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Gastric Cancer in Southern Benin: Access to Surgical Treatment and Postoperative Outcomes

Freddy Houéhanou Rodrigue Gnangnon[1,2,3*], Ismail Lawani[4], Antoine Azon[3], René Hounsou[3,4], Roland Goudou[3], Sètondji Gilles Roger Attolou[4,5], Dansou Gaspard Gbessi[3,4]

[1]Division of Surgical Oncology, Faculty of Health Sciences, University of Abomey-Calavi, Cotonou, Benin
[2]Laboratory of Epidemiology of Chronic and Neurological Diseases, University of Abomey-Calavi, Cotonou, Benin
[3]Department of Visceral Surgery, National Teaching Hospital-Hubert Koutoukou Maga, CNHU-HKM, Cotonou, Benin
[4]Division of Visceral Surgery, Faculty of Health Sciences, University of Abomey-Calavi, Cotonou, Benin
[5]General Surgery Department, Suru Lere Regional University Hospital Center, Cotonou, Benin
Email: *freddy.gnangnon@uac.bj

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Abstract

Background: Gastric cancer remains a major public health challenge in low- and middle-income countries, where late-stage diagnosis and limited access to specialized surgical oncology care adversely affect outcomes. Surgery remains the cornerstone of curative treatment; however, data on access to surgical management and survival in West Africa are scarce. This study aimed to assess access to surgical treatment and survival outcomes among patients with gastric cancer managed in referral hospitals in southern Benin. **Methods:** We conducted a retrospective descriptive study over a nine-year period (January 1, 2013 to December 31, 2021) in three tertiary hospitals in the Littoral Department of Benin. All patients who underwent surgery for histologically confirmed gastric cancer were included. Sociodemographic characteristics, diagnostic work-up, tumor stage (UICC TNM 2016), surgical procedures, and outcomes were analyzed. Overall survival was estimated using the Kaplan-Meier method. **Results:** Among 114 identified cases of gastric cancer, 52 patients (45.6%) underwent surgical intervention. The mean age was 57.2 ± 12.3 years, with a male predominance (61.5%). Upper gastrointestinal endoscopy was performed in 92.3% of cases, while staging computed tomography was available in 55.8%. Tumors were predominantly distal, involving the antrum or antropyloric region in 86.5% of patients. Adenocarcinoma was the most frequent histological type (97.4%). Most tumors were diagnosed at an advanced stage (T4: 71.2%; stage III: 57.7%). Partial gastrectomy was the most commonly performed procedure (57.7%), whereas palliative procedures accounted for a sub-

stantial proportion of cases. Surgical management was compliant with international oncologic recommendations in 65.4% of patients. Among the 18 patients with available follow-up data, the median overall survival was 6 months. **Conclusion:** In southern Benin, gastric cancer is frequently diagnosed at an advanced stage, resulting in low resectability rates and poor survival outcomes. Surgery remains the central component of treatment but is often limited to palliative intent due to delayed presentation. Improving early diagnosis, accurate staging, and access to standardized surgical oncology care is essential to increase curative resection rates and improve survival in this setting.

Keywords

Gastric Cancer, Surgical Oncology, Gastrectomy, Resectability, Survival, Sub-Saharan Africa

1. Introduction

Gastric cancer remains a major global public health concern. In 2020, it accounted for more than one million new cases worldwide and 769,000 deaths, corresponding to approximately one in every thirteen cancer-related deaths globally [1]. It ranks fifth in incidence and fourth in cancer-related mortality and occurs nearly twice as frequently in men as in women [1].

In Africa, gastric cancer ranked ninth among all cancers in 2020, with 32,402 new cases (2.9% of all new cancer diagnoses) and 27,945 deaths, representing 3.9% of cancer-related mortality on the continent [2]. These figures highlight a substantial disease burden in settings where access to early diagnosis and specialized oncologic care remains limited.

In Benin, particularly in Cotonou, a descriptive and analytical cross-sectional study conducted in 2020 across three referral hospitals identified gastric cancer as the third most frequent primary digestive malignancy [3]. Despite its significant incidence, gastric cancer in this context is often diagnosed at an advanced stage, which profoundly compromises therapeutic options and survival.

Prognosis in gastric cancer is strongly correlated with tumor stage at diagnosis [4]. Surgery remains the cornerstone of curative treatment and represents the only modality with curative intent when complete tumor resection with adequate lymphadenectomy can be achieved, especially in early-stage disease [5]. However, in low-resource settings, delayed presentation, limited staging facilities, and restricted access to perioperative chemotherapy substantially reduce the proportion of patients eligible for curative surgery.

