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ORIGINAL RESEARCH

Retrospective Evaluation of Demographic and Clinical Features of Gastrointestinal Stromal Tumors

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ABSTRACT

This study aimed to retrospectively examine the demographic, clinical, and pathological characteristics; prognostic risk factors; treatments administered; clinical course; and survival times of patients diagnosed with gastrointestinal stromal tumors (GIST) and treated and followed up at Department of Medical Oncology at the Bursa Uludağ University Faculty of Medicine in Bursa. Medical records of 54 patients diagnosed with GIST between 2002 and 2017 were reviewed retrospectively through the hospital record system. The mean age was 56.15 ± 10.68 years, and the disease was more prevalent in men (n = 34, 63.0%). The most common primary tumor site was the small intestine (n=22, 40.7%), followed by the stomach (n=19, 35.2%). The most common symptom was abdominal pain (n=40, 74.1%). Liver metastasis was the most common (n=12, 54.5%). CD117 (C-KIT) was the most common immunohistochemical staining marker (n=51, 94.4%). Most patients had high-risk disease. Patients who underwent curative surgery had longer survival times. While a high mitotic index and lymph node metastasis were associated with progression, tumor size, location, and stage were not associated with progression. This study illuminates the demographic and clinical characteristics of patients diagnosed with GIST.

Keywords: Gastrointestinal stromal tumor. Imatinib. Sunitinib. Survival.

Gastrointestinal Stromal Tümörlerin Demografik ve Klinik Özelliklerinin Retrospektif Değerlendirilmesi

ÖZET

Bu çalışma, Bursa Uludağ Üniversitesi Tıp Fakültesi Tıbbi Onkoloji Bilim Dalı'nda gastrointestinal stromal tümör (GIST) tanısı konulan, tedavi edilen ve takip edilen hastaların demografik, klinik ve patolojik özelliklerini, prognostik risk faktörlerini, uygulanan tedavileri, klinik seyrini ve sağkalım sürelerini retrospektif olarak incelemek amacıyla yapılmıştır. 2002-2017 yılları arasında GIST tanısı konulan 54 hastanın tıbbi kayıtları, hastane kayıt sistemi aracılığıyla retrospektif olarak incelenmiştir. Ortalama yaş 56,15 ± 10,68 idi ve hastalık erkeklerde daha yaygındı (n=34, %63,0). En yaygın tümör yerleşim bölgesi ince bağırsak (n=22, %40,7) idi, bunu mide (n=19, %35,2) izliyordu. En sık görülen semptom karın ağrısıydı (n=40, %74,1). Karaciğer metastazı en sık görülen metastaz türüydü (n=12, %54,5). CD117 (C-KIT) en sık görülen immünohistokimyasal boyama markeriydi (n=51, %94,4). Çoğu hasta yüksek riskli hastalığa sahipti. Küratif cerrahi geçiren hastaların hayatta kalma süreleri daha uzundu. Yüksek mitotik indeks ve lenf nodu metastazı ilerleme ile ilişkiliyken, tümör boyutu, yeri ve evresi ilerleme ile ilişkili değildi. Bu çalışma, GIST tanısı konulan hastaların demografik ve klinik özelliklerini aydınlatmaktadır.

Anahtar Kelimeler: Gastrointestinal stromal tümör. İmatinib. Sunitinib. Sağkalım.

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Gastrointestinal stromal tumors (GIST) are the most common mesenchymal tumors of the gastrointestinal system, primarily located in the gastrointestinal tract and abdomen, with unique histological features[1,2]. GISTs are believed to originate from CD34+ interstitial Cajal cells, which are pacemaker cells of the gastrointestinal system[3]. GISTs arise from oncogenic mutations in the tyrosine kinase receptor C-KIT (CD117) and/or the platelet-derived growth factor receptor alpha (PDGFRα)[4,5]. The incidence rate is reported to be 10–20 per million people[6]. GISTs are most commonly seen between the ages of 55 and 65[7,8]. They occur equally in both sexes[2].

The main events involved in GIST pathogenesis are specific mutations in the CD117 and PDGFRα genes.

