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Epidemiological, Therapeutic, and Prognostic Profile of Gastrointestinal Stromal Tumors in Senegal

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Abstract

Introduction: Gastrointestinal stromal tumors (GIST) constitute a rare subset of digestive tract malignancies classified within the sarcoma group. The objective of this study was to describe the epidemiological, therapeutic, and prognostic characteristics of GISTs and to determine factors associated with poor outcomes in a developing country context. **Patients and Methods:** A retrospective, descriptive study was conducted over a seven-year period (January 2016 to December 2022) in the Onco-hematology Department of Dalal Jamm National Hospital Center, Senegal. All patients with a diagnosis of GIST confirmed by histological and immunohistochemical analysis were included. Data were extracted from medical charts, operative records, pathology, and immunohistochemistry reports, and analyzed using Sphinx software version 23. **Results:** Fifty-seven cases of GIST were identified, corresponding to an average annual hospital incidence of eight cases. The mean age of patients was 56 years (range: 29 - 80), with a sex ratio (M/F) of 1.03. The stomach represented the predominant tumor site (54.32%), followed by the mesentery (19%). Abdominal pain was the most frequent presenting symptom (64.91%). Upper gastrointestinal endoscopy revealed endophytic lesions in 24.56% of patients, while computed tomography demonstrated exophytic growth in 87.72%. The mean tumor size was 16.5 cm (range: 2.9 - 31 cm). Spindle-cell morphology predominated histologically (92.08%), and C-kit positivity was observed in 70.17% of cases. According to the AFIP classification, available for 33 patients (57.89%), a high risk of recurrence was noted in 36.36%. All patients received imatinib therapy. Surgical management was performed in 54.40% of cases, and one patient underwent full-thickness endoscopic resection. After a mean fol-

low-up of 27.9 months, complete remission was maintained in 24.56% of patients. Mortality occurred in 28.07% and tumor recurrence in 21.05% of cases. **Conclusion:** GIST remain uncommon in our setting. Diagnostic delays and limited access to comprehensive management significantly affect patient prognosis. The high recurrence rate underscores the need to improve availability of advanced targeted therapies in resource-limited environments.

Keywords

GIST, Dog 1, CKIT, Imatinib, Progression

1. Introduction

Gastrointestinal stromal tumors (GISTs) are mesenchymal neoplasms of the digestive tract characterized by distinctive histological and immunohistochemical features, most often composed of spindle cells, occasionally epithelioid, and rarely pleomorphic and typically expressing the KIT protein [1] [2].

Over the past three decades, advances in the understanding of GIST pathophysiology and natural history, along with improvements in endoscopy, imaging, and immunohistochemical techniques, have significantly enhanced diagnostic and therapeutic strategies.

GISTs are frequently asymptomatic until they attain a considerable size or become complicated. Diagnosis can only be confirmed by histopathological evaluation combined with immunohistochemistry [3].

The introduction of imatinib, a tyrosine kinase inhibitor, has revolutionized the management of GIST, although complete surgical resection (R0) remains the only potentially curative option for localized tumors.

Prognosis depends on several factors, including tumor size, mitotic index, anatomical location, completeness of surgical resection, presence of necrosis, perforation, and underlying molecular mutations [4].

In Africa, data remain limited, with few studies published. In Senegal, Fall *et al.* reported ten cases of GIST in 2010 [5].

To contribute to a better understanding of these tumors, we conducted a retrospective, descriptive, and analytical study aimed at determining the epidemiological, therapeutic, and prognostic features of GISTs, and identifying factors associated with poor prognosis.

2. Patients and Methods

2.1. Study Design

This was a retrospective, descriptive, and analytical study conducted over a seven-year period.

2.2. Study Period

The study covered the period from January 1, 2016, to December 31, 2022.

2.3. Study Population

The study population included all patients diagnosed and managed for GIST in the Onco-Hematology Department of Dalal Jamm National Hospital Center, a tertiary university hospital located in Dakar, Senegal.

