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ORIGINAL ARTICLE

Clinical and Therapeutic Effects of Adjacent Organ Invasion in Gastrointestinal Stromal Tumor (GIST) Cases

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Abstract

Background: This retrospective study aimed to investigate the clinical and therapeutic effects of adjacent organ invasion in gastrointestinal stromal tumor (GIST) cases.

Methods: The files of 114 GIST patients from various centers who underwent surgery by the principal investigator between January 2007 and December 2020 were retrospectively included. Patients were divided into two groups: those with adjacent organ invasion (n=29) and those without (n=85).

Results: Invasion was significantly correlated with symptoms (r=0.271; p<0.01), location (r=0.274; p<0.01), focus (r=0.277; p<0.01), metastasis history (r=0.277; p<0.01), post operation metastasis (r=0.352; p<0.01), maximum diameter (r=0.311; p<0.01), surgical margin (r=0.311; p<0.01), recurrence (r=0.287; p<0.01), post operation blood transfusion (r=0.263; p<0.01) and NIH (National Institutes of Health) risk class (r=0.460; p<0.01). Effect of invasion (OR=1.863; p<0.01), location (OR=0.463; p<0.05), focus (OR=3.037; p<0.01), maximum diameter (OR=0.012; p<0.05), surgical margin (OR=1.587; p<0.05), preoperative blood transfusion (OR=2.426; p<0.01), post operation blood transfusion (OR=1.710; p<0.05) and NIH risk class (OR=1.568; p<0.05) were significant at univariate level. However, their effects on complication at multivariate level was insignificant (p>0.05). Additionally, exploratory multivariate analysis identified abdominal pain, multiple tumor foci, and high NIH risk class as clinical predictors of adjacent organ invasion itself (p<0.05).

Conclusion: Adjacent organ invasion does not appear to be an independent predictor of postoperative complications in GIST patients. However, its association with specific clinical markers warrants consideration for preoperative risk assessment and surgical planning. Therefore, more prospective studies with more variables are needed to better understand the impact of invasion on postoperative complications in GIST cases.

Keywords: Gastrointestinal stromal tumor (GIST), invasion, tumor, complication.

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INTRODUCTION

Gastrointestinal stromal tumors (GISTs) are the most common tumor type, accounting for up to 80% of mesenchymal tumors in the digestive tract (1). Morphologically, GISTs can be pleomorphic, epithelioid, or spindle cell, and harbor mutations in the gene encoding type III receptor tyrosine kinase (2). Although they exhibit varying clinical presentations, bleeding and masses are the most common symptoms in GISTs (3). Kinase-targeted therapies are gaining prominence in the treatment process, alongside surgical methods (4). According to the current National Comprehensive Cancer Network (NCCN) and European Society for Medical Oncology (ESMO) guidelines, targeted therapies have become a cornerstone in the comprehensive management of GISTs. Specifically, tyrosine kinase inhibitors (TKIs) such as imatinib are established as the standard first-line treatment for locally advanced, inoperable, and metastatic cases, as well as in adjuvant and neoadjuvant settings for high-risk patients. (5, 6) Because conventional endoscopic biopsy is difficult for non-ulcer GISTs, the histological diagnosis rate is low (7). The fact that the KIT or homologous receptor tyrosine kinase gene is active in approximately 85% of GISTs has led to the use of other diagnostic methods, such as immunohistochemical markers, molecular analyses, and risk assessment (8).

Clinically, GISTs can involve the entire gastrointestinal tract, from the distal esophagus to the anus, but they most frequently involve the stomach and intestines (9,10). Adjacent organ invasion generally refers to the spread of malignant tumors to organs adjacent to the primary cancer (11,12). For GISTs, adjacent organ invasion has been investigated for its potential as an indicator of malignancy and metastasis (13). Although the precise boundaries of adjacent organ invasion have not been established, adjacent organ invasion has been reported in the literature for tumors measuring 5–10 cm (14). Furthermore, adjacent organ invasion has also been reported in GIST tumors larger than 11.1 cm (15). Magnetic resonance imaging (MRI) and computed tomography (CT) are important for imaging adjacent organ invasion of GISTs (16). GIST invasion of adjacent organs can also lead to gastric transformation (17,18). Therefore, examining the differences between GISTs with and without adjacent organ invasion is important in managing their effects on the treatment process.

