The Effect of Pre- And Post-Operative Prognostic Values on Patient Survival in Patients With Stomach Cancer

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ABSTRACT

Objective: Prognostic values in gastric cancer have been frequently investigated in the literature. While some studies have yielded similar results, others have been the subject of debate. In our study, we examined several preoperative and postoperative parameters to evaluate factors that may influence prognosis. This study retrospectively evaluated the prognostic factors and investigated their impact on postoperative patient survival.

Methods: This retrospective study examined the clinical records, pathological results, and operative reports of 180 patients who underwent elective surgery for gastric cancer at the General Surgery Clinic of Kocaeli University Faculty of Medicine Research and Practice Hospital between January 2017 and December 2020.

Results: The impact of different surgical procedures on patient survival: 61.2% of patients who underwent total gastrectomy, 68.4% who underwent subtotal gastrectomy, and 43.7% who underwent other surgical procedures survived. Among patients with Stage 0+1 disease, 83.8% survived, whereas this rate was lower in patients with other stages (p = 0.007). These results suggest that tumor metastasis plays an important role in treatment effectiveness and patient survival (p = 0.004). The presence of lymph node metastases significantly impacts cancer patients' survival (p = 0.004). The rate of metastases in dissected lymph nodes was also significant in multivariate analysis (p = 0.041).

Conclusion: In this study, when evaluated univariately, four values (stage, presence of lymph node metastasis, serosa invasion, and metastasis rate in the dissected lymph node) were predictive of prognosis, whereas, when analyzed multivariately, only one value (metastasis rate in the dissected lymph node) was significant.

Keywords: Gastric Cancer, Lymph Node, Metastasis, C-Reactive Protein (CRP), Albumin.

INTRODUCTION

Although it is trending downward, approximately 1 million people are diagnosed with gastric cancer each year. Studies have shown that it is the fifth most frequently diagnosed cancer worldwide. More than 780.000 people die from gastric cancer, accounting for approximately 8.2% of all cancer-related deaths (1, 2).

Gastric cancer accounts for 5% of cancer cases in Turkey, and it is the second most common gastrointestinal tumor. Additionally, it is the sixth most common cancer in women and the fifth most common in men in our country. Although it is subject to a complex treatment algorithm, surgery is the most effective treatment option (3). While the stage of the disease at the time of diagnosis is very important for prognostication, it also plays a significant role in geographic location, depending on the patient's characteristics, socioeconomic level, and dietary habits. Five-year survival is 27% in the US, 10-30% in EU countries, and approaching 90% in Japan. Also, 70% of gastric cancers occur in developing countries (2, 4 – 6).

Prognostic values in gastric cancer have been frequently investigated in the literature. While some studies have yielded similar results, others have been the subject of debate (7). In our study, we examined several preoperative and postoperative parameters to evaluate factors that may influence prognosis. This study retrospectively evaluated the prognostic factors and investigated their impact on postoperative patient survival.

METHOD

This retrospective study examined the clinical records, pathological results, and operative reports of 180 patients who underwent elective surgery for gastric cancer at the General Surgery Clinic of Kocaeli University Faculty of Medicine Research and Practice Hospital between January 2017 and December 2020.

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. Our institution has granted ethics committee approval with protocol number 2022/260. As this was a retrospective study, informed consent was not obtained from participants.

We investigated the impact of preoperative and postoperative prognostic values on patient survival in patients with gastric cancer who underwent surgery. Prognostic factors included patient gender, age, tumor location in the stomach, preoperative CRP/albumin (CRP/ALB) levels, neoadjuvant therapy, surgery type, resection margin, tumor stage, size, histological type, serosa invasion, metastasis to the liver, lymph nodes, peritoneum, and other distant organs, Lauren classification, pathological lymph node involvement rate in dissected lymph nodes, and postoperative adjuvant therapy. Fifty-nine patients with incomplete clinical records, those who underwent surgery for recurrent gastric cancer, or those who underwent surgery for benign conditions were excluded from the study.