2.3.1. Inclusion Criteria

All hospitalized or outpatient patients with histologically and immunohistochemically confirmed GIST were included.

2.3.2. Exclusion Criteria

Patients with suspected GIST without immunohistochemical confirmation were excluded.

2.4. Methodology

2.4.1. Data Collection

Data were retrieved from medical records, surgical reports, and pathology files. They were recorded on a standardized data collection sheet in quantitative and qualitative formats.

Collected variables included sociodemographic, clinical, paraclinical, therapeutic, and prognostic data.

2.4.2. Data Analysis

Variables were entered in Microsoft Excel 2013 and analyzed using Sphinx software version 23.

Qualitative variables were expressed as percentages, and quantitative variables as means, medians, and standard deviations. Statistical comparisons were performed using the Chi-square and Fisher's exact tests.

Survival curves were generated using the Kaplan-Meier method, with comparisons performed by the Log-rank test. A p-value < 0.05 was considered statistically significant.

Analytical evaluation aimed to identify prognostic factors associated with poor outcomes.

2.5. Operational Definitions

The diagnosis of GIST was established based on histological features (spindle-cell, epithelioid, or mixed morphology) and immunohistochemical expression of KIT, CD56 and CD 117.

Tumor response and progression were evaluated using RECIST criteria:

- Complete response: Disappearance of all target and non-target lesions, with lymph nodes <10 mm in short axis.
- Partial response: ≥30% decrease in the sum of target lesion diameters compared to baseline.
- Progressive disease (failure): ≥20% increase in the sum of target lesion diameters compared to the smallest recorded value during follow-up.
- Stable disease: No progression and no significant reduction of target lesions.

3. Results

3.1. Descriptive Data

3.1.1. Socio-Epidemiological Characteristics

Incidence

During the study period, a total of 57 cases of gastrointestinal stromal tumors were recorded. The mean annual incidence was 8 ± 4 cases, with a range of 4 to 14 cases per year (Figure 1).

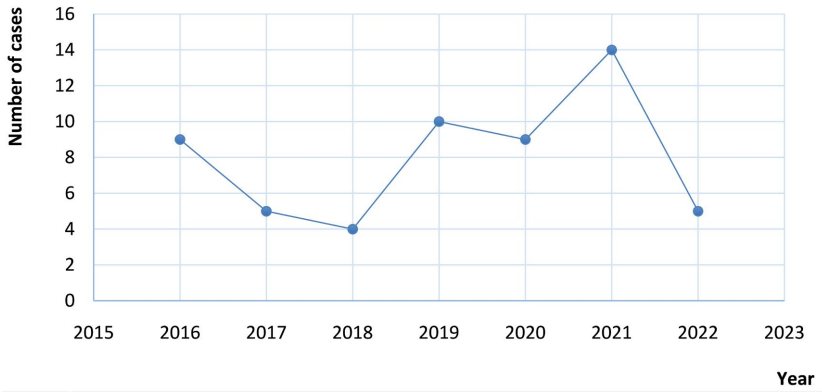


Figure 1. Hospital incidence of gastrointestinal stromal tumors (GIST) during the study period (2016-2022).

Age

The mean age of patients was 56 years, with a range from 29 to 80 years. The most represented age group was 51 to 60 years. Patients aged over 50 years accounted for 59.65% of the study population (Figure 2).

