size of GIST, there are other factors contributing to the low preoperative diagnosis rate: (1) EUS demonstrates superior diagnostic capability for mesenchymal tissue GIST compared to conventional gastroscopy; however, most patients still opt for conventional gastroscopy; (2) Patients with concurrent GC and GIST primarily seek medical attention due to symptoms related to GC, resulting in a rarity of clinical recognition. Consequently, some clinicians may prioritize the diagnosis of GC while overlooking the presence of GIST; and (3) Some GISTs are extraluminal. Studies have shown that epigastric discomfort, dull pain, upper gastrointestinal bleeding, or melena may occur when the diameter of GIST is > 5 cm, and bleeding is the first symptom in most patients [55]. The clinical signs of synchronous GC and GIST lack specificity, and the symptoms of GIST are often masked by GC [45], probably because most GISTs are small in diameter ($68\% \leq 2$ cm).

In this study, the median age of concurrent GC and GIST was 62 years and combined with the literature review [7-41], the median age was 70 years (range: 45-93 years, 47 reports, 157 patients) (Table 3), which is similar to the median age at diagnosis for GIST (range: 66-69 years) [55]. Older people may have specific changes in gene expression profiles, lower immunity, and greater susceptibility to synchronous tumors [45]. The male to female ratio in this study was 8.5:1.0, and combined with other studies [7-41], the ratio was 3.4:1.0 (Table 3). The latest statistics report that GC incidence is two times higher in males than in females [56], while GIST has almost equal gender distribution [55].

The preoperative diagnosis rate of synchronous GIST and GC is low, and diagnosis is usually made during intraoperative exploration or postoperative pathological examination [6,30,45]. GIST is often misdiagnosed as metastatic lymph nodes from epithelial-mesenchymal transition or GC recurrence and metastasis. In our study, the preoperative diagnostic rate of suspicious GIST was 15% with CT, 21% with gastroscopy, and 63% with intraoperative exploration. Lin *et al* [45] found that among 42 patients with synchronous GC and GIST, only one (2.4%) was diagnosed preoperatively. Therefore, it is necessary for clinicians to carefully improve imaging examinations such as endoscopy and CT before surgery, and conduct comprehensive and meticulous exploration during surgery. If suspicious lesions are found, a routine biopsy or intraoperative frozen examination is performed to confirm the diagnosis, and a detailed analysis of specimens after surgery is required.

Table 2 The clinical, histological and immunohistochemical characteristics of gastrointestinal stromal tumor in 19 patients

No.	CT	EGD	Location	Origin	Size (cm)	Type	Growth pattern	Mitotic index (HPF)	Risk category	CD117	CD34	Dog-1	S-100	SMA	VIM	IM
1	GIST	GIST	Antrum	Submucosal	9.0	Spindle, epithelioid	Intraluminal	< 5/50	High	+	+	+	-	-	NA	Yes
2	(-)	(-)	Body	Muscularis	0.4	NA	Intramural	< 5/50	Very low	++	+++	+++	-	-	NA	No
3	(-)	(-)	Body	Subserous	1.0	Spindle	Extraluminal	< 5/50	Low	+	+	+	-	-	+	No
4	Mass	(-)	Duodenum	NA	2.0	Spindle	Extraluminal	< 5/50	Low	+	+	+	-	-	+	No
5	(-)	(-)	Jejunum	NA	1.5	Spindle	Extraluminal	< 5/50	Low	++	+	+++	-	-	NA	No
6	(-)	GIST	Fundus	Muscularis	1.5	Spindle	Extraluminal	< 5/50	Low	+	+	+	-	-	+	No
7	GIST	GIST	Body	NA	5.0	Spindle	Extraluminal	< 5/50	Low	+	+	+	-	-	+	No
8	Mass	Mass	Fundus	Subserous	1.0	Spindle	Intraluminal	< 5/50	Low	+	+	+	-	NA	NA	No
9	(-)	Mass	Duodenum	NA	4.0	Spindle	Extraluminal	< 5/50	Low	+	+	+	-	-	+	No
10	(-)	(-)	Cardia	Subserous	0.2	Spindle	Extraluminal	< 5/50	Very low	+	+	+	-	-	NA	No
11	GIST	GIST	Body	Muscularis	12.0	Spindle	Extraluminal, intraluminal	6-10/50	High	+	+	+	-	-	+	Yes
12	(-)	(-)	Jejunum	NA	4.0	Spindle	Extraluminal	< 5/50	Low	+	-	+	-	-	+	No
13	(-)	(-)	Body	Muscularis	0.4	Spindle	Intramural	< 5/50	Very low	+	+	+	-	-	NA	No
14	(-)	(-)	Fundus	Subserous	0.4	Spindle	Extraluminal	< 5/50	Very low	++	+++	+++	-	NA	NA	No
15	(-)	(-)	Body	Submucosal	0.6	Spindle	Intramural	< 5/50	Very low	+	+	+	-	-	NA	No
16	(-)	(-)	Body	Subserous	3.0.	Spindle	Extraluminal	< 5/50	Low	+	+	+	-	-	+	No
17	(-)	(-)	Antrum	Muscularis	< 1.0	NA	Intramural	< 5/50	Very low	+	+	NA	NA	NA	NA	No
18	(-)	(-)	Cardia, fundus	Subserous	0.4	Spindle	Extraluminal	< 5/50	Low	+	+	+	NA	-	NA	No
19	(-)	(-)	Body	Subserous	1.3	Spindle	Extraluminal	< 5/50	Very low	+	+	-	-	NA	+	No

NA: Not assessed; CT: Computed tomography; EGD: Esophagogastroduodenoscopy; V-L: Very low; L: Low; IN: Intermediate; H: High; IM: Imatinib mesylate; GC: Gastric cancer; GIST: Gastrointestinal stromal tumor.

In the present study, the median maximum diameter of the GC was 3.5 cm (range: 1.5-10.0 cm), and the most common appearance of GC was ulcerative (53%), which was similar to that reported by Maiorana *et al*[6] (50%) and Cai *et al*[25] (50%). Summarizing this study and literature review[7-41], we found that the median maximum diameter of the GC was 4 cm (range: 1.0-10.2 cm). GC is usually located in the lower third of the stomach (42%), stage I (42%), poorly differentiated (42%), and intestinal adenocarcinoma (51%) (Table 3). Therefore, we hypothesized that the occurrence of GIST might have an inhibitory effect on the progression of GC. This was a finding not encountered before in the literature. However, this conjecture is solely based on the findings of pertinent global research due to limited case numbers and a dearth of molecular biological mechanism investigations, thereby insufficiently substantiating this conclusion.

Table 3 Details of the clinical, histological, immunohistochemical, and outcomes of concurrent gastric cancer and gastrointestinal stromal tumor summarized in this study and literature review