Statistical Analysis

Patient data collected within the scope of the study were analyzed with the IBM Statistical Package for the Social Sciences (SPSS) for Windows 26.0 (IBM Corp., Armonk, NY) package program. Frequency and percentage for categorical data, and mean and standard deviation for continuous data, were provided as descriptive statistics. For comparisons between groups, the "Independent Sample T-test" was used for two groups, and the "Pearson Chi-Square Test" was used to compare categorical variables. The Kaplan-Meier method and Cox regression analysis were used in survival analysis. The results were considered statistically significant when the p-value was less than 0.05.

RESULTS

Table 1. Baseline demographics of patients according to gender, age, tumor localization, and preoperative CRP/ALB

Gender	N	%
Female	34	28,1%
Male	87	71,9%
Age		
24-40	4	3,3%
40-60	49	40,5%
>60	68	56,2%
Tumor Localization		
Cardia	39	32,2%
Corpus	29	24%
Antrum - pylorus	53	43,8%
Preoperative CRP/ALB		
<0.025	75	62%
≥0.025	40	33,1%
None	6	5%
Total	121	100%

This retrospective study included 121 patients, 87 men and 34 women. Guided by previous studies, three age groups were identified: 24-40 years old, 40-60 years old, and >60 years old. We observed that gastric cancer was more common in the >60 age group. When tumor location was examined, the most common location was in the antropyloric region. Preoperative CRP/ALB levels were measured in 62% of the patients. Among the total number of patients, 66 received neoadjuvant therapy, and 67 underwent total gastrectomy. A total resection with R0 margin was reported in 101 patients, including 33 with stage 1

and tumor size ranging from 2 to 58 cm. Pathology revealed adenocarcinoma in 89 patients, and 51 patients had serosa invasion. According to the Lauren classification, 56 patients had intestinal-type disease. Lymph node metastases were present in 56.2%, liver metastases in 4.1%, peritoneal metastases in 91.7%, and other organ metastases in 80.2%. When the dissected lymph nodes were evaluated, metastases were found in 62 patients (rate $\geq$ 17%). Postoperatively, 89 of 121 patients received adjuvant therapy. Consequently, 38.8% of the 121 patients included in the study died of their disease by the time the study was terminated (Table 1).

When examined by age group, the highest mortality rate was observed in those over 60. 58.8% of patients in this age group survived, while 41.2% died. Compared to other age groups, the lowest mortality rate was between 24 and 40 years of age. Twenty-five percent of patients in this age group died. Consequently, this table demonstrates that age significantly impacts patient outcomes (p = 0.742).

Table 2. Patient data according to postoperative resection margin, stage, and size in the study data

Rezection	N	%
R0	101	83,5%
R1	4	3,3%
Unresektable	16	13,2%
Stage		
0+1	37	30,5%
2	28	23,1%
3	28	23,1%
4	28	23,1%
<2 cm	20	16,5%
2-5 cm	58	47,9%
>5 cm	43	35,5%
Total	121	100%

The most common location of gastric cancer was the antropyloric region (43.8%). However, 66% of patients in this region survived. While 56.4% of patients with cardiac involvement survived, only 58.6% of patients with corpus involvement survived (Table 2). A difference in survival rates by tumor location within the stomach was observed, but it was not statistically significant (p = 0.624). According to the data, the majority of patients (62%) were in the group with preoperative CRP/ALB values <0.25. In this group, 65.4% of patients survived, while 34.6% died. Similarly, in the group with a P <0.25, 57.5% survived, while 42.5% died (p = 0.26) (Table 3).

Table 3. Comparison of preoperative CRP/ALB levels and vital status

CRP/ALB	Alive	Deceased	Total
<0.025	49 (%65,4)	26 (%34,6)	75 (%62)
≥0.025	23 (%57,5)	17 (%42,5)	40 (%33)
Yok	2 (%33,3)	4 (%66,7)	6 (%5)
Total	74 (%61,2)	47 (%38,8)	121(%100)

Fifty-six percent of patients who received neoadjuvant chemotherapy survived from surgery to the start of the study, compared to 67.3% of patients who did not receive neoadjuvant chemotherapy. The lower survival rate among patients who received neoadjuvant chemo or radiotherapy was due to their advanced stage (p = 0.283).