CD117 mutations lead to the uncontrolled activation of the tyrosine kinase domain, which results in increased cell proliferation[4,9].

GISTs can be found anywhere along the gastrointestinal tract. They are most commonly found in the stomach (60-70%), the small intestine (20-30%), the colon and rectum (5%), and the esophagus (<5%)[10]. GISTs most often present with gastrointestinal bleeding, which is accompanied by anemia, fatigue, weight loss, and abdominal pain and bloating due to the tumor's mass effect[2]. Patients may present with signs of an acute abdomen, such as intra-abdominal bleeding, massive gastrointestinal (GI) bleeding, perforation, or obstruction[11,12]. Sometimes, due to their small size, GISTs may be asymptomatic and detected incidentally by endoscopic or radiological imaging[13].

After taking a detailed medical history and performing a physical examination to diagnose GIST, the first test should be a computed tomography scan of the upper abdomen and pelvis[14]. Although advanced imaging methods, such as endoscopic ultrasonography and magnetic resonance imaging, are helpful, the definitive diagnosis is made through histopathological examination and evaluation of immunohistochemical markers[1,15].

GISTs are considered malignant tumors. Rather than distinguishing between benign and malignant, Miettinen et al.[16,17] developed a risk classification system that includes mitotic index, tumor size, and location. This system categorizes tumors as very low risk, low risk, intermediate risk, or high risk.

The curative treatment for GIST is surgery. Adjuvant imatinib therapy is recommended for high-risk patients and as the first-line treatment for advanced disease to achieve disease control[18,19]. If progression or intolerance occurs with imatinib therapy, the standard second-line treatment is sunitinib, which is another tyrosine kinase inhibitor[20]. Regorafenib is the standard third-line treatment for patients who do not respond to imatinib and sunitinib[21].

The study aimed to retrospectively examine the demographic, clinical, pathological, prognostic, and treatment-related characteristics of patients diagnosed with GIST who were treated and followed up in Department of Medical Oncology at the Bursa Uludağ University Faculty of Medicine in Bursa.

Materials and Methods

The study included 54 patients diagnosed with GIST based on histopathology. These patients underwent treatment and follow-up at Department of Medical Oncology at the Bursa Uludağ University Faculty of Medicine in Bursa between 2002 and 2017. Patients who were treated at another center or had a different malignancy diagnosis were excluded. The patients' data records were reviewed retrospectively through the hospital information system. The following information was recorded: basic demographic information (age and gender); presenting complaints; Eastern Cooperative Oncology Group (ECOG) performance status (PS) at the time of diagnosis; whether or not they underwent surgical intervention after diagnosis; whether they received medical treatment; presence of recurrence or progression; duration from initiation of treatment to progression, if progression occurred; pathological characteristics of tumors; presence of metastasis; location of metastasis, if present; patients' final status; and survival times[22].

The study was conducted in accordance with the principles of the Declaration of Helsinki. Approval for the study was obtained from the Uludağ University Faculty of Medicine Clinical Research Ethics Committee (Date and Number: 6 March 2018, 2018-5/14).

Statistical analysis

The normality of the variables was assessed using the Shapiro-Wilk test. Continuous variables are expressed as mean ± standard deviation and median (minimum – maximum). Categorical variables are expressed as n (%). To determine whether survival time differed according to variables, Kaplan-Meier analysis was performed to determine survival times in analyses including the relevant variables, and survival curves were compared using the log-rank test. Cox regression analysis was performed to identify risk factors affecting mortality, and the results were reported with the Wald statistic value and hazard ratios at a 95% confidence interval. The SPSS program (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.) was used for statistical analyses. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 54 patients were included in the study. The mean age of the patients was 56.15 ± 10.68 years, the median age was 59 years, and ages ranged from 34 to 74 years. Thirty-four patients (63.0%) were male, and 20 (37.0%) were female. According to the ECOG PS, 36 patients (66.7%) had ECOG PS 0, 17 patients (31.5%) had ECOG PS 1, and 1 patient (1.9%) had ECOG PS 2. The most common presenting symptoms, in order of frequency, were abdominal pain (n=40, 74.1%), GI bleeding (n=9, 16.7%), weight loss (n=8, 14.8%), fatigue and weakness (n=8, 14.8%), bloating (n=8, 14.8%), nausea and vomiting (n=3, 5.6%), abdominal mass (n=3, 5.6%), ileus (n=3, 5.6%), diarrhea (n=1, 1.9%), and perforation (n=1, 1.9%).