Ref.	Sex	Age in yr	GC					GIST					Outcome
			Location	Size (cm)	TNM status	Lauren	Differentiation	Location	Size (cm)	Risk	CD117	CD34	
Maiorana <i>et al</i> [6], 2000	F	81	Cardias	4.0	T2bN0M0, IB	Intestinal	NA	Fundus	5.0	L	NA		21 m, DOD
	F	79	Antrum	2.0	T1bN0M0, IA	Diffuse		Pylorus	6.0	H		+	54 m, PFS
	M	75	Antrum	4.0	T2bN1M0, IIA	Intestinal		Antrum	5.0	L			12 m, PFS
	F	79	Pylorus	1.2	T2aN1M0, IIA	Intestinal		Cardias	5.0	L		+	28 m, PFS
	M	79	Antrum	2.0	T2aN0M0, IB	Intestinal		Cardias	0.6	V-L		+	75 m, PFS
Bircan <i>et al</i> [7], 2004	71	Antrum	5.7	T3NxM0	Intestinal	P	Cardias	0.5	V-L	+	+	NA	71
	77	Cardias	7.5	T2N1M0, IIA	NA	M	Cardias	0.6	V-L	+	+	NA	77
Villias <i>et al</i> [8], 2008	M	78	Antrum	NA	T1N0M0, IA	Intestinal	M	Antrum	0.9	V-L	+	+	NA
Lin <i>et al</i> [9], 2006	F	70	Cardias	1.7	T1N0M0, IA	NA	P, SRCC	Fundus	1.1	V-L	+	+	14 m, PFS
Liu <i>et al</i> [10], 2018	M	72	Antrum	4.0	T2N1M0, IIA	NA	M	Fundus	2.0	V-L	+	+	18 m, PFS
Wronski <i>et al</i> [11], 2006	F	64	Antrum	5.0	T4N0M0, IIB	Diffuse	NA	Cardias	2.0	L	+	+	NA
	M	66	Cardias	1.0	T1N0M0, IA	Intestinal	NA	Cardias	1.0	V-L	+	+	NA
Theodosopoulos <i>et al</i> [63], 2011	M	80	Antrum	6.5	T1N0M0, IA	Intestinal	W	Body	3.0	IN	+	NA	12 m, PFS
Rauf <i>et al</i> [46], 2006	F	70	Antrum, body	10.0.	T4N1M0, IIIA	Diffuse	P, SRCC	Body	2.0	L	+	+	18 m, DOD
Namikawa <i>et al</i> [14], 2021	M	74	Body	2.0	T2N0M0, IB	NA	M	Body	2.2	L	NA	NA	1 m, PFS
Shimodate <i>et al</i> [15], 2014	M	79	Body	3.0	T1bN0M0, IA	NA	NA	Body	1.3	V-L	+	+	NA
Khoshnevis <i>et al</i> [16], 2013	F	64	Pylorus	6.0	T4N0M0, IIIA	Diffuse	P, SRCC	Fundus, body	1.0	H	+	NA	4 m, PFS
Namikawa <i>et al</i> [17], 2016	M	58	Body	9.0	T2N1M0, IIA	Diffuse	SRCC	Body	21.0	H	NA	NA	4 m, PFS
Kaffes <i>et al</i> [18], 2002	M	78	Antrum	NA	T1N0M0, IA	Diffuse	P	Body	1.5	ND	NA	+	20 m, PFS
Uchiyama <i>et al</i> [19], 2007	M	74	Antrum	1.5	T1aN0M0, IA	Intestinal	M-P	Body	0.8	L	+	+	NA

Salemis <i>et al</i> [20], 2008	F	78	Antrum	6.5	T4N2M0, IIIA	Diffuse	P	Body	1.0	L	+	+	14 m, DOD
Narasimhamurthy <i>et al</i> [21], 2010	M	65	Cardias	4.0	T4NxM0	Diffuse	P	Antrum	2.5	L	+	NA	NA
Ferreira <i>et al</i> [22], 2010	M	52	NA	10.2	T3N1M0, IIB	NA	NA	NA	1.1	V-L	+	+	NA
	F	65	NA	4.8	T3N1M0, IIB	NA	NA	NA	0.7	V-L	+	+	
Gonçalves <i>et al</i> [23], 2010	M	74	NA	NA	NA	NA	NA	NA	1.2	V-L	NA	NA	5 m, DOD
	M	67	NA	NA	NA	NA	NA	NA	0.3	V-L	NA	NA	2 m, DOD
Jeong <i>et al</i> [24], 2011	M	74	Antrum	3.3	T1aN0M0, IA	Intestinal	M	Body	2.0	V-L	+	+	NA
Cai <i>et al</i> [25], 2013	M	47	Cardias	8.0	T3N1M0, IIB	NA	P	Cardias	2.0	V-L	+	+	NA
	M	80	Antrum	2.0	T1N0M0, IA		P	Cardias	1.5	V-L	+	+	
	M	60	Antrum	8.0	T3N0M0, IIA			Antrum	0.6	V-L	+	+	
	F	67	Antrum	4.0	T3N1M0, IIB			Body	0.8	V-L	+	+	
	M	78	Pylorus	6.0	T4N2M0, IIIA			Body	2.5	L	+	+	
	M	78	Body	10.0	T3N1M0, IIB			Body	1.4	L	+	+	
	F	59	Body	4.0	T2N1M0, IIA		P	Body	0.8	L	+	+	
	M	80	Antrum	6.0	T2N0M0, IB		P	Body	5.0	L	+	+	
Liszka <i>et al</i> [26], 2007	M	53	NA	NA	NA	NA	NA	NA	NA	V-L	+	NA	NA
	M	63	NA	NA	NA	NA	NA	NA	NA	L	+	NA	
Yamamoto <i>et al</i> [27], 2012	M	67	Body	3.0	T4N0M0, IIB	Diffuse	P	Body	3.0	L	+	+	NA
Gülpınar <i>et al</i> [28], 2014	M	75	Antrum	NA	T1N1M0, IB	NA	M	Antrum	1.0		NA	NA	NA
Trihia <i>et al</i> [29], 2019	M	79	Cardias	8.5	NA	Intestinal	M-P	Body	0.9	L	+	+	Days, DOD
Yan <i>et al</i> [30], 2013	M	53	U	NA	T4N0M0, IIIA	NA	P	NA	0.4	V-L	NA		NA
	M	51	U	NA	T4N3M0, IIIB		M-P		0.8	V-L	+		
	M	62	U	NA	T4N2M0, IIIA		P		0.8	V-L	NA		
	F	73	L	NA	T4N3M0, IIIB		P, SRCC		0.2	V-L	NA		
	M	68	M	NA	T1N0M0, IA		M		0.8	V-L	NA		
	F	46	L	NA	T1bN0M0, IA		P, SRCCM		2.5	L	+		
	M	78	U	NA	T4N1M0, IIIA		M		1.5	V-L	+		