MATERIALS AND METHODS

Research Model

The study was retrospective, multicenter, and chart-based, using a mixed model design. The mixed model included descriptive and correlational screening models. According to this model, the baseline characteristics of GIST cases with and without adjacent organ invasion were first defined, and then the relationship between invasion and clinical presentation and treatment outcomes was analyzed.

Definition of Adjacent Organ Invasion

In this study, adjacent organ invasion was defined primarily from a surgical perspective based on intraoperative findings, in accordance with established surgical oncology principles for GISTs. It was characterized by dense macroscopic adherence of the tumor to adjacent structures that necessitated an *en bloc* multivisceral resection to prevent tumor rupture and achieve negative (R0) margins, regardless of whether the final histopathological examination revealed true microscopic infiltration or inflammatory adhesion. (5,19).

Patients

The files of 114 GIST patients from various centers who underwent surgery by the principal investigator between January 2007 and December 2020 were retrospectively included. Patients were divided into two groups: those with adjacent organ invasion (n=29) and those without (n=85). According to the power analysis conducted in this context, the aim was to obtain a total of 64 patient files with an effect size of 0.30, an 80% confidence interval, and a significance level of 0.05. Patient inclusion criteria were as follows:

- Patients who have undergone surgery by the researchers,
- Age 18 and over,
- Have undergone GIST surgery,
- Have complete patient data in their files,

- Have no adverse health conditions that could affect the research results

The study's exclusion criteria were:

- Those under 18 years of age,
- Those with comorbid conditions that could affect the study results,
- Patients with incomplete or missing data in their medical records.

Ethical Approval and Informed Consent

The research was conducted in accordance with the principles of the Declaration of Helsinki and Good Clinical Practice guidelines. Ethical approval was obtained from the Üsküdar University Non-Interventional Research Ethics Committee (Date: 31/07/2025, Decision No: 61351342/020-61). The requirement for informed consent was waived by the Üsküdar University Non-Interventional Research Ethics Committee because the study was retrospective in nature and based on the screening of patient files. All procedures were carried out in compliance with the applicable rules and regulations.

Statistical Methods

Frequency analysis was used to describe nominal and ordinal data, and mean, standard deviation, median, and variation ranges were used to describe measurement data. The Kolmogorov-Smirnov test was used to determine the normality of distribution of measurement data. The independent samples t-test was used for the differences of parameters conforming to a normal distribution, and the Mann-Whitney U test was used for the differences of parameters not conforming to a normal distribution. Fisher's Exact test and Chi-Square tests were used for the differences of nominal and ordinal parameters. Spearman's rho correlation analysis was performed in relational screening analysis. Binary Logistic Regression analysis was used to minimize linearization deviations in regression in univariate and multivariate analyses (20,21). Furthermore, post-hoc analysis for the categorical variables was performed using adjusted standardized residuals, with the Bonferroni correction applied to account for multiple comparisons and ensure the robustness of the statistical findings. All analyses were performed using SPSS 25.0 for Windows with a 95% confidence interval and a significance level of 0.05.

RESULTS

Age mean of the non-invasion group was 59.40±14.23 and age mean of the invasion group was 56.93±13.05 with statistically insignificant difference ($p>0.05$). Abdominal pain, metastasis history, metastasis after operation, recurrence, postoperative blood transfusion, high NIH (National Institutes of Health) risk classification rates and maximum diameter were significantly higher in the invasion group ($p<0.05$). Stomach location, single focus, and negative surgical margin were significantly more common in the non-invasion group ($p<0.05$). Age, gender, comorbidities, complication, preoperative blood transfusion, mortality and postoperative hospitalization duration differences were statistically insignificant ($p>0.05$) (Table 1).

Post-hoc analysis using adjusted standardized residuals with Bonferroni correction confirmed that the significant differences between the groups were driven by the high prevalence of abdominal pain in the invasion group (adjusted residual = 3.86, $p<0.05$) and the high prevalence of stomach location in the non-invasion group (adjusted residual = 2.90, $p<0.05$).