Four patients were asymptomatic and were incidentally diagnosed during a health screening. The primary tumors were: small intestine (40.7%), stomach (35.2%), retroperitoneum (13.0%), omentum (5.6%), colon (3.7%), and rectum (1.9%). At the time of diagnosis, metastasis was detected in 22 patients (40.7%), while 32 patients (59.3%) had no metastasis. The most common site of metastasis was the liver (n = 12, 54.5%). Four patients (7.4%) were low risk, 13 patients (24.1%) were intermediate risk, and 36 patients (66.7%) were high risk. Risk assessment could not be performed for one patient due to the unavailability of risk-scoring data. The mean tumor diameter was 111.9 mm (range, 22–350 mm). CD117 was positive in 51 patients (94.4%), CD34 in 34 patients (63.0%), and PDGFRα in 18 patients (33.3%) (Table I).

Table I. Demographic data of patients

	n = 54		n = 54
Age (years)	59 (34 – 74)	**Lymph node metastasis**	
	56.15 ± 10.68	*Present*	9 (16.7%)
		Absent	40 (74.1%)
		Unknown	5 (9.3%)
Gender		**Metastasis**	
Female	20 (37.0%)	*Present*	22 (40.7%)
Male	34 (63.0%)	*Absent*	32 (59.3%)
ECOG PS		**Metastasis site**	
0	36 (66.7%)	*Liver*	12 (54.5%)
1	17 (31.5%)	*Peritoneum*	3 (13.6%)
2	1 (1.9%)	*LN*	2 (9.1%)
		Liver&LN& Peritoneum	2 (9.1%)
		Liver&Peritoneum	2 (9.1%)
		Surrenal & LN	1 (4.5%)
Site		**Immunohistochemistry**	
Small intestine	22 (40.7%)	*CD117(C-KIT)*	51 (94.4%)
Stomach	19 (35.2%)	*CD34*	34 (63.0%)
Retroperitoneum	7 (13.0%)	*PDGFRα*	18 (33.3%)
Omentum	3 (5.6%)	*DOG1*	15 (27.8%)
Colon	2 (3.7%)		
Rectum	1 (1.9%)		
Tumor diameter (mm)	80 (22 – 350)	**Admission symptom**	
	111.90 ± 71.75	*Abdominal pain*	40 (74.1%)
		Bleeding	9 (16.7%)
20–≤50	*9 (16.7%)*	*Weight loss*	8 (14.8%)
50–≤100	*23 (42.6%)*	*Weakness & Fatigue*	8 (14.8%)
>100	*20 (37.0%)*	*Dyspepsia & Bloating*	8 (14.8%)
Unknown	*2 (3.7%)*	*Asymptomatic*	4 (7.4%)
		Nausea & Vomiting	3 (5.6%)
		Abdominal mass	3 (5.6%)
		Ileus	3 (5.6%)
		Diarrhea	1 (1.9%)
		Perforation	1 (1.9%)
Risk scoring			
Low	4 (7.4%)		
Medium	13 (24.1%)		
High	36 (66.7%)		
Unknown	1 (1.9%)		

ECOG: Eastern Cooperative Oncology Group; PS: Performance status; LN: Lymph node; PDGFRα: Platelet-derived growth factor receptor alpha

Data are presented as median (minimum – maximum), mean ± standard deviation, and n (%).