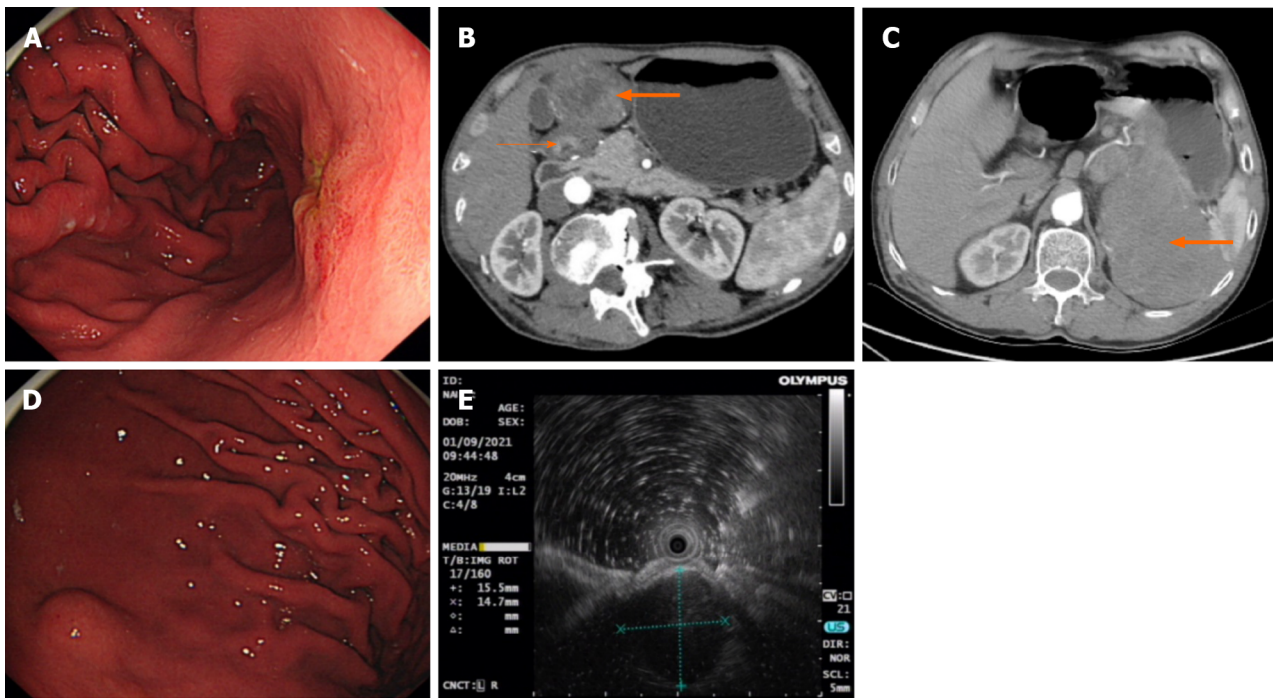
	M	66	U	NA	T4N3M0, IIIB		M-P		1.5	V-L	+		
	M	85	U, M	NA	T4N2M0, IIIA		P		1.0	V-L	+		
	M	68	L	NA	T4N0M0, IIB		M		0.8	V-L	+		
	M	69	U	NA	T4N0M0, IIB		P, SRCC		2.0	V-L	+		
	M	77	U	NA	T2N1M0, IIA		M		0.2	V-L	+		
	M	71	L	NA	T4N3M0, IIIB		M-P		0.6	V-L	+		
	F	77	L	NA	T4N3M0, IIIB		M-P		0.5	V-L	+		
	F	70	L	NA	T1bN0M0, IA				0.6	V-L	+		
Vogel <i>et al</i> [31], 2011	M	79	Body	6.0	T1N0M0, IA	Diffuse	P, SRCC	Body	0.8	V-L	+	NA	12 m, PFS
¹ Ozgun <i>et al</i> [32], 2009	M	78	Body	NA	NA	NA	NA	Antrum	10.0	H	+	+	
Hsiao <i>et al</i> [33], 2009	M	75	Cardias	1.0	T1N0M0, IA	NA	W	Cardias	3.3	L	+	+	6 m, DOD
Kountourakis <i>et al</i> [34], 2008	F	72	NA	NA	NA	Diffuse	NA	NA	1.8	V-L	+	+	6 m, PFS
Lee <i>et al</i> [35], 2007	M	82	Body	9.5	T4NxM1, IV	NA	NA	Body	1.5	L	+	+	NA
Chen <i>et al</i> [36], 2001	M	72	Pylorus	1.5	NA	NA	NA	Body	2.5	V-L	+	+	NA
¹ Katsoulis <i>et al</i> [37], 2007	F	78	Cardias	NA	T4N3aM0, IIIB	Diffuse	P	Antrum	0.9	V-L	+	NA	NA
¹ Liu <i>et al</i> [38], 2002	M	70	Cardia, fundus	8.5	T4N0M1, IV	Intestinal	NA	Cardia	NA	V-L	+	+	3 m, DOD
¹ Toyoda <i>et al</i> [39], 2009	F	83	Body	9.0	T4NxM0	Intestinal	P	Body	4.5	H	+	+	6 m, DOD
¹ Matsuno <i>et al</i> [40], 2021	M	68	Body	5.0	T3N0M0, IIA	NA	M	Body	0.5	V-L	+	NA	2.5 yr, PFS
¹ Kleist <i>et al</i> [41], 2010	F	86	Body	6.0	NA	Intestinal	SRCC	Body	6.0	IN	+	+	11 m, PFS
	M	78	Body	6.0	NA	NA	SRCC	Body	5.5	IN	+	+	4 m, DOD
¹ Trabelsi <i>et al</i> [42], 2008	M	54	NA	NA	NA	Diffuse	NA	NA	1.0	V-L	NA	NA	NA
¹ Zámecník <i>et al</i> [64], 2005	F	93	Fundus	NA	LGIN, 0	NA	NA	Fundus	4.5	L	+	+	NA
¹ Idema <i>et al</i> [43], 2008	M	71	Body	5.0	T4N2M0, III A	Intestinal	SRCC	Body	0.6	V-L	+	+	30 m, DOD
Alkaaki <i>et al</i> [65], 2018	M	55	Cardia	1.7	T1aNxM0	NA	NA	Antrum	10	H	-	+	NA
¹ Bi <i>et al</i> [66], 2009	F	73	Fundus, body	4.0	T4N2M0, III A	Intestinal	W	Fundus	4	L	+	+	NA
¹ Firat <i>et al</i> [44], 2010	M	63	Cardia	9.0	T4N3bM0, IIIB	Intestinal	NA	Cardia	0.4	V-L	+	+	13 m, DOD

	M	60	Body	4.0	T1N0M0, IA	Intestinal		Body	0.5	V-L	+	+	12 m, PFS		
Telugu <i>et al</i> [67], 2016	M	63	Cardia	4.0	T3N1M0, IIB	NA	M	Fundus	1.0	V-L	-	+	7 m, PFS		
Lin <i>et al</i> [45], 2014	M (32), F (10)	> 60 (30), ≤ 60 (12)	NA	NA	IA (14), IB (8), IIA (5), IIB (1), IIIA (7), IIIB (4), IIIC (3)	NA	W (6), M (21), P (10), SRCC (5)	U (14), M (20), L (8)	≤ 2 (35), 2-5 (7)	V-L (35), L (4), IN (2), H (1)	+	(28)	+	(25)	3-yr (62.6), 5-yr (57.8%)
Liu <i>et al</i> [52], 2009	M (19), F (3)	64.5, (Med)	NA	NA	NA	NA	NA	Cardias (1), fundus (7), body (13), antrum (1)	0.8 (Med)	< L					5-yr (31.8%)
Present study	M (17), F (2)	62 (Med)	U (5), M (6), L (7), W (1)	3.5 (Med)	0 (1), IA (3), IB (3), IIA (3), IIB (3), IIIA (4), IIIC (2)	Diffuse (6), intestinal (5), mixed (3)	M-P (7), M (5), P (5), W (1)	Body (8), fundus (3), antrum (2), Cardia (2)	1.4 (Med)	L (10), V-L (7), H (2)	+	(19)	+	(18), - (1)	3-yr (73.9%), 5-yr (59.2%)
All	M (122), F (35)	70 (Med)	U (26), M (23), L (35)	4 (Med)	0 (2), IA (33), IB (16), IIA (17), IIB (13), IIIA (21), IIIB (11), IIIC (5), IV (2)	Diffuse (19), intestinal (23), mixed (3)	M-P (13), M (38), P (45), W (10)	U (43), M (66), L (20)	1.2 (Med)	V-L (84), L (35), IN (5), H (9)	-	(2)	-	(1)	3-yr (54.5%), 5-yr (46.7%)

¹Collision tumor.

