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Significance of the Modified Glasgow Prognostic Score in Predicting the Short-Term Outcome of Patient with Operable Gastric Carcinoma

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ABSTRACT

Background: Modified Glasgow Prognostic score (mGPS) is a treatment independent, routinely available, and well standardized prognostic factor, that reflects both an ongoing systemic inflammatory response and a progressive nutritional decline in patients with advanced cancer. Considering the data scarcity in our country context, this study aimed to assess the significance of mGPS for predicting short-term outcome of operable gastric carcinoma patients in a tertiary care hospital of Bangladesh.

Methodology: This observational study was conducted in the Department of General Surgery, Bangabandhu Sheikh Mujib Medical University for 12- month period following acceptance of the protocol from January 2023 to December 2023. A total of 38 patients with gastric carcinoma who underwent curative surgery were included after getting informed written consent. Socio- demographic history, clinical presentation, pre-and post-operative mGPS, and in-hospital outcome were recorded. Data were collected in separate case- record form and analyzed by SPSS-26. In this study Chi-square, paired-t test, multiple response considered & one way ANOVA were used.

Result: The mean age was 58.39 (±10.62 SD) years with male majority (60.5%). Abdominal pain (68.4%), weakness (68.4%), and weight loss (65.8%) were the commonest presentation. Among all patients, two patients (5.3%) died and 11patients (28.9%) developed post-operative complications, mainly Surgical site infection (10.5%), cardiac complication (2.6%), hemorrhage (2.6%), anastomotic leakage (5.3%). The percentage of patients with mGPS 0 decreases from 55.3% pre- operatively to 28.9% post-operatively, while the percentage of patients with mGPS 1 increases from 36.8% to 65.8%. Post- operative complication, especially anastomotic leakage, wound complication, and cardiac complication were associated with higher post-operative mGPS ($p<0.05$).

Conclusion: The percentage of patients with mGPS 0 significantly decreases post-operatively, while the percentage of patients with mGPS 1 increases post-operatively. Besides, post-operative complications, especially anastomotic leakage, stomal obstruction, wound complication, and cardiac complication were associated with higher post-operative mGPS. Hence, it can be concluded that modified Glasgow Prognostic score is significant association with short-term outcome of patient with operable gastric carcinoma.

Keywords: Modified Glasgow Prognostic Score, Short-Term Outcome, Gastric Carcinoma.

INTRODUCTION

Gastric cancer is one of the most prevalent cancers, with significant geographic, ethnic, and socioeconomic disparities in prevalence. Until lung cancer overtook it as the top cause of cancer fatalities in the 1980s, it was the world's leading cause of cancer deaths, but it has remained a major public health concern [1].Gastric cancer is the fourth greatest cause of cancer deaths globally, trailing only lung and colorectal cancer in terms of overall mortality, according to GLOBOCAN 2020 data. Gastric cancer accounts for approximately one- twelfth of all oncological fatalities. Gastric cancer is the sixth highest incidence rate among cancers, accounting for 5.7% [2] of all new cases. Every year, almost a million new cases of stomach cancer are reported worldwide. Gastric cancer is also one of the major tumors that is most behaviorally influenced and thus prevented [3].The Glasgow prognostic score (GPS), which is a cumulative inflammation- based cancer-prognostic marker made up of an increase in CRP and a decrease in albumin concentration in the blood, is thought to reflect the host's systemic inflammatory response and has been shown to be useful as a prognostic indicator in cancer patients [4,5,6]. The first study on GPS, published in 2003, found that it might be used to predict prognosis in patients with non-small-cell lung cancer [7]. Following that, mounting evidence revealed that GPS might be used as a standalone prognostic marker in a range of cancers, [6] including hepatocellular carcinoma, esophageal cancer, gastric cancer, renal cancer, and pancreatic cancer [8-12]. In addition to the original GPS, the modified GPS (mGPS) was employed to assess inflammatory status before to surgery in patients with stomach cancer to see which score is more indicative of prognosis. The mGPS can predict postoperative survival for patients with stomach cancer, according to a study [13]. More importantly, the mGPS may be easily obtained prior to surgery, and it appears to be comparable to traditional tumor markers such as carcinoembryonic antigen and carbohydrate antigen 19-9 [14]. A study including 232 gastric carcinoma patients found GPS based on abnormalities of serum albumin and CRP is a reasonable as a universal parameter to determine prognosis of patients with gastric carcinoma. This is quite useful and simple parameter for clinical use and helpful to predict prognosis of patients with gastric carcinoma [6]. Another study reported even if gastric carcinoma patients have a normal serum level of carcinoembryonic antigen (CEA), the GPS is able to predict their postoperative survival and classify such patients into three independent groups before surgery [15]. A comparative study revealed modified GPS is a superior predictor of survival compared with the cellular components of the systemic inflammatory response (SIR) in patients undergoing resection of GC [16]. There is no head-to-head study has been published in Bangladesh. The study will generate evidence for the physicians to learn more about gastric carcinoma and the prognosis. The findings will bring about changes in existing treatment protocol which will eventually help the patients.