Curative surgery was performed on 34 patients (63.0%), while 20 patients (37.0%) had unresectable disease. Of the 20 patients with unresectable disease, 14 (25.9%) underwent palliative surgery. Of the patients who underwent curative surgery, 14 (25.9%) were followed up without medication, and 20 (37.0%) were started on adjuvant imatinib. Of the patients who received adjuvant imatinib, six (11.1%) developed recurrence and started sunitinib treatment. Imatinib was initiated in the 20 patients (37.0%) with unresectable disease. Ten patients (18.5%) progressed on imatinib and received second-line sunitinib therapy. Four patients (7.4%) progressed on sunitinib and received third-line regorafenib therapy. These patients were in the unresectable disease group.

The overall survival time in the resectable patient group was 146.40 ± 13.01 months. In the unresectable patient group, the overall survival time was 65.95 ± 11.27 months. A significant difference in overall survival time was observed between the resectable and unresectable disease groups, with the resectable group having a higher overall survival time ($p<0.001$) (Table II, Figure 1). Overall survival did not differ between patients with unresectable disease who underwent palliative surgery and those who did not.

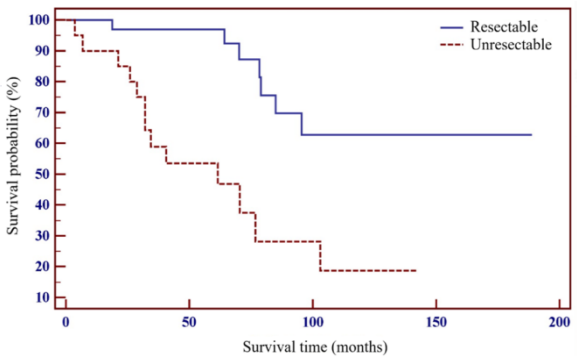

Figure 1:
Overall survival time in resectable and unresectable disease

The disease-free survival period for resectable disease was found to be 97.70 ± 12.75 months. For patients with resectable disease who received adjuvant imatinib, the disease-free survival period was 91.54 ± 13.08 months. For those who underwent curative surgery and were observed without medication, the disease-free survival period was 106.50 ± 0 months. For unresectable disease, the progression-free survival period was 58.79 ± 13.36 months. Progression-free survival was 16.10 ± 3.78 months in the unresectable disease group for patients who progressed and switched to sunitinib treatment. Progression-free survival was 94.86 ± 20.17 months in the unresectable disease group for patients who continued imatinib treatment (Table II). Sixteen patients switched to

sunitinib due to progression while on imatinib. Among these patients, the progression-free survival period was 18.89 ± 3.06 months.

Table II. Survival analysis in patient groups.

	n	Number of patients at risk (%)[a]	Number of deaths (%)[b]	Overall survival time (months)	p-value
Resectable	54	34 (63.0%)	7 (20.6%)	146.40 ± 13.01	**< 0.001**
Unresectable		20 (37.0%)	13 (65.0%)	65.95 ± 11.27	
Unresectable					
Operated	20	14 (70.0%)	9 (64.3%)	66.90 ± 12.65	0.728
Not operated		6 (30.0%)	4 (66.7%)	56.17 ± 18.49	
	n	**Number of patients at risk (%)[a]**	**Number of recurrences (%)[b]**	**Disease-free survival time (months)**	**p-value**
Resectable	34	34 (100.0%)	8 (23.5%)	97.70 ± 12.75	-
Adjuvant therapy (+)	34	20 (58.8%)	6 (30.0%)	91.54 ± 13.08	0.300
Adjuvant therapy (-)		14 (41.2%)	2 (14.3%)	106.50 ± 0	
	n	**Number of patients at risk (%)[a]**	**Number of recurrences (%)[b]**	**Progression-free survival time (months)**	**p-value**
Unresectable	20	20 (100.0%)	12(60.0%)	58.79 ± 13.36	-
Imatinib	20	10 (50.0%)	3 (30.0%)	94.86 ± 20.17	0.072
Sunitinib		10 (50.0%)	5(50.0%)	16.10 ± 3.78	

a: The number and proportion are given in column n.
b: The number and proportion are given within the number of patients at risk.
The overall survival, disease-free survival, and progression-free survival times are presented as the mean ± standard deviation.