Spearman's rho correlation analysis results between invasion and patient characteristics showed that invasion was significantly correlated with symptoms ($r=0.271$; $p<0.01$), location ($r=0.274$; $p<0.01$), focus ($r=0.277$; $p<0.01$), metastasis history ($r=0.277$; $p<0.01$), postoperative metastasis ($r=0.352$; $p<0.01$), maximum diameter ($r=0.311$; $p<0.01$), surgical margin ($r=0.311$; $p<0.01$), recurrence ($r=0.287$; $p<0.01$), postoperative blood transfusion ($r=0.263$; $p<0.01$) and NIH risk class ($r=0.460$; $p<0.01$) (Table 2).

In all GIST patients, recurrence was significantly correlated with invasion ($r=0.287$; $p<0.01$), location ($r=0.288$; $p<0.01$), focus ($r=0.456$; $p<0.01$), postoperative metastasis ($r=0.346$; $p<0.01$), maximum diameter ($r=0.281$; $p<0.01$), surgical margin ($r=0.240$; $p<0.05$), preoperative blood transfusion ($r=0.346$; $p<0.01$), postoperative blood transfusion ($r=0.260$; $p<0.01$), mortality ($r=0.190$; $p<0.05$), and NIH risk class ($r=0.358$; $p<0.01$) (Table 3).

Effect of invasion (odds ratio OR=1.863; $p<0.01$), location (OR=0.463; $p<0.05$), focus (OR=3.037; $p<0.01$),

Table 1. Baseline Characteristics and Difference Analysis Results for Patient Groups

	Invasion			*P* value
	No (n=85)	Yes (n=29)	Total (n=114)	
Age, years, mean ± SD Median (Min-Max)	59.40±14.23 61.00 (18.00-84.00)	56.93±13.05 60.00 (30.00-79.00)	58.77±13.92 60.00 (18.00-84.00)	0.412[a]
Gender, n (%)				
Female	46 (54.1)	16 (55.2)	62 (54.4)	0.548[b]
Male	39 (45.9)	13 (44.8)	52 (45.6)	
Symptoms, n (%)				
None	3 (4.5)	-	3 (2.6)	
Incidental	5 (5.9)	-	5 (4.4)	
Bleeding	22 (25.9)	1 (3.4)	23 (20.2)	0.010[c]
Abdominal pain	46 (54.1)	**24 (82.8)**	70 (61.4)	
Obstruction	3 (3.5)	-	3 (2.6)	
Others	6 (7.1)	4 (13.8)	10 (8.8)	
Location, n (%)				
Stomach	**47 (55.3)**	7 (24.1)	54 (47.4)	
Small intestine	28 (32.9)	15 (51.7)	43 (37.7)	
Pancreas	2 (2.4)	-	2 (1.8)	0.012[c]
Colon	1 (1.2)	2 (6.9)	3 (2.6)	
Multiple	7 (8.2)	5 (17.2)	12 (10.5)	
Focus, n (%)				
Single	**82 (96.5)**	23 (79.3)	105 (92.1)	0.008[b]
Multiple	3 (3.5)	6 (20.7)	9 (7.9)	
Hypertension, n (%)	28 (32.9)	8 (27.6)	36 (31.6)	0.386[b]
Diabetes Mellitus, n (%)	12 (14.1)	1 (2.4)	13 (11.4)	0.105[b]
Cardiovascular disease, n (%)	8 (9.4)	2 (6.9)	10 (8.8)	0.509[b]
Malignancy, n (%)	6 (7.1)	2 (6.9)	8 (7.0)	0.670[b]
Metastasis history, n (%)	3 (3.5)	**6 (20.7)**	9 (7.9)	0.008[b]

Table 1. Baseline Characteristics and Difference Analysis Results for Patient Groups