METHODOLOGY OF THE STUDY

Study design: Observational Longitudinal study

Study place: Department of General Surgery (with Surgical Oncology), Bangabandhu Sheikh Mujib Medical University (BSMMU) Shahbag, Dhaka, Bangladesh.

Study period: One Year (January 2023 to December 2023).

Study population: Patients with gastric carcinoma who underwent curative surgery in Department of General Surgery and Fulfilled the inclusion and exclusion criteria.

Sample size: A sample size of 37 achieves 80.515% power to detect a difference (P1-P0) of 0.2200 using a two-sided Z-test uses S(P0) to estimate the standard deviation with a significance level (alpha) of 0.0500. These results assume that the population proportion under the null hypothesis (P0) is 0.2500. Source: Journal of Clinical Medicine: Received: 19 July 2019; Accepted: 10 September 2019; Published: 12 September 2019 [17]
So, the final targeted sample of the study was 38.

Eligibility Criteria

Inclusion criteria:

- Diagnosed gastric carcinoma who will undergo surgery with curative intent.

Exclusion criteria:

- Previous history any gastric surgery
- Suffering from inflammatory disease-causing higher CR
- Received neoadjuvant therapy
- Patient of gastric carcinoma with malignancy in other organs
- Not willing to participate

Study procedure

This longitudinal study will be conducted in Department of General Surgery BSMMU, Dhaka, Bangladesh from January 2023 to December 2023. The study population were the patients diagnosed of gastric carcinoma who underwent surgery with curative intent. Prior commencing, inclusion and exclusion criteria were matched for each individuals. A total of 37 patients were included and interviewed for the study. Before interview of the patients, the study purpose and procedure of the study was discussed with them and written informed consent was taken from those who agree to participate in the study. Ethical clearance was obtained from the institution beofore commencement of the study. After getting consent, the parents were studied in four subheading including socio-demographic parameters (age, occupation, living standard, monthly income etc.), about the disease and duration of disease, co-morbid disease and their laboratory profile, Modified Glassgow Prognostic Score was evaluated pre-operatively and post operatively. During and after operation, all the patients were followed up by the researcher. Patients' short-term outcome was followed up at after 48 hours of operation, at 7th POD and at 1st month. Separate data collection sheet were used for each subject with maintaining confidentiality. Highest level of confidentiality and ethical standard was maintained during storage and analysis of the data. Data analysis was done by statistics software, SPSS 26.

Data Processing and Analysis

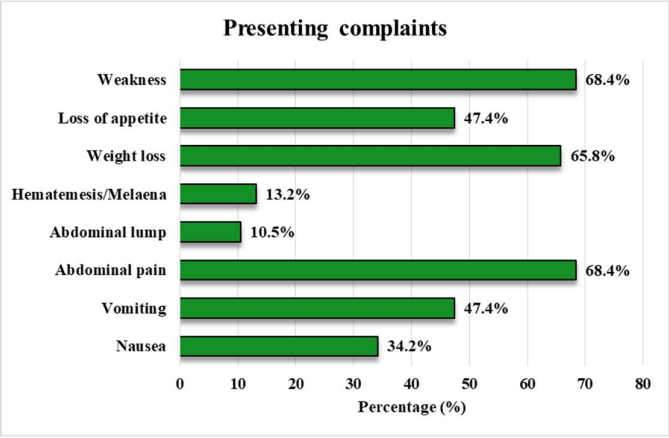
After collection of all the required data, these were checked, verified for consistency and tabulated using the SPSS/PC software. Statistical significance is set as 95% confidence level at 10% acceptable error level. Patients' characteristics were reported as percentages or mean ± standard deviation. Chi square tests were used to compare the difference of proportion values between GPS scores. Survival curves were made using the Kaplan- Meier method, and the Mantel-Cox test was used to analyze the equality of the survival curves. On multivariate analysis to determine the independent prognostic indicators, a Cox propor- tional-hazards model in a forward stepwise manner was used. P values < .05 were considered significant. Data will be analyzed using SPSS 26 for Windows 10 (SPSS, Inc, Chicago, IL). Graph & chart will be expressed by using SPSS 26 and MS Excel.

RESULTS

Table-1: Demographic characteristics of the study population (n=38)

Demographic variables	Frequency (n)	Percentage (%)
Age Group		
≤40 years	2	5.3
41-50 years	6	15.8
51-60 years	14	36.8
61-70 years	8	21.1
>70 years	8	21.1
Mean±SD age, years	58.39±10.62	
Gender		
Male	23	60.5
Female	15	39.5

A total of 38 patients were enrolled in the study, 23 (60.5%) were males and 15 (39.5%) were females. The mean age was 58.39 (±10.62 SD) years. Majority aged between 51-60 years (36.8%).