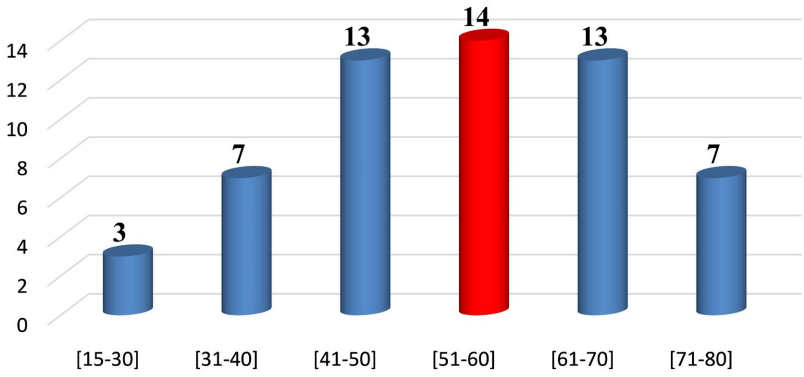


Figure 2. Distribution of patients by age group.

Sex

The study included 28 men (49.12%), resulting in a female-to-male sex ratio of 1.03.

Tumor Location

Gastric tumors were observed in 54.38% of patients, while mesenteric localization accounted for 19.29% (Figure 3).

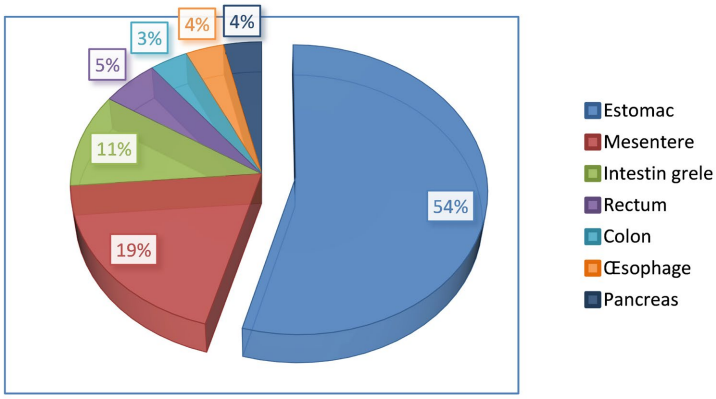


Figure 3. Distribution of patients according to tumor location.

Medical History

Hypertension and diabetes were present in 15.78% and 10.52% of patients, respectively. Chronic inactive hepatitis B virus (HBV) carriage was documented in 5 cases (8.77%), while 2 patients (3.50%) were infected with HIV. One patient (1.75%) had neurofibromatosis.

3.1.2. Clinical Data

Consultation Delay

The mean time from symptom onset to consultation was 12.4 ± 7.3 weeks, ranging from 3 to 26 weeks.

Clinical Presentation

Abdominal pain was reported in 37 patients (64.91%), with 18 patients (31.57%) experiencing epigastric pain. Vomiting was noted in 26 patients (45.61%). Gastrointestinal bleeding was observed in 14 patients, manifesting as hematemesis in 6 cases (10.52%). Weight loss was present in 33 patients (57.89%).

Table 1. Distribution of patients according to physical signs.

Physical sign	Frequency (n)	Percentage (%)
Abdominal mass	30	52.63%
Tumor hepatomegaly	12	21.05%
Lymphadenopathy	7	12.28%
Abdominal bloating	7	12.28%
Splenomegaly	4	7.01%
Ascite	3	5.28%
Paresthesia	2	3.50%
Big inflammatory leg	2	3.50%
Crackling rales	2	3.50%
Subcutaneous nodular lesions	1	1.75%
Facial puffiness	1	1.75%
Hepatojugular reflux	1	1.75%

An abdominal mass was palpable in 57.89% of patients, predominantly located in the epigastric region (26.31%). Hepatomegaly was noted in 12 patients (21.05%), and ascites in 3 patients (5.28%) (Table 1).

3.1.3. Paraclinical Data

Blood Count

The mean hemoglobin level was 10.52 g/dL ± 2.82. Anemia was diagnosed in 41 patients (71.92%), predominantly microcytic hypochromic in 26 patients (63.41%). Leukopenia was observed in 13 patients (22.80%), and thrombocytosis in 8 patients (14.03%).