	Invasion			*P* value
	No (n=85)	Yes (n=29)	Total (n=114)	
Operation, n (%)				0.000[c]
Wedge resection	21 (25.0)	2 (6.9)	23 (20.4)	
Whipple	4 (4.8)	-	4 (3.5)	
Subtotal gastrectomy	18 (21.4)	1 (3.4)	19 (16.8)	
Small bowel resection	27 (32.1)	13 (44.8)	40 (35.4)	
Other	14 (16.7)	13 (44.8)	27 (23.9)	
Complication, n (%)	6 (7.1)	3 (10.3)	9 (7.9)	0.412[b]
Metastasis after operation, n (%)	2 (2.4)	**7 (24.1)**	9 (7.9)	0.001[b]
Surgical margin, n (%)				0.002[b]
Negative	**75 (89.3)**	18 (62.1)	93 (82.3)	
Positive	9 (10.7)	11 (37.9)	20 (17.7)	
Recurrence, n (%)	4 (4.7)	**7 (24.1)**	11 (9.6)	0.006[b]
Preop blood, n (%)	5 (5.9)	4 (13.8)	9 (7.9)	0.165[b]
Postop blood, n (%)	18 (21.2)	**14 (48.3)**	32 (28.1)	0.006[b]
Mortality, n (%)	3 (3.5)	3 (10.3)	6 (5.3)	0.171[b]
NIH Risk, n (%)				0.000[c]
Very low	11 (18.0)	-	11 (12.8)	
Low	32 (52.5)	6 (24.0)	38 (44.2)	
Moderate	6 (9.8)	3 (12.0)	9 (10.5)	
High	12 (19.7)	**16 (64.0)**	28 (32.6)	
Postop duration, days, mean ± SD Median (Min-Max)	3.20±2.09 3.00 (0.00-7.00)	3.83±1.95 4.00 (0.00-7.00)	3.36±2.07 3.00 (0.00-7.00)	0.094[d]
Max diameter, mm, mean ± SD Median (Min-Max)	55.97±47.75 47.00 (7.00-330.00)	**85.40±47.34** **80.00 (8.00-190.00)**	63.56±49.13 50.00 (7.00-330.00)	0.002[d]

a. Independent Samples t-test, b. Fisher's Exact Test, c. Chi-Square Test, d. Mann Whitney U Test, SD: Standard Deviation. Min: Minimum, Max: Maximum, Preop: Preoperative, Postop: Postoperative, NIH: National Institutes of Health.

Table 2. Spearman's Rho Correlation Analysis Results Between Invasion and Patient Characteristics

Invasion	r	p
Age	-0.094	0.320
Gender	-0.009	0.922
Symptoms	**0.271****	**0.003**
Location	**0.274****	**0.003**
Focus	**0.277****	**0.003**
HT	-0.050	0.596
DM	-0.146	0.121
CVD	-0.039	0.683
Malignancy	-0.003	0.977
Metastasis history	**0.277****	**0.003**
Complication	0.053	0.575
Metastasis postop	**0.352****	**0.000**
Postop duration	0.158	0.094
Max diameter	**0.311****	**0.002**
Surgical margin	**0.311****	**0.001**
Recurrence	**0.287****	**0.002**
Preop blood transfusion	0.128	0.176
Postop blood transfusion	**0.263****	**0.005**
Mortality	0.133	0.159
NIH risk	**0.460****	**0.000**

**p<0.01. r: Spearman's rho correlation coefficient. HT: Hypertension, DM: Diabetes Mellitus, CVD: Cardiovascular Disease, Preop: Preoperative, Postop: Postoperative, Max: Maximum, NIH: National Institutes of Health.

Table 3. Spearman's Rho Correlation Between Recurrence and Baseline Characteristics

Recurrence	r	p
Invasion	**0.287****	**0.002**
Age	-0.170	0.069
Gender	0.061	0.518
Symptoms	0.142	0.129
Location	**0.288****	**0.002**
Focus	**0.456****	**0.000**
HT	0.035	0.707
DM	-0.116	0.217
CVD	-0.100	0.286
Malignancy	0.027	0.772
Metastasis	0.125	0.182
Complication	0.125	0.182
Metastasis postop	**0.346****	**0.000**
Postop duration	0.067	0.475
Max diameter	**0.281****	**0.005**
Surgical margin	**0.240***	**0.010**
Preop blood	**0.346****	**0.000**
Postop blood	**0.260****	**0.005**
Mortality	**0.190***	**0.042**
NIH risk	**0.358****	**0.001**

*p < 0.05, **p < 0.01. r: Spearman's rho correlation coefficient. HT: Hypertension, DM: Diabetes Mellitus, CVD: Cardiovascular Disease, Preop: Preoperative, Postop: Postoperative, Max: Maximum, NIH: National Institutes of Health.

maximum diameter (OR=0.012; p<0.05), surgical margin (OR=1.587; p<0.05), preoperative blood transfusion (OR=2.426; p<0.01), postoperative blood transfusion (OR=1.710; p<0.05) and NIH risk class (OR=1.568; p<0.05) were significant at univariate level. However, their effects on complication at multivariate level was insignificant (p>0.05) (Table 4).