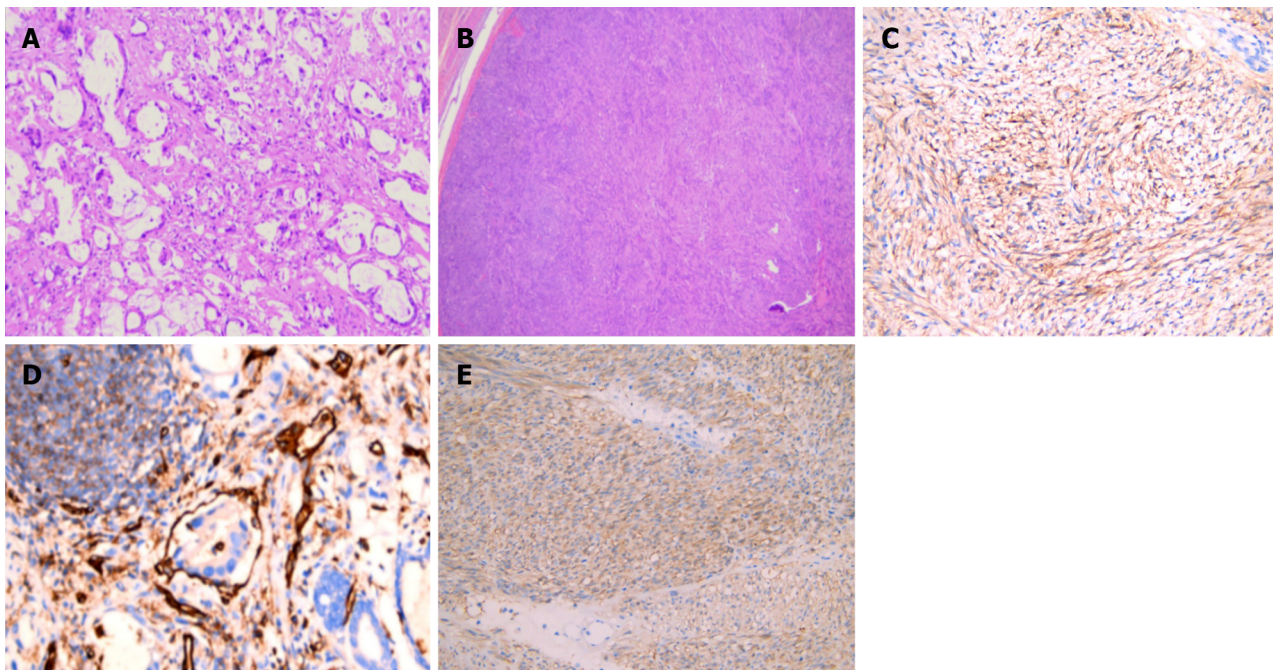
GC: Gastric cancer; GIST: Gastrointestinal stromal tumor; M: Male; F: Female; Med: Median; DOD: Dead of disease; U: Upper one-third of the stomach; M: Middle one-third of the stomach; L: Lower one-third of the stomach; LGIN: Low-grade intraepithelial neoplasia; M-P: Moderately to poorly differentiated; M: Moderately differentiated; P: Poorly differentiated; W: Well differentiated; SRCC: Signet-ring cell carcinoma; V-L: Very low; L: Low; IN: Intermediate; H: High; SRCC: Signet-ring cell carcinoma; NA: Not assessed; PFS: Progression-free survival; pTNM: Pathological tumor-node-metastasis.

In the case of GC occurring concomitantly with GIST, we found that GISTs were most frequently located in the gastric body (42%), with a maximum diameter of 1.4 cm ($68\% \leq 2$ cm), most often occurred in the subserosal layer, and the most common growth pattern was extraluminal (Table 2). These results were similar to our summary[7-41], with 51% of GISTs located in the middle third of the stomach, and the median largest diameter of GISTs was 1.2 cm ($78\% \leq 2$ cm) (Table 3). Yan *et al*[30] reported that 93% of GISTs simultaneously occurring with GC were < 2 cm in diameter, and Agaimy *et al*[57] found that 73% of GISTs were < 5 cm in diameter. Liu *et al*[52] found that GISTs that occurred simultaneously with GC were small, with a median diameter of 0.8 cm (range: 0.2-2.5 cm), while the median value of pure GIST was 7.5 cm (range: 1.5-30.0 cm). At present, the most practical value for the diagnosis of GIST is the proto-oncogene c-kit gene expression product CD-117 (80%-100%) and CD-34 (56%-83%)[55-57]. In our study, the positive rates of CD117 and CD34 in GIST co-occurring with GC were 100% and 95%, respectively; similar to the results reported by Liu *et al*[52] (CD117 92.6%, CD34 96.3%). Lin *et al*[45] found that compared with pure GIST, the positive rate of CD117 (66.7%) and CD34 (59.5%) in synchronous GC combined with GIST was lower. On the contrary, Liszka *et al*[26] found that the positive expression rate of CD117 in GIST combined with other tumors and GIST alone was 100%, and the positive rate of CD34 was 54.5% and 56.7%, respectively, with no significant difference. Combined with the literature review[7-41], we found that only two cases were negative for CD117 expression and one was negative for CD34 expression (Table 3). Liu *et al*[52] found that most incidental GISTs (90.7%) had low mitotic activity and low risk, while only 1.9% of clinical GIST cases had low risk. Cai *et al*[25] and Liszka *et al*[26] found that patients with synchronously occurring GIST and other tumors had a lower risk of invasion and a smaller tumor diameter than patients with GIST alone. Yan *et al*[30] reported that almost all GISTs occurring concomitantly with GC were stratified as very low or low risk. We found that 89% of GISTs were low or very low risk. When combined with other studies[7-41], we found that 89% of GISTs co-occurring with GC were classified as low or very low risk (Table 3). Liu *et al*[58] conducted a retrospective analysis on 24 patients diagnosed with GC



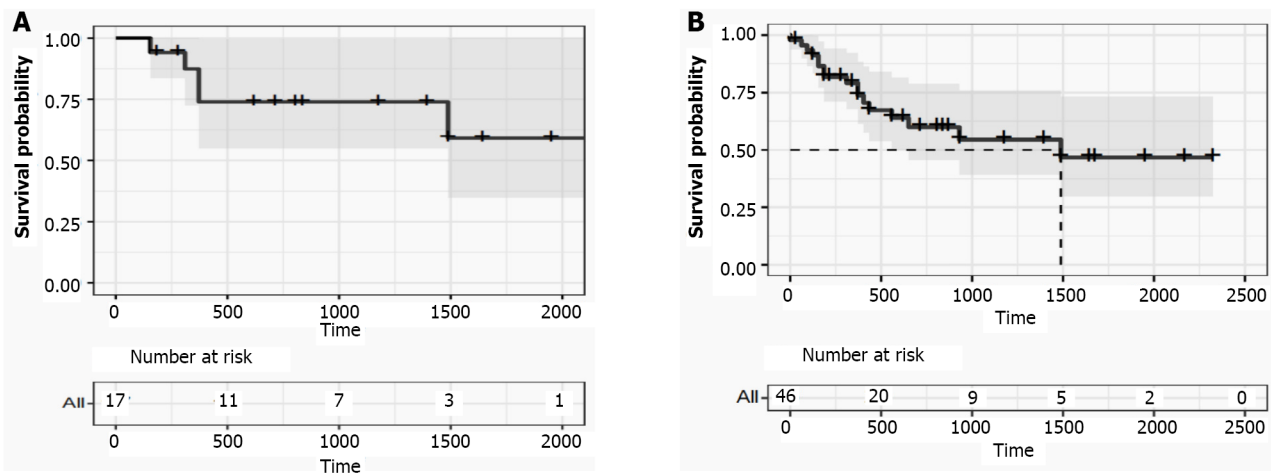
DOI: 10.4251/wjgo.v15.i10.1807 Copyright ©The Author(s) 2023.

Figure 1 Gastroscopic and imaging features of gastric cancer concomitant with gastrointestinal stromal tumor. A: Ulcerative gastric adenocarcinoma (patient 6); B: Pyloric adenocarcinoma (thin arrow) and intraluminal gastrointestinal stromal tumor (GIST; thick arrow) leading to pyloric obstruction (patient 1); C: Giant GIST (9.5 cm × 10.9 cm × 11.7 cm, arrow) showing intraluminal and extraluminal growth, compressing the spleen and left kidney (patient 11); D: Suspicious GIST under gastroscopy (patient 6); E: Suspicious GIST on ultrasound Endoscopy (patient 6).



DOI: 10.4251/wjgo.v15.i10.1807 Copyright ©The Author(s) 2023.

Figure 2 Pathological and immunohistochemical features of gastric cancer concomitant with gastrointestinal stromal tumor. A: Microscopically showing gastric adenocarcinoma (patient 6; HE, 100 ×); B: Microscopically showing gastric stromal tumor (patient 6; HE, 100 ×); C: CD117 positive under microscope (patient 6; immunohistochemical staining, 200 ×); D: CD34 positive under microscope (patient 6; immunohistochemical staining, 200 ×); E: Dog-1 positive under microscope (patient 6; immunohistochemical staining, 200 ×).