Digestive Endoscopy

Esophagogastroduodenoscopy (EOGD) was performed in 39 patients and was abnormal in 28 cases. Lesions involving the fundus were noted in 75% of abnormal examinations, with a budding appearance observed in 65% of these cases (Table 2).

Table 2. Distribution of patients according to endoscopic characteristics of EOGD.

Parameter	Subcategory	Frequency (n)	Percentage (%)
Tumor lesion	—	20	51.28
Tumor location	Esophagus	2	5
	Fundus	15	75
	Lair	2	10
	Antro-fundic	1	5
Tumor appearance	Budding	13	65
	Submucosal	4	20
	Necrotic	4	20
	Hemorrhagic	3	15
	Stenosing	2	10

Lower Digestive Endoscopy

Lower digestive endoscopy was performed in 7 patients. Tumor lesions were identified in 4 patients (57.14%), while extrinsic compression was noted in 2 patients (28.57%).

Thoraco-Abdomino-Pelvic Computed Tomography (CT)

CT scans were performed in all patients. An exophytic tumor lesion was observed in 50 patients (87.71%), with gastric localization in 27 cases (54.00%). Tumors appeared heterogeneous in 48 patients (84.21%), necrotic in 42 (80%), and calcified in 14 (28%). Metastases were detected in 20 patients (40%). Table 3 illustrates the distribution of patients according to CT scan results (Table 3).

Histopathology

Type of Specimen

Histological analysis was performed on surgical specimens in 52.63% of cases and biopsy samples in 47.37%.

Table 3. Distribution of patients according to CT scan results.

Parameter	Subcategory	Frequency (n)	Percentage (%)
Tumor lesion(s) present	—	50	87.71
Tumor location	Stomach	27	54.00
	Duodenum	2	4.00
	Jejunum	2	4.00
	Sigmoid colon	2	4.00
	Rectum	3	6.00
	Mesentery	13	26.00
	Pancreas	2	4.00
Tumor structure	Tissue	46	92.00
	Cystic	4	8.00
	Necrosis	33	66.00
	Calcifications	14	28.00
	Hemorrhage	3	6.00
Maximum tumor diameter	<2 cm	2	4.00
	2 cm ≤ T < 5 cm	5	10.00
	5 cm ≤ T < 10 cm	7	14.00
	≥10 cm	36	72.00
Exophytic tumor		50	87.71
Heterogeneous enhancement		34	68.00

Macroscopic Findings

Resection margins were tumor-free (R0) in 20 patients (35.08%). Tumor friability was observed in 8 patients (14.03%), necrosis in 16 patients (28.07%), and hemorrhage in 7 patients (12.28%).

Histological Features

Spindle cells were identified in 92.98% of tumors, with epithelioid cells present in 7.02%. No mixed histological forms were reported.

Mitotic Index

The mitotic index was assessed in 46 patients (80.70%), with a mean value of 5%.

Immunohistochemistry

C-KIT (CD117) expression was detected in 70.17% of cases, while CD34 positivity was observed in 40.35% of patients (Table 4).

3.1.4. Prognosis

AFIP Classification (Miettinen and Lasota)

The AFIP classification was applied to 33 patients (57.89%). Among these, 18 patients (54.54%) were classified as having an intermediate risk of recurrence.

Table 4. Distribution of patients according to immunohistochemistry results.

Markers	Number (n)	Percentage (%)
CKIT	40	70.17%
CD 34	23	40.35%
Dog 1	18	31.57%
PS100	5	8.77%
Desmine	2	3.50%
AML	2	3.50%
SDH B	1	1.75%

pTNM Classification

According to the pTNM staging, 40.35% of patients were classified as stage pT4N0M0, while 14.35% were at stage pT4N0M1 (Table 5).

Table 5. Distribution of patients by TNM classification.