These data demonstrate the impact of different surgical procedures on patient survival: 61.2% of patients who underwent total gastrectomy, 68.4% who underwent subtotal gastrectomy, and 43.7% who underwent other surgical procedures survived. Among patients with Stage 0+1 disease, 83.8% survived, whereas this rate was lower in patients with other stages (p = 0.007). Additionally, 81.8% of patients had adenocarcinoma histology. While there were no deaths in benign tumors (10.8%), the mortality rate in resectable adenocarcinoma patients was 40.4%. Patients without serosa invasion had a higher survival rate, while those with serosa invasion had a lower survival rate. These results suggest that tumor metastasis plays an important role in treatment effectiveness and patient survival (p = 0.004) (Table 2).

These data demonstrate the varying survival rates of different histological types of gastric cancer. While 53.9% of patients with diffuse gastric cancer survive, this rate rises to 62.5% in those with intestinal cancer. A similar trend is observed for other histological types. Therefore, it is important to emphasize that different histological types require distinct treatment approaches for gastric cancer, and early diagnosis increases the chance of survival (p = 0.693).

In patients with lymph node metastases, 51.5% died, while 48.5% survived. The situation is different in the absence of lymph node metastases, with a survival rate of 78.3% and a death rate of 21.7%. These results demonstrate that the presence of lymph node metastases significantly impacts cancer patients' survival (p = 0.004). It can be emphasized that patients with lymph node metastases require a more aggressive treatment plan, and regular post-treatment follow-up is crucial (Table 4).

Table 4. The histological type of postoperative tumor, serous invasion of postoperative tumor, and patient numbers according to Lauren classification in the study data

Hystologic Type	N	%
Adenocarcinoma	99	81,8%
Benign	8	6,6%
None	14	11,6%
Serosal invasion		
No	70	57,9%
Yes	51	42,1%
Lauren Classification	**Frequency**	**%**
Diffuse	26	21,5%
Intestinal	56	46,3%
Other	39	2,2%
Lenf Nodu metastazı	**N**	**%**
No	46	38,0%
Yes	68	56,2%
Other	7	5,8%
Total	121	100%

According to the analysis, 63.1% of patients without peritoneal metastases were alive, while 36.9% had died. Furthermore, 40% of patients with peritoneal metastases are alive, while 60% have died. Of patients without organ metastases, 64.9% are alive, while 35.1% have died. Of those with metastases, 47.8% are alive, while 52.2% have died (p = 0.201). Conclusively, patients with a lower rate of pathological lymph node metastases had a higher chance of survival. This demonstrates that the rate of pathological lymph nodes has a significant impact on treatment success and survival. The rate of metastases in dissected lymph nodes was also significant in multivariate analysis (p = 0.041). These data suggest that patients who received adjuvant therapy had a higher survival rate than those who did not. 64% of patients who received adjuvant therapy survived, compared to only 53% of patients who did not.

DISCUSSION

Despite early diagnosis, surgery, and neoadjuvant chemotherapy, stomach cancer remains the most common cause of cancer-related death. If diagnosed and treated in the first stage — before it has metastasized beyond the stomach — the 5-year survival rate is 70%. For stage 2, the 5-year survival rate after treatment is 32-45%; for stage 3, it is 9-20%. If the cancer had metastasized beyond the stomach to a distant part of the body, the 5-year survival rate in stage 4 is 4% (8, 9). The aim of this study was to investigate the effects of age, sex, tumor location, preoperative CRP/ALB values, neoadjuvant therapy, type of surgery, resection margin, other organ metastasis, lymph node metastasis, peritoneal metastasis, liver metastasis, serosa invasion, postoperative tumor size, histopathological type, tumor stage, Lauren classification, histopathological lymph node metastasis rate, and postoperative chemo or radiotherapy on survival in our surgical population. Studies on patients with gastric cancer show a 1.7- to 2-fold higher prevalence in men than in women (10, 11). In our study, 71.9% of patients were men and 28.1% were women. While 54.5% of the women died, this rate was measured as 67.3% in men. Studies on age groups have shown that younger patients have a shorter life expectancy, but because the disease is more