Cox regression analysis was performed to determine the effects of adjuvant imatinib on tumor location, diameter, mitotic index, lymph node metastasis, stage, and recurrence. However, the Cox regression model obtained from the analysis was not statistically significant (p=0.075). No significant risk factors affecting recurrence were identified.

Cox regression analysis was performed to examine the effects of tumor location, size, mitotic index, lymph node metastasis, stage, imatinib use, and sunitinib use on overall survival in the unresectable disease group. A forward selection procedure was adopted for variable selection, and the presence of lymph node metastasis and a mitotic index >5 were determined to be risk factors for overall survival. The Cox regression model obtained from the analysis was significant (p=0.001). The risk of mortality was 8.91 times higher when the mitotic index was above 5 than when it indicated low risk. In the presence of lymph node metastasis, the risk of mortality was 6.62 times higher.

Table III presents the 1-, 3-, and 5-year survival rates for the 54 patients diagnosed with GIST included in our study.

Table III. 1-, 3-, and 5-year survival rates

Average survival time (months)	118.08 ± 11.35
1-year survival rate (%)	96.0
3-year survival rate (%)	82.0
5-year survival rate (%)	80.0

The survival time is given as the mean ± standard deviation.

Discussion and Conclusions

GISTs are the most common mesenchymal tumors of the gastrointestinal tract. They originate from interstitial Cajal cells. Mutations in the CD117 and PDGFRα genes activate tyrosine kinase receptors, which leads to tumor development[4,5].

GISTs are most commonly detected in individuals in their 60s[23]. In our study, consistent with the literature, the median age was found to be 59, with cases ranging from 34 to 74 years of age and an average age of 56.15 ± 10.68 years. Although GISTs occur equally in both genders, some studies have reported a higher incidence in males[24,25].

Symptoms vary depending on the location of the tumor. The most common symptom is GI bleeding. Other common symptoms are abdominal pain and an abdominal mass[25]. In our study, the most common presenting complaint was abdominal pain. Other common reasons for presentation included GI bleeding, weight loss, fatigue and weakness, dyspepsia, and bloating. Four patients were asymptomatic.

According to the literature, the frequency of occurrence by tumor location is as follows: stomach (50–70%), small intestine (25–35%), colon and rectum (5–10%), mesentery or omentum (7%), and esophagus (< 5%)[26]. In our study, the primary sites were the small intestine (40.7%), stomach (35.2%), retroperitoneum (13.0%), omentum (5.6%), colon (3.7%), and rectum (1.9%). Unlike previous studies, tumor localization was most frequently detected in the small intestine, possibly due to the small sample size.

Lymph node metastasis is rare in GISTs. Distant metastases most commonly occur in the liver (50-60%) and peritoneum (20-40%)[27]. In our study, nine patients (16.7%) had lymph node metastasis. Distant organ metastasis was detected in 22 (40.7%) of the 54 patients. Consistent with previous studies, metastases were most frequently detected in the liver (54.5%) and second most frequently in the peritoneum (13.6%).

GISTs carry a CD117 or PDGFRα mutation in 90% of cases[4,5]. The immunohistochemical findings in our study were consistent with those reported in the literature. CD117 was positive in 51 patients (94.4%), CD34 in 34 patients (63.0%), and PDGFRα in 18 patients (33.3%). GISTs are histologically classified

into three subtypes: spindle cell (70%), epithelioid cell (20%), and mixed cell (10%)[1]. In our study, spindle cell cytology was detected in 13 patients (24.1%), epithelioid cell cytology in three patients (5.6%), mixed cell cytology in 29 patients (53.7%), and the cytomorphological feature was unknown in nine patients (16.7%).