Furthermore, a multivariate logistic regression analysis was performed to determine the independent predictors of adjacent organ invasion. This analysis revealed that abdominal pain (OR=13.263, p=0.017), multiple foci (OR=9.982, p=0.022), and high NIH risk class (OR=2.743, p=0.002) were significant independent predictors of adjacent organ invasion (Table 5).

Table 4. Binary Regression Analysis for Effects of Significantly Correlated Factors on Complication at Univariate and Multivariate Level

	Univariate				Multivariate			
	OR	S.E.	95% CI	p	OR	S.E.	95% CI	p
Invasion	1.863	0.671	1.195 – 2.904	0.006*	0.363	1.269	0.001 – 378.103	0.775
Location	0.463	0.203	0.238 – 0.899	0.023*	0.737	0.656	0.204 – 2.668	0.642
Focus	3.037	0.792	1.567 – 5.886	0.000*	35.012	6053.206	0.001 – >999	0.995
Max diameter	0.012	0.006	0.001 – 0.766	0.037*	0.988	0.018	0.954 – 1.023	0.500
Surgical margin	1.587	0.667	1.086 – 2.319	0.017*	1.730	1.267	0.788 – 3.799	0.172
Preop blood	2.426	0.777	1.383 – 4.256	0.002*	1.288	1.938	0.611 – 2.715	0.506
Postop blood	1.710	0.667	1.137 – 2.572	0.010*	0.596	1.626	0.024 – 14.571	0.751
NIH risk	1.568	0.596	1.125 – 2.186	0.008*	16.986	3026.603	0.001 – >999	0.996

OR: Odds Ratio, S.E.: Standard Error, Preop: Preoperative, Postop: Postoperative, Max: Maximum, NIH: National Institutes of Health. CI: Confidence Interval, p: p-value.
*p < 0.05 indicates statistical significance.
Note: The 95% Confidence Intervals that do not include the value of 1.00 signify a statistically significant association at the univariate level. For multivariate analysis, wide confidence intervals (e.g., for tumor focus and NIH risk) reflect the separation or sparse data distribution common in models with high categorical probability parameters.