DOI: 10.4251/wjgo.v15.i10.1807 Copyright ©The Author(s) 2023.

Figure 3 Kaplan-Meier survival curves. A: 19 patients with gastric cancer (GC) accompanying gastrointestinal stromal tumor (GIST) in this study; B: 46 patients with GC accompanying GIST in this study and the literature reviewed.

combined with GISTs. The findings revealed that the occurrence of GIST combined with GC was more prevalent among elderly male patients, while GIST predominantly exhibited low-risk characteristics. Similarly, Liu *et al*[59] conducted an analysis on 26 patients diagnosed with GC and GISTs, revealing that the Fletcher classification typically indicates a very low or low risk of invasion in patients with GIST and GC. These findings may be related to the following factors: Widespread KIT/PDGFRA mutations in early tumorigenesis. Since additional mutations are required for GIST progression, synchronized tumors may influence the environment, release factors that inhibit the acquisition of further genetic changes, or inhibit GIST growth[30]. It may also be incidental that GIST develops later than GC.

At present, the etiology of GC co-occurrence with GIST is unclear. Some researchers believe that it is an accidental phenomenon[6,11], and others believe that several unknown carcinogens induce simultaneous proliferation and tumorigenesis of epithelial and stromal cells, such as gene mutation, nitrite, and *Helicobacter pylori*[6,7,9,11,18,30,34,37,38,46-49]. Gene mutations may lead to the interaction of two adjacent tissues, interfering with mesothelial and epithelial cell growth regulation, thereby inducing different tumors in two tissues of the same organ. Through next-generation sequencing, Liu *et al*[10] detected that GC and GIST had significantly different gene mutations at the molecular level (TP53 and KIT gene mutations, respectively). Some researchers have hypothesized that there might be a field effect, with etiological cofactors leading to these two lesions[60]. Based on the high correlation between clinical and microscopic GIST and GC, we believe that GC and GIST may be affected by the same unknown carcinogen, resulting in the simultaneous proliferation of epithelial and stromal cells.

Synchronous GC and GIST treatment is comprehensive and based on surgery. The surgical method is mainly based on GC, and adjuvant IM therapy should be given to patients with intermediate- and high-risk GIST after surgery[55]. In our study, all patients were given chemotherapy based on GC after surgery, and imatinib (IM) therapy was also given to patients with high-risk GIST. Xu *et al*[61] demonstrated that apatinib exhibits promising therapeutic potential and tolerability in patients with GC complicated by GISTs who have shown resistance to IM in combination with chemotherapy. However, there is still no conclusion on whether there is any interaction between chemotherapy for GC and IM treatment for GIST and the time sequence of medication.

For patients with synchronously occurring GC and GIST, studies have shown that regardless of the Fletcher grade of GIST, GC is the main factor affecting the prognosis[35,45,51]. Liu *et al*[52] conducted a follow-up study on 22 patients with synchronously occurring GC and GIST who underwent surgery and found that the 5-year survival rate after surgery was 31.8%, and the average survival time was 3 years. Lin *et al*[45] found that GIST risk stratification, postoperative oral IM, and synchronous GC were independent predictors of survival; the 3-year survival rate was 62.6%, the 5-year survival rate was 57.8%, and the 5-year overall survival rate of patients with synchronous GC was lower than that of patients with nonsynchronous GC (very low/low: 60.2% *vs* 98.6%; moderate/high risk: 33.3% *vs* 98.1%). In our study, the 3-year cumulative survival rate of 19 patients with concurrent GC and GIST was 73.9%, and the 5-year cumulative survival rate was 59.2%. We analyzed the survival of 46 patients with synchronous GC and GIST by combining the patients in this study ($n = 17$) and those reviewed in the literature ($n = 29$) (Figure 3B)[6-67]. The 3-year cumulative survival rate was 54.5%, the 5-year cumulative survival rate was 46.7%, the median survival time was 4 years, and none of the GISTs recurred during follow-up. In addition to the report by Liu *et al*[52], the 5-year survival rate of patients with GC combined with GIST in our study and in most studies was higher than that of patients with simple curable GC treated with surgery (5-year survival rate: 45%)[62], and similar to that of patients with simple GIST treated with complete resection (5-year survival rate: 50%-65%)[55]. To our knowledge, this is a finding that has not been encountered before in the literature. The reasons may be as follows: In patients with GC combined with GIST, most GC is early stage (42%), and most GIST is very low or low risk (89%). We hypothesize that there may be mutual inhibition between GC and GIST in the pathogenesis and progression. It is crucial to emphasize that our conjecture is solely based on a comprehensive analysis of current research findings both domestically and internationally. However, in order to validate this hypothesis,

extensive medical records and molecular biological investigations are imperative due to the absence of studies elucidating the underlying molecular mechanisms. In contrast, distinct findings emerge when comparing and analyzing GC patients with GIST and those diagnosed solely with GIST. Liu *et al*[58] conducted a comparative analysis between GC patients with GIST ($n = 24$) and gastric GIST patients ($n = 217$), revealing significantly lower 5-year disease-free survival rate and disease-specific survival rate in the former group compared to the non-synchronous group (54.9% *vs* 93.5%, $P < 0.001$; 37.9% *vs* 89.9%, $P < 0.001$). Similarly, Liu *et al*[59] conducted an analysis on a cohort of 26 patients with synchronous GC (group A) and 96 patients with gastric GIST (group B). The findings revealed that the Fletcher classification ($P < 0.05$) and synchronous GC ($P < 0.01$) were identified as independent prognostic factors.

LIMITATION

Our study had some limitations. Firstly, the research data quality could be better, with a limited number of cases (19 cases) and insufficient pathological research data. Additionally, more comprehensive test results and genetic and molecular data must be needed to support statistically significant conclusions based on limited information. Methodologically, this study is a retrospective single-centre investigation lacking prospective and case-control studies (including patients with superficial GC and Simple GIST patients) and molecular biological mechanism exploration. Regarding the study's content, an in-depth investigation of *H. pylori* was not conducted. Consequently, this study remains at a preliminary stage of exploration. This study concludes that further investigations are required to validate and supplement the conjecture. The future research will require enhancements in data quality, research methods, and a deeper exploration of the content.

CONCLUSION

Synchronous of GIST and GC are more common than previously considered. There are specific clinicopathological features between GC and GIST, such as those commonly seen in older men, GC is usually poorly differentiated intestinal-type early adenocarcinoma located in the lower third of the stomach, and GIST is usually small-diameter, low risk or very low risk located in the gastric body. We hypothesize that GC and GIST may be affected by the same unknown carcinogen, resulting in the simultaneous proliferation of epithelial and stromal cells. GC and GIST may have mutual inhibitory effects on the pathogenesis and disease progression. Importantly, a substantial amount of case data and studies on molecular biological mechanisms are imperative to validate this hypothesis.

ACKNOWLEDGEMENTS

The authors thanks professor Yu-Min Li for his comments on this manuscript and professor Ai-Lin Song, Xiao Chen, Ying-Xin Kang for their expert consultation on this article. All the authors thank the enrolled patients for their support of the data.

FOOTNOTES

Author contributions: Liu J performed data collection, statistical analysis, literature collection, and manuscript writing; Huang BJ, Tang FT, and Ding FF participated in the investigation and revision; Li YM designed, supervised, and guided this study; and all authors contributed to the article and approved the submitted version.

Supported by the Fundamental Research Funds for the Central Universities, No. lzujbky-2022-sp08.

Informed consent statement: Informed written or verbal consent were obtained from the patient for publication of this report and any accompanying images.

Conflict-of-interest statement: The authors declare that they have no conflict of interest to disclose.

CARE Checklist (2016) statement: The authors have read the CARE Checklist (2016), and the manuscript was prepared and revised according to the CARE Checklist (2016).

Open-Access: This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <https://creativecommons.org/licenses/by-nc/4.0/>

Country/Territory of origin: China

ORCID number: Yu-Min Li 0000-0002-9267-1412.