common in people over 60 years of age, this is the age group with the highest mortality rate, at 41.2% (12). When we look at tumor location, studies and our study show that tumors are more commonly seen in the antropyloric region, or the lower third. However, the highest mortality rate, at 43.5%, is seen in tumors located in the cardia, or the upper third (13).

In their study on CRP/ALB values, Xuechao Liu et al. (14) found that patients with CRP/ALB values ≤ 0.025 had significantly longer median survival than those with CRP/ALB values > 0.025. Similar results were obtained in our study. While the mortality rate was 42.5% in patients with CRP/ALB values > 0.025, it was 34.6% in those with CRP/ALB values ≤ 0.025 (15). Although Gökler et al.'s study (16) on the effect of metastasis rates in dissected lymph nodes on survival found no effect, in our study, 28 of 70 patients (40%) with metastasis rates > 17% in dissected lymph nodes died. Of the 42 patients with a metastasis rate of <17%, 10 died (24%) (p = 0.041). A study by Bademler et al. (17) found that the presence of lymph node metastases in patients with gastric cancer significantly affected survival. Five-year overall survival rates were 74.3%, 66.3%, 59.8%, and 30% for N0, N1, N2, and N3, respectively (p = 0.004). Yokota et al. (18) reported that tumor size affected survival in patients with gastric cancer, but it was not an independent factor in multivariate analyses. However, tumor size may be an important factor for patients diagnosed with cancer, especially considering the higher mortality rates associated with larger tumor sizes. A study by Joong Min Park et al. (19) found that while 5-year survival was >90% in patients with early-stage gastric cancer (stage 1b), it was much lower in advanced stages. Our study also found that 83.8% of patients in the stage 1+2 group survived. Hasan Aydede et al. investigated the effects of depth of invasion on survival and found that depth of invasion was more prognostically significant than tumor size and inversely associated with survival (20).

In this study, we divided patients into two groups based on the presence or absence of serosa invasion. Of the 70 patients without serosa invasion, 19 (27.1%) died, while 28 (54.9%) of the 51 patients with serosa invasion died, with a statistically significant difference (p = 0.004).

CONCLUSION

Although numerous studies have been conducted on the prognosis of patients with gastric cancer, there are still areas for further study. In our study, we evaluated prognostic markers in gastric cancer patients we treated. In this study, when evaluated univariately, four values (stage, presence of lymph node metastasis, serosa invasion, and metastasis rate in the dissected lymph node) were found to be predictive of prognosis, whereas, when analyzed multivariately, only one value (metastasis rate in the dissected lymph node) was significant. While advancements in preoperative imaging and minimally invasive intervention devices have helped surgeons and oncologists, they remain insufficient. It is undeniable that future advancements in molecular, genetic, biological, and other methods will contribute to both patient survival and aid surgical and medical practitioners.

DESCRIPTIONS

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AI Statement: The authors used AI and AI-assisted Technologies (Grammarly and MS Word Editor) in the writing process. These technologies improved the readability and language of the work but did not replace key authoring tasks such as producing scientific or medical insights, drawing scientific conclusions, or providing clinical recommendations. The authors are ultimately responsible and accountable for the contents of the whole work.

Consent for Publication: The original article is not under consideration by another publication, and its substance, tables, or figures have not been published previously and will only be published elsewhere.

Data Availability: The data supporting this study's findings are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Ethical Declaration: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

Our institution has granted ethics committee approval with protocol number 2022/260. As this was a retrospective study, informed consent was not obtained from participants.

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