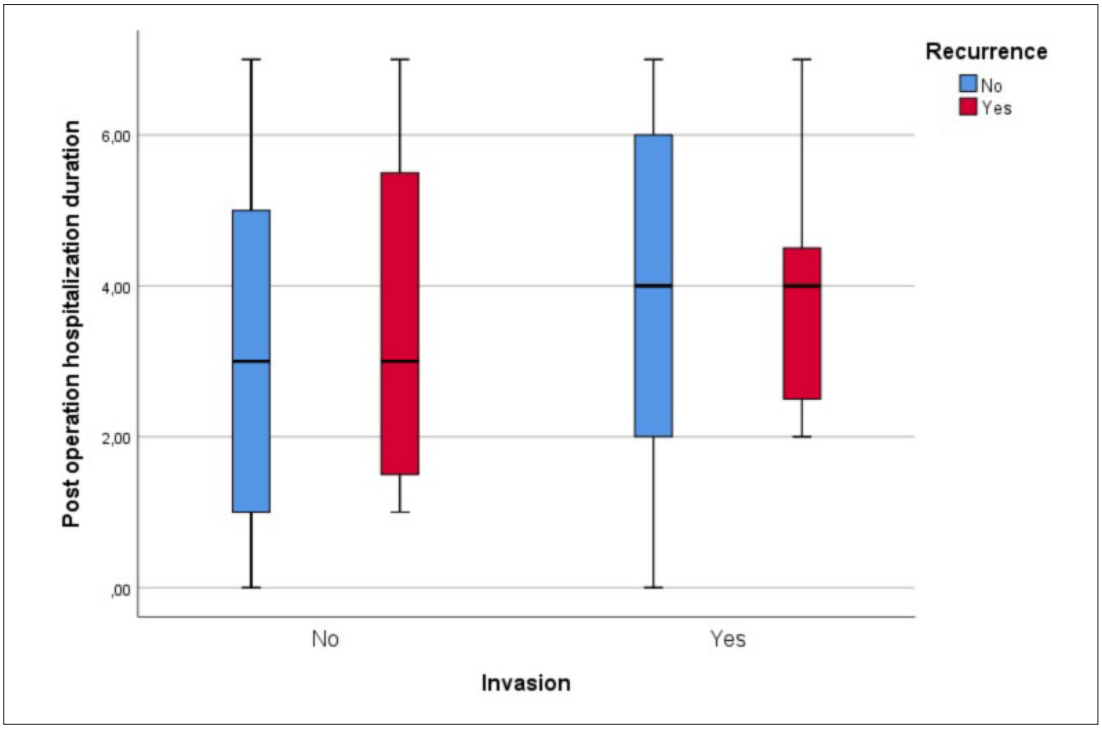


Figure 1: Postoperative Hospitalization Duration According to Invasion and Recurrence.

Table 5. Multivariate Logistic Regression Analysis for Predictors of Adjacent Organ Invasion

	OR	95% CI	p
Symptoms (Abdominal Pain)	13.263	1.587 – 110.808	0.017*
Focus (Multiple)	9.982	1.394 – 71.500	0.022*
NIH Risk (High)	2.743	1.446 – 5.202	0.002*
Location (Stomach)	0.402	0.131 – 1.233	0.111
Max Diameter	0.996	0.985 – 1.007	0.468

OR: Odds Ratio, NIH: National Institutes of Health, Max: Maximum CI: Confidence Interval, p: p-value. *p < 0.05 indicates statistical significance. Note: All reported independent predictors (abdominal pain, multiple foci, and high NIH risk) demonstrated a 95% Confidence Interval entirely above 1.00, confirming their robust predictive value for adjacent organ invasion.

Postoperative hospitalization durations were higher in invasion groups for both recurrence and non-recurrence patients. In both invasion and non-invasion groups, recurrence patients had higher hospitalization stay after operation (Figure 1).

DISCUSSION

This retrospective study aimed to investigate the clinical and therapeutic effects of adjacent organ invasion in gastrointestinal stromal tumor (GIST) cases. The investigator retrospectively analyzed the files of 114 GIST patients from various centers where the surgery was performed. The study concluded that adjacent organ invasion can be associated with complications during the surgical process of GIST cases.

GIST cases, which commonly present with bleeding and masses and are widespread in the gastrointestinal tract (1,3), frequently involve the stomach and intestines (9,10). While invasion of adjacent organs is often mentioned in metastasis from primary cancer (11,12), invasion of adjacent organs, albeit limited, has also been reported in cases without primary cancer (14). Invasion of adjacent organs is important for both surgical procedures and treatment. Atay et al (22) reported that constant interplay occurs in adjacent stromal cells as GIT tumors develop. Pidhorecky et al (23) reported that invasion is generally seen in large and multiple lesions. Yan et al (18) reported that prognostic criteria differed statistically significantly in the group with invasion. Sanchez-Hidalgo et al (24) reported that invasion of adjacent organs was the cause of conversion in 19% of GIST cases. Tazawa et al (25) reported that aggressive groups in GIST cases tended to directly invade adjacent organs, and this could be associated with prognostic factors. Therefore, adjacent organ invasion also indicates aggressive tumors. Tabrizian et al (26) reported that conversions occurred in 14% of GIST cases due to adjacent organ invasion during surgery. Zhou et al (27) indicated that adjacent organ invasion may also be important in imaging and risk stratification in GIST cases. Similarly, Chamadol et al (28) indicated that organ invasion may be a risk factor on CT scans of GIST cases. However, these findings were generally either suggestive or lacked sufficient quantitative data. Furthermore, more detailed diagnostic criteria and baseline characteristics are needed for adjacent organ invasion observed on CT findings.

In our study; abdominal pain, metastasis history, metastasis after operation, recurrence, postoperative blood transfusion, high NIH risk classification rates and maximum diameter were significantly higher in the invasion group. Stomach location, single focus, and negative surgical margin were significantly more common in the non-invasion group. Age, gender, comorbidities, complication, preoperative blood transfusion, mortality and postoperative hospitalization duration differences were statistically insignificant. Invasion was significantly correlated with symptoms, location, focus, metastasis

history, postoperative metastasis, maximum diameter, surgical margin, recurrence, postoperative blood transfusion and NIH risk class. Effect of invasion, location, focus, maximum diameter, surgical margin, preoperative blood transfusion, postoperative blood transfusion and NIH risk class were significant at univariate level. However, their effects on complication at multivariate level were insignificant.