In Benin, several studies have addressed gastric cancer; however, only one, conducted approximately three decades ago, partially explored its surgical management [6] [7]. Contemporary data focusing on access to surgical oncology care, operative practices, and postoperative outcomes are therefore lacking. The present study aims to evaluate the role of surgery in the management of gastric cancer in

Cotonou, with particular emphasis on access to surgical treatment and patient prognosis.

2. Methods

2.1. Study Design and Setting

This was a retrospective descriptive study conducted over a nine-year period, from January 1, 2013 to December 31, 2021. The study was carried out in three referral hospitals located in the Littoral Department of Benin: the National Teaching Hospital Hubert Koutoukou Maga (CNHU-HKM), the Armed Forces Teaching Hospital (HIA-CHU), and the Suru-Lere Regional University Hospital Center (CHUZ-SL). These institutions serve as major centers for the surgical management of digestive cancers in southern Benin.

2.2. Study Population

We included all patients who underwent surgical intervention for histologically confirmed gastric cancer during the study period. Only patients with available operative reports were considered. For survival analysis, inclusion was restricted to operated patients for whom follow-up information was available. Patients with incomplete medical records or missing key data were excluded from the corresponding analyses.

2.3. Data Sources and Collection

Data were retrospectively collected from several hospital sources, including operative reports, medical records, hospitalization registers, and available histopathology reports. Extracted information covered sociodemographic characteristics, diagnostic investigations, tumor location, histological type, tumor stage, type of surgical procedure performed, and postoperative outcomes. Patients lost to follow-up were actively traced using contact details available in their medical files.

2.4. Diagnostic and Staging Assessment

Diagnosis of gastric cancer was based on upper gastrointestinal endoscopy with biopsy and histological confirmation whenever available. Tumor staging was assessed using available imaging investigations, mainly thoracoabdominopelvic or abdominopelvic computed tomography scans. Tumors were classified according to the Union for International Cancer Control (UICC) TNM classification, 2016 edition, based on clinical, radiological, and pathological data.

2.5. Surgical Management

Surgical procedures were categorized according to therapeutic intent as curative or palliative. Curative surgery included partial or total gastrectomy performed with oncologic intent, while palliative procedures included gastrojejunostomy, feeding jejunostomy, or non-curative gastric resections. Surgical management was considered compliant with international oncologic recommendations when the

type of gastrectomy and lymph node dissection were appropriate for tumor location and stage, based on available operative and pathological data.

2.6. Outcome Measures

The primary outcomes were access to surgical treatment and overall survival. Overall survival was defined as the time interval between the date of surgery and death from any cause or last known follow-up. Secondary outcomes included tumor stage at diagnosis, type of surgical procedure performed, and conformity of surgical management with international standards.

2.7. Statistical Analysis

Data entry and analysis were performed using Epi Info version 7. Quantitative variables were summarized as means with standard deviations, and qualitative variables were expressed as frequencies and percentages. Results were presented in tables using Microsoft Word, and figures were generated using Microsoft Excel. Overall survival was estimated using the Kaplan-Meier method.

3. Results

3.1. Study Population and Patient Flow

During the study period, a total of 9634 patients were hospitalized in the three surgical departments included in the study. Among them, 114 cases of gastric cancer were identified, representing 11.8% of all admissions. Of these 114 patients, 52 (45.6%) underwent surgical intervention: two (3.8%) at CHUZ-SL, one (1.9%) at HIA-CHU, and forty-nine (94.2%) at CNHU-HKM. Survival data were available for 18 operated patients, all of whom were treated at CNHU-HKM.

3.2. Sociodemographic Characteristics

The mean age of the operated patients was 57.2 ± 12.3 years, with ages ranging from 35 to 82 years. The highest frequency was observed in the 55 - 65-year age group. The study population showed a male predominance (n = 32; 61.5%), corresponding to a male-to-female ratio of 1.6.

3.3. Diagnostic Assessment and Tumor Characteristics

Upper gastrointestinal endoscopy was the most frequently performed diagnostic investigation and was carried out in 48 patients (92.3%). For disease staging, thoracoabdominopelvic or abdominopelvic computed tomography was the most commonly used imaging modality (n = 29).

Tumors were predominantly located in the distal stomach. The antropyloric region was involved in 27 cases (52.0%), while purely antral tumors accounted for 18 cases (34.6%). Less frequent locations included the lesser curvature (7.7%), the cardia (3.8%), and the pylorus alone (1.9%).

The distribution of gastric tumors according to anatomical location is summarized in Table 1.

Table 1. Distribution of gastric cancer according to tumor location.