A large tumor size and a mitotic index > 5 per 50 high-power fields are poor prognostic factors in GISTs. Several studies have found a significant relationship between tumor location and clinical outcomes. Gastric GISTs generally have a better prognosis than other GISTs[28]. Lymph node metastasis is rare in GIST. According to an analysis of the SEER (Surveillance, Epidemiology, and End Results) database of over 5,000 patients diagnosed with GIST, lymph node involvement negatively affects survival[29]. In our study, we found that the mean tumor diameter of the patients was 111.90 ± 71.75 mm. Nine patients (16.7%) had tumors measuring 20–≤ 50 mm, 23 patients (42.6%) had tumors measuring 50–≤ 100 mm, and 20 patients (37.0%) had tumors measuring > 100 mm. Twenty-two patients (40.7%) had a mitotic index of ≤ 5, and 22 patients (40.7%) had a mitotic index of > 5; data for 10 patients were unavailable. In our study, we examined the effects of tumor location, size, mitotic index, stage, and lymph node metastasis on recurrence and survival in unresectable disease separately in patients receiving adjuvant imatinib. No significant effects of these five factors were found in the adjuvant imatinib group. This was believed to be due to the small sample size and the inability to access all patient data retrospectively through the hospital record system. In our group of patients with unresectable disease, we found that a mitotic index greater than five and the presence of lymph node metastasis impacted overall survival. The risk of mortality is 8.91 times higher in cases where the mitotic index is > 5, and it is 6.62 times higher in cases where there is lymph node metastasis.

The standard approach for GISTs is surgical removal with negative margins, followed by risk classification and, in appropriate cases, initiation of adjuvant imatinib therapy. For patients who are not eligible for surgery, imatinib therapy is the primary treatment option[30]. In our case series, 34 patients (63.0%) underwent curative surgery, 14 patients (25.9%) underwent palliative surgery, and six patients (11.1%) did not undergo surgery. The overall survival time was found to be 146.40 ± 13.01 months in patients who underwent curative surgery. This survival time was higher compared to that of unresectable patients ($p<0.001$). Although the randomized study by DeMatteo et al.[31] demonstrated that adjuvant imatinib prolongs recurrence-free survival, the shorter disease-free survival in our adjuvant-treated group, compared with those followed without medication, likely reflects that adjuvant therapy was preferentially administered to higher-risk patients in this retrospective cohort, as well as our limited sample size.

The optimal duration of imatinib treatment for patients with metastatic GIST is unknown. However, treatment until progression is recommended[32]. In our case series, imatinib was initiated in patients with metastatic, unresectable disease. The progression-free survival in unresectable patients was 58.79 ± 13.36 months. Sunitinib therapy is recommended for patients who do not respond to imatinib. A study by Demetri et al.[20] found a 58% response rate with sunitinib and a time to progression of 27 weeks. In our study, 16 patients switched to sunitinib due to imatinib resistance. Progression-free survival time was found to be 18.89±3.06 months in the 16 patients with imatinib-resistant resectable and unresectable disease. A 2013 study by Seker et al.[33] examined 333 GIST cases in our country and found that the median survival time was 26 months (range: 4–166 months). The 1-, 3-, and 5-year survival rates were 96.9%, 85.8%, and 78.5%, respectively. In our case series, the mean survival time was 118.08 ± 11.35 months. The one-, three-, and five-year survival rates were 96.0%, 82.0%, and 80.0%, respectively.

Our study was conducted on patients who consulted with a medical oncologist. It is believed that patients who were monitored without additional treatment after surgery could not be reached due to the absence of a GIST International Classification of Diseases (ICD) code. Since this was a retrospective study, not all patient data was accessible. While our results are consistent with those in the literature, our different findings are thought to be due to the small number of patients and our inability to access all the data.

In conclusion, the primary treatment for GISTs is surgery. Risk classification should be performed on patients undergoing surgery for GISTs, and adjuvant imatinib therapy should be administered to high-risk patients based on current information. During risk classification, patients should be evaluated for mitotic index and lymph node metastasis. For patients who do not respond to imatinib treatment, the dosage can be increased, or second- or third-line tyrosine kinase inhibitors, such as sunitinib and regorafenib, can be used.

Researcher Contribution Statement:
Idea and design: N.Y.Ç., Ö.K., A.D.; Data collection and processing: N.Y.Ç., N.U., A.D., Ö.K.; Analysis and interpretation of data: N.Y.Ç., A.D.; Writing of significant parts of the article: N.Y.Ç., N.U., A.D., Ö.K.
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