S-Editor: Chen YL

L-Editor: A

P-Editor: Chen YL

REFERENCES

- Menge F, Jakob J, Kasper B, Smakic A, Gaiser T, Hohenberger P. Clinical Presentation of Gastrointestinal Stromal Tumors. *Visc Med* 2018; **34**: 335-340 [PMID: 30498699 DOI: 10.1159/000494303]
- Rabin I, Chikman B, Lavy R, Sandbank J, Maklakovsky M, Gold-Deutch R, Halpren Z, Wassermann I, Halevy A. Gastrointestinal stromal tumors: a 19 year experience. *Isr Med Assoc J* 2009; **11**: 98-102 [PMID: 19432038]
- Nilsson B, Bümbling P, Meis-Kindblom JM, Odén A, Dortok A, Gustavsson B, Sablinska K, Kindblom LG. Gastrointestinal stromal tumors: the incidence, prevalence, clinical course, and prognostication in the preimatinib mesylate era--a population-based study in western Sweden. *Cancer* 2005; **103**: 821-829 [PMID: 15648083 DOI: 10.1002/cncr.20862]
- Goettsch WG, Bos SD, Breekveldt-Postma N, Casparie M, Herings RM, Hogendoorn PC. Incidence of gastrointestinal stromal tumours is underestimated: results of a nation-wide study. *Eur J Cancer* 2005; **41**: 2868-2872 [PMID: 16293410 DOI: 10.1016/j.ejca.2005.09.009]
- Nishida T, Hirota S. Biological and clinical review of stromal tumors in the gastrointestinal tract. *Histol Histopathol* 2000; **15**: 1293-1301 [PMID: 11005253 DOI: 10.14670/HH-15.1293]
- Maiorana A, Fante R, Maria Cesinaro A, Adriana Fano R. Synchronous occurrence of epithelial and stromal tumors in the stomach: a report of 6 cases. *Arch Pathol Lab Med* 2000; **124**: 682-686 [PMID: 10782147 DOI: 10.5858/2000-124-0682-SOOEAS]
- Bircan S, Candir O, Aydin S, Başpınar S, Bülbül M, Kapucuoğlu N, Karahan N, Ciriş M. Synchronous primary adenocarcinoma and gastrointestinal stromal tumor in the stomach: a report of two cases. *Turk J Gastroenterol* 2004; **15**: 187-191 [PMID: 15492920]
- Villias C, Gourgoutis S, Veloudis G, Sampaziotis D, Moreas H. Synchronous early gastric cancer and gastrointestinal stromal tumor in the stomach of a patient with idiopathic thrombocytopenic purpura. *J Dig Dis* 2008; **9**: 104-107 [PMID: 18419644 DOI: 10.1111/j.1751-2980.2008.00330.x]
- Lin YL, Tzeng JE, Wei CK, Lin CW. Small gastrointestinal stromal tumor concomitant with early gastric cancer: a case report. *World J Gastroenterol* 2006; **12**: 815-817 [PMID: 16521203 DOI: 10.3748/wjg.v12.i5.815]
- Liu S, Liu H, Dong Y, Wang F, Wang H, Chen J. Gastric carcinoma with a gastrointestinal stromal tumor - A case report and literature review. *Med Sci (Paris)* 2018; **34** Focus issue F1: 15-19 [PMID: 30403169 DOI: 10.1051/medsci/201834f103]
- Wronski M, Ziarkiewicz-Wroblewska B, Gornicka B, Cebulski W, Słodkowski M, Wasiutynski A, Krasnodebski IW. Synchronous occurrence of gastrointestinal stromal tumors and other primary gastrointestinal neoplasms. *World J Gastroenterol* 2006; **12**: 5360-5362 [PMID: 16981268 DOI: 10.3748/wjg.v12.i33.5360]
- A/L Chandrasekaran T, Sahid NA, Maiyauen TK. Synchronous Gastrointestinal Stromal Tumor (GIST) with pancreatic adenocarcinoma: A case report. *Ann Med Surg (Lond)* 2022; **77**: 103588 [PMID: 35638052 DOI: 10.1016/j.amsu.2022.103588]
- Vasilakaki T, Koulia K, Tsavari A, Arkoumani E, Kouroumpas E, Pavlis A, Christopoulos G, Stamatou K, Manoloudaki K, Zisis D. Synchronous gastric gastrointestinal stromal tumor and colon adenocarcinoma: a case report. *Case Rep Oncol Med* 2014; **2014**: 305848 [PMID: 25197591 DOI: 10.1155/2014/305848]
- Namikawa T, Maeda M, Yokota K, Tanioka N, Iwabu J, Munekage M, Uemura S, Maeda H, Kitagawa H, Nagata Y, Kobayashi M, Hanazaki K. Laparoscopic Distal Gastrectomy for Synchronous Gastric Cancer and Gastrointestinal Stromal Tumor With Situs Inversus Totalis. *In Vivo* 2021; **35**: 913-918 [PMID: 33622883 DOI: 10.21873/in vivo.12331]
- Shimodate Y, Sugiyama K, Mitani Y, Hamaguchi K, Doi A, Nishimura N, Fujita H, Mouri H, Matsueda K, Yamamoto H. [A case report of endosonography used for the diagnosis of early gastric cancer and gastrointestinal stromal tumor]. *Nihon Shokakibyo Gakkai Zasshi* 2014; **111**: 1976-1982 [PMID: 25283226]
- Khoshnevis J, Rakhshan A, Sobhiyeh MR, Gholizadeh B, Rahbari A, Adhami F, Lotfollahzadeh S. Simultaneous gastric adenocarcinoma and gastrointestinal stromal tumor of the stomach: a case report. *Iran J Cancer Prev* 2013; **6**: 55-58 [PMID: 25250111]
- Namikawa T, Munekage E, Munekage M, Maeda M, Yatabe T, Kitagawa H, Sakamoto K, Obatake M, Kobayashi M, Hanazaki K. Synchronous Large Gastrointestinal Stromal Tumor and Adenocarcinoma in the Stomach Treated with Imatinib Mesylate Followed by Total Gastrectomy. *Anticancer Res* 2016; **36**: 1855-1859 [PMID: 27069170]
- Kaffes A, Hughes L, Hollinshead J, Katelaris P. Synchronous primary adenocarcinoma, mucosa-associated lymphoid tissue lymphoma and a stromal tumor in a Helicobacter pylori-infected stomach. *J Gastroenterol Hepatol* 2002; **17**: 1033-1036 [PMID: 12167128 DOI: 10.1046/j.1440-1746.2002.02649.x]
- Uchiyama S, Nagano M, Takahashi N, Hidaka H, Matsuda H, Nagaike K, Maehara N, Hotokezaka M, Chijiwa K. Synchronous adenocarcinoma and gastrointestinal stromal tumors of the stomach treated laparoscopically. *Int J Clin Oncol* 2007; **12**: 478-481 [PMID: 18071869 DOI: 10.1007/s10147-007-0684-8]
- Salemi NS, Gourgoutis S, Tsiambas E, Karameris A, Tsohataridis E. Synchronous occurrence of advanced adenocarcinoma with a stromal tumor in the stomach: a case report. *J Gastrointest Liver Dis* 2008; **17**: 213-215 [PMID: 18568146]
- Narasimhamurthy MS, Vallachira GP, Mahadev PS. Synchronous adenocarcinoma and gastrointestinal stromal tumor in the stomach. *Saudi J Gastroenterol* 2010; **16**: 218-220 [PMID: 20616420 DOI: 10.4103/1319-3767.65196]
- Ferreira SS, Werutsky G, Toneto MG, Alves JM, Piantá CD, Breunig RC, Brondani da Rocha A, Grivicich I, Garicochea B. Synchronous gastrointestinal stromal tumors (GIST) and other primary cancers: case series of a single institution experience. *Int J Surg* 2010; **8**: 314-317 [PMID: 20380900 DOI: 10.1016/j.ijsu.2010.03.008]
- Gonçalves R, Linhares E, Albagli R, Valadão M, Vilhena B, Romano S, Ferreira CG. Occurrence of other tumors in patients with GIST. *Surg Oncol* 2010; **19**: e140-e143 [PMID: 20675121 DOI: 10.1016/j.suronc.2010.06.004]
- Jeong SH, Lee YJ, Park ST, Choi SK, Hong SC, Jung EJ, Ju YT, Jeong CY, Ha WS. Synchronous Adenocarcinoma and Gastrointestinal Stromal Tumor of the Stomach Treated by a Combination of Laparoscopy-assisted Distal Gastrectomy and Wedge Resection. *J Gastric Cancer* 2011; **11**: 55-58 [PMID: 22076202 DOI: 10.5230/jgc.2011.11.1.55]