Stage	Number (n)	Percentage (%)
pT 4N0M0	23	40.35%
pT 4N0M1	8	14.35%
pT 4N1M1	4	7.01%
pT 4N1M0	1	1.75%
pT 3N0M0	7	12.28%
pT 3N0M1	4	7.01%
pT 3N1M1	1	1.75%
pT 2N1M1	3	5.26%
pT 1N1M1	1	1.75%
pT 1N0M0	3	5.26%
PTxNxMx	2	3.50%

3.1.5. Therapeutic Strategy

Medical Treatment

All patients received imatinib, with an average dose of 400 mg/day (range: 100 - 800 mg). Imatinib was administered as adjuvant therapy following surgery in 33 patients (57.89%) and as palliative treatment in 24 patients (42.11%).

Sunitinib, at an average dose of 50 mg/day (range: 50 - 100 mg), was prescribed to 6 patients (10.52%) who exhibited imatinib resistance.

Surgical Management

Curative surgery was performed in 33 patients (57.89%). Among these, gastrectomy accounted for 18 cases (54.45%), including atypical gastrectomy in 2 patients (11.11%), total gastrectomy in 6 (33.33%), and 4/5 gastrectomy in 10 (55.55%). Hemicolectomy was performed in 2 patients (6.45%).

Physical and Instrumental Treatments

Full-thickness endoscopic resection was successfully performed in one patient (1.75%) for a small fundic GIST. Radiotherapy was administered to two patients to control digestive hemorrhage (Table 6).

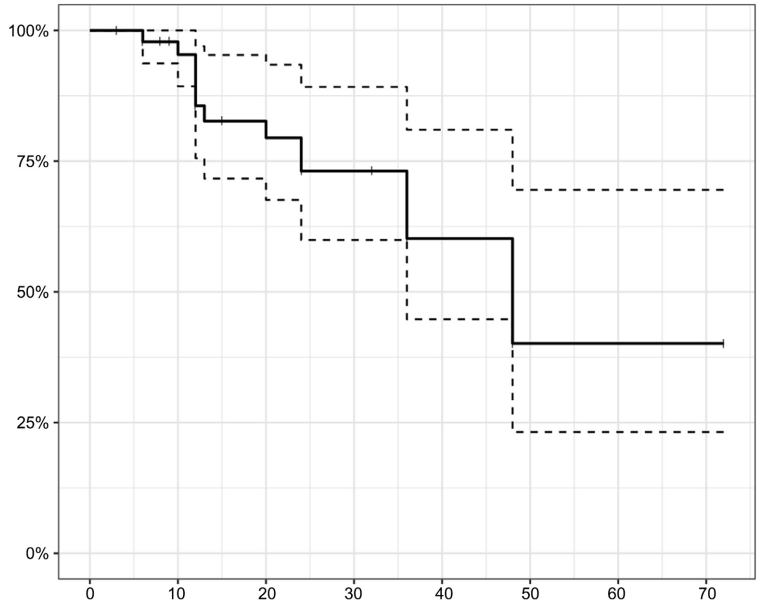
Table 6. Distribution of patients according to surgical treatment.

Type of Surgery	Frequency (n)	Percentage (%)
Curative surgery	33	93.93
Gastrectomy	18	51.61
-Atypical gastrectomy	2	11.11
-Gastrectomy 4/5	10	55.55
-Total gastrectomy	6	33.33
Bowel resection	5	16.12
-Coloprotectomy	2	6.45
-Mesentery tumor excision	8	24.24
Associated procedures		
-Splenectomy	5	16.12
-Lymph node dissection	8	25.80
-CPD (Common bile duct procedure)	1	3.22
-Nephrectomy	1	3.22
-Ovariectomy	1	3.22
Palliative surgery	2	6.06
-Gastrostomy	1	3.22
-Colostomy	1	3.22

3.1.6. Evolution

Duration of Follow-Up

The mean follow-up duration was 27.91 ± 18.48 months, ranging from 3 to 72 months.



	median (95% CI)	max tracking	N	n events	survival rate (95% CI)
Follow up	48.0 (36.0; -)	72.0	48	16	40.1% (23.2%; 69.5%)

Figure 4. Kaplan-Meier survival curve for overall survival.