In our study, post-hoc analysis revealed that the significant association between clinical presentation and adjacent organ invasion was specifically driven by abdominal pain. This is clinically plausible, as exophytic growth and direct infiltration into adjacent structures are more likely to cause peritoneal irritation or capsular stretching, in contrast to intraluminal tumors that typically present with gastrointestinal bleeding due to mucosal ulceration (1,3). Furthermore, gastric location was significantly associated with the non-invasion group. This may be due to the larger anatomical space in the upper abdomen, which allows gastric tumors to expand substantially (7) before encountering adjacent organs compared to the anatomically restricted midgut or pelvis.

Multivariate analysis identified abdominal pain, multiple foci, and high NIH risk classification as independent predictors of adjacent organ invasion. These findings suggest that patients presenting with these features warrant intensified preoperative imaging to anticipate potential multivisceral resection. Integrating these clinical markers into preoperative counseling can significantly improve surgical planning and patient management strategies.

Limitations of the Study

The most significant limitation of this study is that adjacent organ invasion in GIST cases is more commonly associated with metastasis, and there are no studies adequately examining other invasions. However, adjacent organ invasion can also be observed clinically and surgically in GIST cases without metastasis. The lack of sufficient studies in this area also limits the number of studies available to compare research results.

Another important limitation of the study is the limited number of patient files and the variety of GIST cases and the frequency of follow-up during diagnosis and treatment. Therefore, the study sample does not fully reflect the prevalence and incidence of GIST cases.

The Study's Contributions to the Literature and Surgical Practice

The study's most significant contribution to the literature is its pioneering work and its addressing of a gap in the literature. While adjacent organ invasion is important, research in this area is limited. In surgical practice, the distinction between a single lesion and invasion has a significant impact on the entire surgical and treatment process. Therefore, the study can serve as a resource for further research.

The study's contribution to surgical practice is that it highlights the significant clinical association between adjacent organ invasion and surgical complications; although this association does not persist as an independent predictor in multivariate modeling, invasion remains a critical marker that surgeons should prioritize during preoperative risk assessment. While this topic needs to be examined with quantitative studies, the study suggests that surgeons and clinicians should also prioritize this area. Moreover, our multivariate analysis indicates that clinical markers such as abdominal pain, multiple foci, and high NIH risk classification may serve as potential indicators for adjacent organ invasion. These clinical features could assist surgeons in identifying patients who might benefit from more detailed preoperative assessment and planning for potentially complex surgical cases.

According to the results of the study, adjacent organ invasion can be associated with complications during the surgical process of GIST cases. However, this effect can be masked when multiple variables are included. Therefore, more prospective studies with more variables are needed to better understand the impact of invasion on postoperative complications in GIST cases. This will allow us to understand both the clinical and surgical features of metastases and benign GIST cases with adjacent organ invasion and make a more positive contribution to the treatment process. Our findings suggest that the preoperative identification of high-risk features for adjacent organ invasion—such as abdominal pain and multiple tumor foci—may help optimize preoperative preparation, potentially facilitating the involvement of multidisciplinary teams to refine patient-specific surgical management.

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Abbreviations List

GIST : Gastrointestinal Stromal Tumor
NIH : National Institute of Health
OR : Odds Ratio.

Ethics Approval and Consent to Participate

The research permission was obtained from the Üsküdar University Non-Interventional Research Ethics Committee with 61351342/020-61 number and 31/07/2025 date. Informed consent to participate was not obtained from all of the participants in the study, because the study was based on mortality and screening from retrospective files. Every technique was carried out in compliance with the applicable rules and regulations. The Üsküdar University Non-Interventional Research Ethics Committee waived the requirement for informed consent to participate because the study was retrospective in nature. The research was conducted according to Helsinki Declaration and Good Clinics guidelines.

Consent for Publication

Not Applicable.

Availability of Data and Materials

The data that support the findings of this study are not openly available due to reasons of sensitivity and are available from the corresponding author upon reasonable request.

Competing Interests

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