- 25 **Cai R**, Ren G, Wang DB. Synchronous adenocarcinoma and gastrointestinal stromal tumors in the stomach. *World J Gastroenterol* 2013; **19**: 3117-3123 [PMID: [23716992](#) DOI: [10.3748/wjg.v19.i20.3117](#)]
- 26 **Liszka L**, Zielińska-Pajak E, Pajak J, Gołka D, Huszno J. Coexistence of gastrointestinal stromal tumors with other neoplasms. *J Gastroenterol* 2007; **42**: 641-649 [PMID: [17701127](#) DOI: [10.1007/s00535-007-2082-4](#)]
- 27 **Yamamoto D**, Hamada Y, Tsubota Y, Kawakami K, Yamamoto C, Yamamoto M. Simultaneous development of adenocarcinoma and gastrointestinal stromal tumor (GIST) in the stomach: case report. *World J Surg Oncol* 2012; **10**: 6 [PMID: [22230934](#) DOI: [10.1186/1477-7819-10-6](#)]
- 28 **Gülpınar K**, Öziş E, Özdemir S, Korkmaz A. Synchronous occurrence of adenocarcinoma and gastrointestinal stromal tumor of the stomach. *Turk J Gastroenterol* 2014; **25** Suppl 1: 256-257 [PMID: [25910328](#) DOI: [10.5152/tjg.2014.3873](#)]
- 29 **Trihia HJ**. Coexistence of Gastric Cancer and Multiple Small Gastrointestinal Stromal Tumors: Report of a Unique Case and Review of the Literature. *Gastrointest Tumors* 2019; **5**: 63-67 [PMID: [30976576](#) DOI: [10.1159/000495178](#)]
- 30 **Yan Y**, Li Z, Liu Y, Zhang L, Li J, Ji J. Coexistence of gastrointestinal stromal tumors and gastric adenocarcinomas. *Tumour Biol* 2013; **34**: 919-927 [PMID: [23283817](#) DOI: [10.1007/s13277-012-0627-5](#)]
- 31 **Vogel Y**, Müller C, Uhl W, Tannapfel A. [Coexistence of multifocal gastric adenocarcinoma with signet-ring cell morphology and a gastrointestinal stromal tumour in a stomach with hp-associated gastritis]. *Z Gastroenterol* 2011; **49**: 201-206 [PMID: [21298606](#) DOI: [10.1055/s-0029-1245593](#)]
- 32 **Ozgun YM**, Ergul E, Sisman IC, Kusdemir A. Gastric adenocarcinoma and GIST (collision tumors) of the stomach presenting with perforation; first report. *Bratisl Lek Listy* 2009; **110**: 504-505 [PMID: [19750991](#)]
- 33 **Hsiao HH**, Yang SF, Liu YC, Yang MJ, Lin SF. Synchronous gastrointestinal stromal tumor and adenocarcinoma at the gastroesophageal junction. *Kaohsiung J Med Sci* 2009; **25**: 338-341 [PMID: [19560999](#) DOI: [10.1016/S1607-551X\(09\)70525-X](#)]
- 34 **Kountourakis P**, Arnogiannaki N, Stavrinides I, Apostolikas N, Rigatos G. Concomitant gastric adenocarcinoma and stromal tumor in a woman with polymyalgia rheumatica. *World J Gastroenterol* 2008; **14**: 6750-6752 [PMID: [19034984](#) DOI: [10.3748/wjg.14.6750](#)]
- 35 **Lee FY**, Jan YJ, Wang J, Yu CC, Wu CC. Synchronous gastric gastrointestinal stromal tumor and signet-ring cell adenocarcinoma: a case report. *Int J Surg Pathol* 2007; **15**: 397-400 [PMID: [17913950](#) DOI: [10.1177/1066896907302369](#)]
- 36 **Chen JH**, Chen CC, Tzeng LM, Tsay SH, Chiang JH, Lu CC, Chang FY, Lee SD. Resection of triple synchronous tumors--gastric adenocarcinoma, gallbladder adenocarcinoma and stromal tumor of the stomach. *Zhonghua Yi Xue Za Zhi (Taipei)* 2001; **64**: 655-660 [PMID: [11853221](#)]
- 37 **Katsoulis IE**, Bossi M, Richman PI, Livingstone JI. Collision of adenocarcinoma and gastrointestinal stromal tumour (GIST) in the stomach: report of a case. *Int Semin Surg Oncol* 2007; **4**: 2 [PMID: [17222335](#) DOI: [10.1186/1477-7800-4-2](#)]
- 38 **Liu SW**, Chen GH, Hsieh PP. Collision tumor of the stomach: a case report of mixed gastrointestinal stromal tumor and adenocarcinoma. *J Clin Gastroenterol* 2002; **35**: 332-334 [PMID: [12352297](#) DOI: [10.1097/00004836-200210000-00010](#)]
- 39 **Toyoda A**, Komaba A, Yoshizumi H, Hanaoka R, Sakuma S, Ichinohe A, Kawana H, Harigaya K. Collision of advanced gastric adenocarcinoma and gastrointestinal stromal tumour: a case report. *BMJ Case Rep* 2009; **2009** [PMID: [22110555](#) DOI: [10.1136/bcr.07.2009.2075](#)]
- 40 **Matsumoto K**, Kanazawa Y, Kakinuma D, Hagiwara N, Ando F, Masuda Y, Fujita I, Arai H, Nomura T, Kato S, Yoshiyuki T, Peng WX, Yoshida H. Preoperatively diagnosed gastric collision tumor with mixed adenocarcinoma and gastrointestinal stromal tumor: a case report and literature review. *Clin J Gastroenterol* 2021; **14**: 494-499 [PMID: [33512639](#) DOI: [10.1007/s12328-021-01343-4](#)]
- 41 **Kleist B**, Lasota J, Miettinen M. Gastrointestinal stromal tumor and gastric adenocarcinoma collision tumors. *Hum Pathol* 2010; **41**: 1034-1039 [PMID: [20381123](#) DOI: [10.1016/j.humpath.2009.11.017](#)]
- 42 **Trabelsi A**, Stita W, Mokni M, Yacoubi T, Mestiri S, Korbi SY. Collision epithelial and stromal tumours of the stomach: a case report. *Pathologica* 2008; **100**: 18-20 [PMID: [18686521](#)]
- 43 **Idema DL**, Daryanani D, Sterk LM, Klaase JM. Collision tumor of the stomach: a case of an adenocarcinoma and a gastrointestinal stromal tumor. *Case Rep Gastroenterol* 2008; **2**: 456-460 [PMID: [21897799](#) DOI: [10.1159/000129707](#)]
- 44 **Firat Ö**, Çalişkan C, Karaca C, Sezak M, Özütemiz Ö, Erşin S, Güler A. Coexistence of gastric cancer and gastrointestinal stromal tumor: report of two cases. *Turk J Gastroenterol* 2010; **21**: 302-304 [PMID: [20931437](#) DOI: [10.4318/tjg.2010.0105](#)]
- 45 **Lin M**, Lin JX, Huang CM, Zheng CH, Li P, Xie JW, Wang JB, Lu J. Prognostic analysis of gastric gastrointestinal stromal tumor with synchronous gastric cancer. *World J Surg Oncol* 2014; **12**: 25 [PMID: [24479763](#) DOI: [10.1186/1477-7819-12-25](#)]
- 46 **Rauf F**, Ahmad Z, Muzzafar S, Hussaini AS. Synchronous occurrence of gastrointestinal stromal tumor and gastric adenocarcinoma: a case report. *J Pak Med Assoc* 2006; **56**: 184-186 [PMID: [16711342](#)]
- 47 **Sugimura T**, Fujimura S, Baba T. Tumor production in the glandular stomach and alimentary tract of the rat by N-methyl-N'-nitro-N-nitrosoguanidine. *Cancer Res* 1970; **30**: 455-465 [PMID: [5458974](#)]
- 48 **Cohen A**, Geller SA, Horowitz I, Toth LS, Werther JL. Experimental models for gastric leiomyosarcoma. The effects of N-methyl-N'-nitro-N-nitrosoguanidine in combination with stress, aspirin, or sodium taurocholate. *Cancer* 1984; **53**: 1088-1092 [PMID: [6692300](#) DOI: [10.1002/1097-0142\(19840301\)53:5<1088::AID-CNCR2820530512>3.0.CO;2-Y](#)]
- 49 **Andea AA**, Lucas C, Cheng JD, Adsay NV. Synchronous occurrence of epithelial and stromal tumors in the stomach. *Arch Pathol Lab Med* 2001; **125**: 318-319 [PMID: [11231473](#) DOI: [10.5858/2001-125-0318-SOOEAS](#)]
- 50 **Amin MB**, Edge SB, Greene FL, Brierley JD. AJCC cancer staging manual. 8th ed. New York: Springer, 2017 [DOI: [10.1007/978-3-319-40618-3](#)]
- 51 **Fletcher CD**, Berman JJ, Corless C, Gorstein F, Lasota J, Longley BJ, Miettinen M, O'Leary TJ, Remotti H, Rubin BP, Shmookler B, Sobin LH, Weiss SW. Diagnosis of gastrointestinal stromal tumors: A consensus approach. *Hum Pathol* 2002; **33**: 459-465 [PMID: [12094370](#) DOI: [10.1053/hupa.2002.123545](#)]
- 52 **Liu YJ**, Yang Z, Hao LS, Xia L, Jia QB, Wu XT. Synchronous incidental gastrointestinal stromal and epithelial malignant tumors. *World J Gastroenterol* 2009; **15**: 2027-2031 [PMID: [19399938](#) DOI: [10.3748/wjg.15.2027](#)]
- 53 **Perez EA**, Livingstone AS, Franceschi D, Rocha-Lima C, Lee DJ, Hodgson N, Jorda M, Koniaris LG. Current incidence and outcomes of gastrointestinal mesenchymal tumors including gastrointestinal stromal tumors. *J Am Coll Surg* 2006; **202**: 623-629 [PMID: [16571433](#) DOI: [10.1016/j.jamcollsurg.2006.01.002](#)]
- 54 **Kawanowa K**, Sakuma Y, Sakurai S, Hishima T, Iwasaki Y, Saito K, Hosoya Y, Nakajima T, Funata N. High incidence of microscopic gastrointestinal stromal tumors in the stomach. *Hum Pathol* 2006; **37**: 1527-1535 [PMID: [16996566](#) DOI: [10.1016/j.humpath.2006.07.002](#)]
- 55 **Joensuu H**. Gastrointestinal stromal tumor (GIST). *Ann Oncol* 2006; **17** Suppl 10: x280-x286 [PMID: [17018739](#) DOI: [10.1093/annonc/mdh381](#)]