Survival Outcomes

During the seven-year follow-up period, 16 patients (28.07%) died. 41 patients (56%) are alive and remain under active follow-up in the department (Figure 4).

Tumor Evolution

Tumor progression was evaluated according to RECIST criteria in 41 patients (71.92%). Among these, 39.02% exhibited tumor progression, 4.88% achieved complete remission, and 43.90% demonstrated stable disease during follow-up (Table 7).

Table 7. Distribution of patients according to tumor evolution based on RECIST criteria.

Evolution Status	Frequency (n)	Percentage (%)
Stable	18	43.90
Progression	16	39.02
Partial remission	5	12.19
Complete remission	2	4.88

3.2. Analytical Results

In multivariate analysis (Table 8), factors significantly associated with mortality included the presence of metastases, a high-risk classification according to Miettinen and Lasota criteria, and tumor progression. The predictive model demonstrated excellent discrimination with an area under the receiver operating characteristic curve (AUC) of 0.905.

Table 8. Multilogistic regression of factors associated with death.

Variable	P-value	Odds Ratio	95% CI Lower Bound	95% CI Upper Bound
Age over 60				
No	0.057	1.774	0.879	12.895
Yes				
Size greater than 5 cm				
No	0.619	0.584	0.070	4.863
Yes				
Ascites				
No	0.173	1.103	0.684	2.713
Yes				
Digestive hemorrhage				
No	0.782	2.341	1.167	10.782
Yes				
Metastases				
No	0.046	3.897	0.750$	6.945
Yes				

Continued

Local invasion				
No	0.010	2.550	1.006	7.499
Yes				
Tumor necrosis				
Yes	0.123	3.859	2.439	13.904
No				
Tumor intrusion				
No	0.767	1.427	1.135	5.073
Yes				
High risk				
No	0.004	3.359	1.045	5.885
Yes				
Tumor progression				
No	0.016	1.968	0.987	6.971
Yes				
Gastric location				
No	0.541	1.501	0.955	4.586
Yes				
Other location				
No	0.118	0.571	0.063	5.164
Yes				

4. Discussion

Gastrointestinal stromal tumors (GISTs) represent the most common mesenchymal tumors of the digestive tract [1] [6], yet they remain rare, accounting for only 1 to 3% of all gastrointestinal malignancies [7]. In our study, the hospital incidence was 8 cases per year, a figure comparable to incidences reported in Tunisia [8] and Mali [1]. However, this incidence is lower than that reported in Western [9] and Asian countries [10], where annual cases range from 11.9 to 182.25. The lower incidence in our region may reflect underdiagnosis related to limited access to immunohistochemistry.

In our cohort, abdominal pain was the predominant symptom, present in 64.91% of patients. This aligns with findings from Taoufiq *et al.* in Morocco (51.88%) [11] and Ahmadou *et al.* in Mali (92.08%) [1]. Contrastingly, a literature review suggests gastrointestinal bleeding is typically the most frequent presentation, occurring in approximately 48% of cases, with abdominal pain reported in no more than 36% [2]. Our observed rate of gastrointestinal bleeding was only 19.29%, possibly due to the low prevalence of endophytic tumor forms in our sample. An abdominal mass was palpable in 52.63% of patients, consistent with findings by Fall *et al.* in

Senegal (70%) [5] in 2011 [5]. Tumor size is often larger in African studies, likely reflecting diagnostic delays and delayed healthcare-seeking behaviors, as well as the common presentation of abdominal mass prompting diagnosis [5].