	N	%
Location of gastric cancer (n = 52)		
Antropyloric region	27	52.0
Antrum only	18	34.6
Pylorus only	1	1.9
Lesser curvature	4	7.7
Cardia	2	3.8
Total	**52**	**100.0**

Histologically, adenocarcinoma was the predominant tumor type (97.4%). Among adenocarcinomas, tumors were moderately differentiated in 78.9% of cases and poorly differentiated in 10.6%. According to the UICC 2016 TNM classification, most tumors were classified as T4 (71.2%), with nodal status frequently undocumented (Nx: 78.8%). Distant metastases were absent in 71.2% of patients (M0), while 25.0% had metastatic disease (M1). Overall, stage III disease was the most frequently observed.

Tumor staging according to the UICC 2016 TNM classification is detailed in Table 2.

Table 2. TNM classification of operated gastric cancer patients (UICC 2016).

	n	%
Primary tumor (T) - T category (n = 52)		
Tx	3	5.8
T3	12	23.1
T4	37	71.1
Regional lymph nodes (N) - N Category (n = 52)		
Nx	41	78.8
N0	1	1.9
N1	4	7.7
N2	3	5.8
N3	3	5.8
Distant metastasis (M) - M Category (n = 52)		
Mx	2	3.8
M0	37	71.2
M1	13	25.0

3.4. Therapeutic Management

3.4.1. Preoperative Chemotherapy

Preoperative chemotherapy was administered to 11 patients. Access to neoadju-

vant treatment was inconsistent and depended on availability and patient-related factors. Due to incomplete retrospective documentation, it was not possible to reliably assess subsequent resection status or R0 resection rates in this subgroup.

3.4.2. Surgical Management

Partial gastrectomy was the most frequently performed surgical procedure (n = 30; 57.7%), reflecting the predominance of distal gastric tumors. Palliative gastrojejunostomy was performed in 11 patients (21.2%), mainly in cases of obstructive, unresectable disease. Total gastrectomy was rarely performed (n = 2; 3.8%). Feeding jejunostomy as a palliative procedure was carried out in 9 patients (17.3%).

The distribution of surgical procedures performed in operated patients is presented in Table 3.

Table 3. Surgical procedures performed in operated gastric cancer patients.

	n	%
Surgical procedure (n = 52)		
Partial gastrectomy	30	57.7
Total gastrectomy	2	3.8
Gastrojejunostomy (palliative bypass)	11	21.2
Feeding jejunostomy	9	17.3
Total	**52**	**100.0**

Overall, surgical management was considered compliant with international oncologic recommendations in 65.4% of cases, based on tumor location, disease stage, and the type of surgical procedure performed.

3.5. Survival Outcomes

Among the 18 patients included in the survival analysis, median overall survival was six months. Overall survival estimated using the Kaplan-Meier method is illustrated in Figure 1.

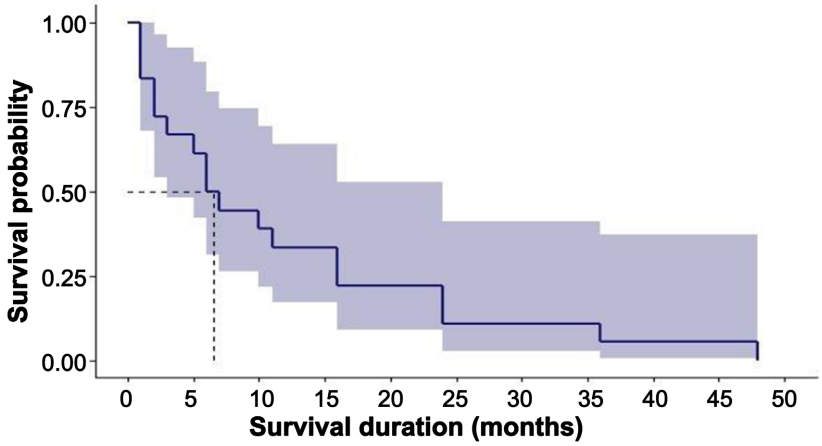

Figure 1. Kaplan-Meier overall survival curve of operated patients with gastric cancer.

4. Discussion

In the present study, gastric cancer accounted for 11.8% of all surgical admissions in the participating hospitals. This proportion is consistent with findings from Cotonou, where Kpossou *et al.* reported that gastric cancer represented 12% of primary digestive cancers in 2020 [3]. Similar proportions have been reported in other African settings, including Togo, where Bouglouga *et al.* found gastric cancer to account for 12.8% of digestive malignancies [8]. In Mali, Diarra *et al.* reported a much higher proportion, with gastric cancer representing 59.1% of digestive cancers [9], highlighting marked regional variability across the continent. In Nigeria, Mandong *et al.* reported a lower proportion (3.6%) among malignant tumors [10].