- 10.1093/annonc/mdl274]
- 56 **Sung H**, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA Cancer J Clin* 2021; **71**: 209-249 [PMID: 33538338 DOI: 10.3322/caac.21660]
- 57 **Agaimy A**, Wünsch PH, Sobin LH, Lasota J, Miettinen M. Occurrence of other malignancies in patients with gastrointestinal stromal tumors. *Semin Diagn Pathol* 2006; **23**: 120-129 [PMID: 17193825 DOI: 10.1053/j.semdp.2006.09.004]
- 58 **Liu Z**, Liu S, Zheng G, Yang J, Hong L, Sun L, Fan D, Zhang H, Feng F. Clinicopathological features and prognosis of coexistence of gastric gastrointestinal stromal tumor and gastric cancer. *Medicine (Baltimore)* 2016; **95**: e5373 [PMID: 27828865 DOI: 10.1097/MD.0000000000005373]
- 59 **Liu XL**, Wang JB, Huang CM, Zheng CH, Li P, Xie JW, Lin JX. [Clinicopathologic features and prognostic factors of gastric gastrointestinal stromal tumor with synchronous gastric cancer]. *Zhonghua Wei Chang Wai Ke Za Zhi* 2012; **15**: 247-250 [PMID: 22454170]
- 60 **Almaça J**, Tian Y, Aldehni F, Ousingsawat J, Kongsuphol P, Rock JR, Harfe BD, Schreiber R, Kunzelmann K. TMEM16 proteins produce volume-regulated chloride currents that are reduced in mice lacking TMEM16A. *J Biol Chem* 2009; **284**: 28571-28578 [PMID: 19654323 DOI: 10.1074/jbc.M109.010074]
- 61 **Xu H**, Zhou S, Hu Q, Cao D. Apatinib treatment for unresectable gastrointestinal stromal tumor with synchronous gastric cancer. *Precis Clin Med* 2020; **3**: 67-70 [PMID: 35693429 DOI: 10.1093/pcmedi/pbaa005]
- 62 **Thrumurthy SG**, Chaudry MA, Chau I, Allum W. Does surgery have a role in managing incurable gastric cancer? *Nat Rev Clin Oncol* 2015; **12**: 676-682 [PMID: 26260039 DOI: 10.1038/nrclinonc.2015.132]
- 63 **Theodosopoulos T**, Dellaportas D, Psychogiou V, Gennatas K, Kondi-Pafiti A, Gkiokas G, Papaconstantinou I, Polymeneas G. Synchronous gastric adenocarcinoma and gastrointestinal stromal tumor (GIST) of the stomach: a case report. *World J Surg Oncol* 2011; **9**: 60 [PMID: 21615935 DOI: 10.1186/1477-7819-9-60]
- 64 **Zámecník M**, Sosna B, Chlumská A. Gastrointestinal stromal tumor (GIST) with glandular component. A report of an unusual tumor resembling adenocarcinoma. *Cesk Patol* 2005; **41**: 150-156 [PMID: 16382991]
- 65 **Alkaaki A**, Abdulhadi B, Aljiffry M, Nassif M, Al-Maghrabi H, Maghrabi AA. Coexistence of Primary GEJ Adenocarcinoma and Pedunculated Gastric Gastrointestinal Stromal Tumor. *Case Rep Surg* 2018; **2018**: 4378368 [PMID: 29992077 DOI: 10.1155/2018/4378368]
- 66 **Bi R**, Sheng W, Wang J. Collision tumor of the stomach: gastric adenocarcinoma intermixed with gastrointestinal stromal tumor. *Pathol Int* 2009; **59**: 880-883 [PMID: 20021614 DOI: 10.1111/j.1440-1827.2009.02460.x]
- 67 **Telugu RB**, Pushparaj M, Masih D, Pulimood A. Synchronous Appearance of Adenocarcinoma and Gastrointestinal Stromal Tumour (GIST) of the Stomach: A Case Report. *J Clin Diagn Res* 2016; **10**: ED16-ED18 [PMID: 27042477 DOI: 10.7860/JCDR/2016/17636.7289]



Published by **Baishideng Publishing Group Inc**
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA

Telephone: +1-925-3991568

E-mail: bpgoffice@wjgnet.com

Help Desk: <https://www.f6publishing.com/helpdesk>

<https://www.wjgnet.com>