Digestive endoscopy was performed in 80% of patients and contributed to diagnosis by identifying a tumor lesion in 33.33% of these cases. This diagnostic yield is lower than rates reported by Clére *et al.* in France (57.14%) [12]. Endoscopy plays a vital role in GIST diagnosis, allowing tumor visualization and biopsy, although biopsies are contributory in only 15 to 50% of cases [13].

Gastric localization was most frequent (54.0%) in our study, paralleling data reported by Ahmadou *et al.* in Mali (48%) [1]and Rios-Moreno in Spain (48.48%) [14]. Globally, gastric tumors represent 60% - 70% of GISTs, followed by the small intestine (20% - 30%), with colon, rectal, and esophageal localizations being less common (<10%) [15] [16]. Mesenteric localization accounted for 19% of cases in our series, a figure similar to Ahmadou *et al.* (20%) [1], but higher than Western reports [14] [15], possibly reflecting sample size differences.

Tumor size varied widely; with a mean diameter of 168 mm in our study, comparable to sizes reported by Cassier [17] in France and Ahmadou in Mali [1], but larger than seen in Spain [14]. This discrepancy may be attributable to delayed consultation among our patients.

Confirmation of GIST diagnosis relies on immunohistochemical markers, principally KIT (CD117) and DOG-1, which demonstrate high sensitivity. C-KIT positivity was noted in 70.17% of our cases, consistent with previous reports [18] [19], whereas CD34 expression was seen in only 42.59%.

According to the Miettinen classification, 36.36% of our patients were classified as high risk for recurrence, comparable to rates in other African series [1] [20], but higher than the 2014 Chinese cohort studied by Lin [21]. This increased risk may result from delayed presentation and larger tumor sizes in our population.

All patients received imatinib therapy at an average dose of 400 mg/day, a regimen not universally accessible in some African contexts [1] [11]. In Senegal, free provision of imatinib has been sustained for several years through European aid programs.

Surgical intervention was performed in 54.40% of patients, consistent with rates reported by Taoufiq *et al.* (44.49%) [11] and Dematteo *et al.* (40%) [22]. Surgery remains the cornerstone of curative treatment, requiring complete (R0) resection with negative margins, while prioritizing organ function preservation. We observed an R0 resection rate of 68%, similar to Taoufiq *et al.* (67%) [11].

Tumor progression occurred in 39.02% of patients, exceeding rates from Morocco (14.81%) [11] and Great Britain (11.35%) [23]. Such progression may reflect imatinib resistance, potentially due to poor compliance or intrinsic resistance. Primary resistance occurs within six months of treatment initiation in 10% - 15% of patients; secondary resistance develops after one year in approximately 15% [24]. These patterns correspond closely to the tumor's mutational landscape, emphasizing the prognostic and predictive value of mutation testing beyond diagnosis.

The mortality rate was 28.07%, comparable to rates reported by Duffaud *et al.* (29.41%) [25] and Taoufiq *et al.* (24.07%) [11]. This rate is higher than reported in studies from the USA by Coe *et al.* (12.9%) and Imran *et al.* (15.18%) [26] [27]. Differences in mortality likely reflect population heterogeneity, stage at diagnosis, tumor size, and healthcare resource disparities. For example, patients in Coe *et al.*'s study had tumors smaller than 2 cm [26], whereas larger tumors were documented in the African series.

5. Conclusion

Gastrointestinal stromal tumors (GISTs) are mesenchymal neoplasms thought to originate from precursors of interstitial cells of Cajal. Their clinical presentation is variable, with imaging and endoscopic evaluation playing key roles in raising suspicion for diagnosis. Definitive diagnosis is established through histopathological examination combined with immunohistochemical detection of CD117 or DOG-1 markers. Our study confirms that GISTs are rare tumors in our region. Management is frequently hindered by diagnostic delays, which adversely affect patient prognosis. Tumor recurrence is common, underscoring the critical need to improve access to novel targeted second-line therapies.

Provenance and Peer Review

All authors have read and approved the document.

Consent

Patients gave consent to report cases.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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