The substantial burden of gastric cancer in Africa may be partly explained by inadequate identification and follow-up of high-risk populations. Early detection and endoscopic surveillance of at-risk individuals are well-recognized strategies to reduce gastric cancer incidence and mortality [7]. However, in many African countries, including Benin, organized screening programs are not publicly funded and remain largely dependent on patients' financial capacity, which substantially limits access.

In high-income countries, a different epidemiological trend has been observed. Santos reported an incidence of 15.8 per 100,000 inhabitants in Peru [11], while Kamiya *et al.* described a steady decline in gastric cancer incidence in Europe, largely attributable to early detection and improved treatment strategies [12]. Similar findings were reported in the United States by Crew and Neugut, who observed a marked decrease in gastric cancer incidence over several decades [13]. Improved control of risk factors, systematic endoscopic surveillance, and timely treatment likely account for these favorable trends in developed settings.

The mean age of patients in our study was 57.2 ± 12.3 years, which is comparable to findings reported in Benin by Kpossou *et al.* (54 ± 14.1 years) [3] and in other African series, including Nigeria (51 ± 6 years) [13] and Kenya (median age 52 years) [14]. In contrast, studies from high-income countries report older patient populations, with a median age of 70 years in Poland [5] and a mean age of 62.9 years in Peru [11]. These differences suggest that gastric cancer tends to occur at a younger age in African populations, possibly reflecting demographic structure, environmental exposures, and disparities in access to preventive care.

Male predominance was observed in our cohort (61.5%), consistent with reports from Mali [9], Nigeria [15], and the United States [16]. Although exceptions have been reported, such as a female predominance in Rwanda [17], gastric cancer generally affects men more frequently than women across both African and non-African populations.

Upper gastrointestinal endoscopy was performed in 92.3% of patients, a rate comparable to that reported by Gbessi *et al.* in Cotonou (93%) [18] and higher than that reported in Tanzania (85.3%) [19]. In contrast, early endoscopic detection is significantly more effective in East Asia, particularly in Japan, where pop-

ulation-based screening and advanced endoscopic techniques, such as chromoendoscopy and magnification endoscopy, are widely available [13]. The widespread adoption of endoscopic screening in high-income countries has contributed substantially to earlier diagnosis and improved surgical outcomes.

Endoscopic biopsy remains the gold standard for preoperative histological confirmation of gastric cancer, allowing accurate pathological diagnosis and guiding therapeutic decision-making [18] [20]. In our study, adenocarcinoma was the predominant histological type, consistent with previous reports [19] [21]. However, access to advanced pathological testing remains limited. HER2 testing, which is recommended in metastatic gastric cancer to guide targeted therapy [22], was performed in only 1.9% of cases, reflecting the limited availability of immunohistochemistry in our setting.

Thoracoabdominopelvic computed tomography is the recommended imaging modality for staging gastric cancer [22], yet only 55.8% of patients in our study underwent CT scanning. Although access to CT imaging has improved over time in Benin, cost constraints and limited health insurance coverage continue to restrict its use. Abdominal ultrasound is sometimes used as an alternative to detect liver metastases, but it lacks sensitivity and is no longer considered sufficient for comprehensive staging [22].

Tumors were predominantly located in the distal stomach, particularly in the antropyloric region. This distribution is consistent with reports from Tanzania [19], Togo [8], and Senegal [21]. From a surgical perspective, distal tumor location theoretically allows for partial gastrectomy with curative intent when diagnosed at an early stage.

However, most patients in our study were diagnosed at an advanced stage, with stage III disease predominating. Similar findings have been reported in Tanzania [19] and Rwanda [17], where the majority of patients present with stage III or IV disease. In contrast, in Japan, the proportion of early-stage gastric cancer has increased markedly due to systematic screening, resulting in improved resectability and survival [4]. Tumor stage at diagnosis remains the key determinant of surgical strategy: early-stage tumors are more likely to be amenable to curative resection, whereas advanced tumors often require palliative surgical procedures.

Neoadjuvant chemotherapy is an integral component of multimodal treatment for gastric cancer, aiming to downstage tumors, increase R0 resection rates, and improve survival [23]. International guidelines recommend perioperative chemotherapy, typically administered as four cycles before and after surgery [15] [22]. In our setting, access to chemotherapy remains inconsistent, reflecting regional disparities in oncology infrastructure and resource availability [19] [24].

Partial gastrectomy was the most frequently performed surgical procedure in our cohort, consistent with the predominance of distal tumors and advanced-stage disease. Other African studies have reported higher rates of palliative procedures, including gastrojejunostomy, reflecting late presentation and low resectability rates [17] [19]. Surgical decision-making in gastric cancer is fundamentally

stage-dependent and must adhere to oncologic principles. Curative gastrectomy requires adequate proximal and distal margins (approximately 6 cm for antral tumors and 12 cm for cardial tumors) and is classified according to residual disease status (R0, R1, or R2). Adequate lymphadenectomy is a critical component of oncologic surgery, with D2 dissection currently recommended as the standard of care, while D1 is considered insufficient and D3 remains controversial outside specialized centers.

In our study, surgical management was compliant with international oncologic recommendations in 65.4% of cases. Non-compliance was mainly related to discrepancies between recommended surgical procedures based on tumor location and those actually performed, often reflecting late-stage presentation and limited intraoperative options.

The high proportion of patients who did not undergo surgical treatment likely reflects multiple interacting factors. Based on our clinical experience, these factors include financial barriers limiting access to diagnostic work-up and surgery, sociocultural constraints particularly fear and misconceptions surrounding surgical interventions as well as tumor-related factors such as poor operability and low resectability due to advanced-stage disease at presentation. However, given the retrospective nature of the study and the absence of standardized documentation regarding reasons for non-operative management, these factors could not be formally quantified and should be interpreted as contextual clinical insights rather than empirically measured determinants.

Median overall survival among the 18 patients included in survival analysis was six months, which is lower than that reported in other African series, such as Nigeria (13.6 months) [15] and Rwanda (10.4 months) [17]. In Western countries, five-year survival rates range between 10% and 15% [11]. These differences may be partly explained by the small sample size in our survival analysis, but also reflect advanced-stage disease at diagnosis and limited access to comprehensive multimodal care.

5. Limitations

A major limitation of this study is the high loss to follow-up, which resulted in overall survival being assessed in only 18 of the 52 operated patients. This may have introduced selection bias, as patients with available follow-up data may not be representative of the entire operated population. For instance, some patients may have been lost to follow-up because they died at home without notification to the treating hospitals. Consequently, survival estimates should be interpreted with caution and considered exploratory. This limitation reflects the challenges of long-term patient follow-up in routine clinical practice in low-resource settings such as Benin, including incomplete contact information, financial constraints, and the absence of structured follow-up systems.

In addition, the high proportion of patients with undocumented nodal status (Nx) and the limited use of preoperative computed tomography imaging may have

affected the accuracy of surgical compliance assessment and could have led to an overestimation of adherence to international surgical oncology recommendations.

6. Conclusion

Gastric cancer is not uncommon in southern Benin and continues to represent a significant surgical oncology burden. Although therapeutic strategies have evolved over time, resectability rates remain low, largely due to advanced-stage presentation at diagnosis. Surgery remains the cornerstone of curative treatment for gastric cancer and must be integrated within a multimodal approach that includes perioperative chemotherapy. Improving early diagnosis, timely staging, and access to standardized surgical oncology care is essential to increase curative resection rates and ultimately improve survival outcomes in this population.

Ethics Declarations

Ethics Approval and Consent to Participate

This retrospective study received ethical approval from the Health Sciences Research Ethics Committee (Comité d'Éthique pour la Recherche en Sciences de la Santé—CER-SS) of the University of Abomey-Calavi, Benin. It was registered under reference number 001-2025/CER-SS. Authorization from hospital administrators and department heads was obtained prior to data collection. In addition, letters of permission were provided by all hospitals where data collection took place by the hospital administration. Strict confidentiality and professional secrecy were maintained. Completed forms were stored securely. Access to the digital database was restricted to the research team, protected by username and password. Files were anonymized and coded before any electronic transfer.

The requirement for informed consent was waived by the Ethics Committee, as the study used anonymized hospital records.

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Conflicts of Interest

The authors declare that they have no conflict of interest.

Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Note on the Use of Artificial Intelligence

During the preparation of this article, the generative artificial intelligence tool ChatGPT (GPT-5, OpenAI; accessed November 2025) was used occasionally to

assist with translation and the reformulation of specific paragraphs. Its use was limited to linguistic clarifications, and all content was reviewed, validated, and finalized by the authors.

Authors' Contributions

GFHR conceived the study. GFHR, LI, and AA designed the research and analyzed the data. AA collected the data. AA and GFHR performed the statistical analyses. GFHR, HR, and ASGR drafted the manuscript. LI, GR, and ASGR contributed to data interpretation and manuscript revision. All authors reviewed and approved the final manuscript.

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