*Multiple response

Figure-1: Presenting complaints of the gastric carcinoma patients in the study (n=38).

It was found that many of the patients had common symptoms like abdominal pain (68.4%), weakness (68.4%),

and weight loss(65.8%).

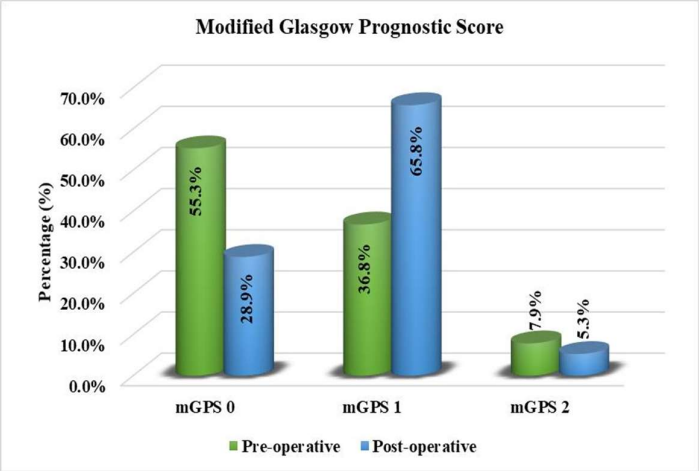
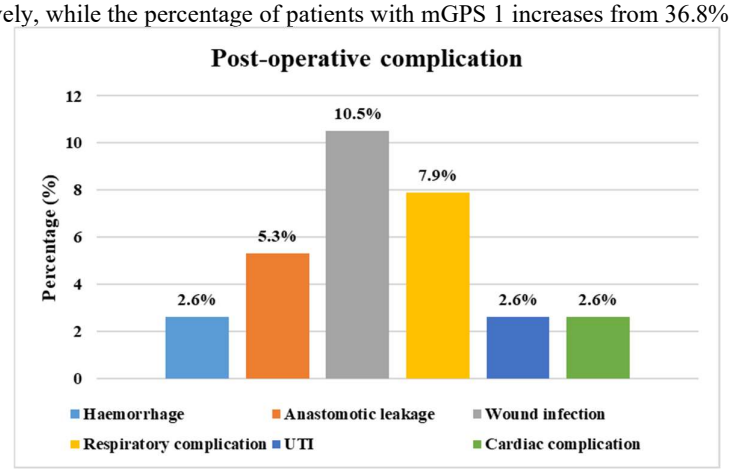


Figure-2: Pre and post-operative Modified Glasgow prognostic score in operable gastric carcinoma patients (n=38)

The distribution of patients across different mGPS (modified Glasgow prognostic score) categories changes after the operation. For instance, the percentage of patients with mGPS 0 decreases from 55.3% pre-operatively to 28.9% post-operatively, while the percentage of patients with mGPS 1 increases from 36.8% to 65.8%.



*Multiple response considered

Figure-3: Post-operative complications among the study participants (n=38).

Post-operative complications were observed in 11 (28.9%) patients. Among them, majority were wound infection (10.5%), respiratory complication (7.9%), anastomotic leakage (5.3%).

Table-2: Causes of death in postoperative period in the study (n=2)

Mortality related variables	**Frequency (n)**	**Percentage (%)**
Cause of death (n=2)		
Cardiovascular cause	1	50.0
Septicaemia	1	50.0
Mean (±SD) time of death after surgery	6.50±4.95	
Min-Max	3- 10	

Among 2 patients who died in postoperative period, 1 (50.0%) died due to cardiovascular causes and rest (50.0%) due to septicaemia. The mean time of death after surgery was 6.50±4.95 days.

Table-3: Association between pre-operative mGPS and post-operative Complications (n=38).

Variables	mGPS 0 (n=21)	mGPS1 (n=14)	mGPS 2 (n=3)	P value*
Post-operative complication				
Yes	3 (14.3%)	5 (35.7%)	3 (100.0%)	0.007
No	18 (85.7%)	9 (64.3%)	0	
List of complications				
Hemorrhage	1 (4.8%)	0	0	0.66
Anastomotic leakage	1 (4.8%)	0	1 (33.3%)	0.063
Stomal obstruction	0	0	0	-
Wound infection	1 (4.8%)	2 (9.6%)	1	0.549
Intraabdominal abscess	0	0	0	
Respiratory complication	1 (4.8%)	2 (14.3%)	0	0.515
UTI	0	1 (7.1%)	0	0.415
Cardiac complication	0	0	1 (33.3%)	0.003

Column percentage considered; *P value measured by Chi-square test

The table presents the association between pre-operative modified Glasgow Prognostic Score (mGPS) and post-operative complications among study population. The table shows the distribution of complications across three mGPS categories: mGPS 0, mGPS 1, and mGPS 2. The incidence of post-operative complications increases with higher mGPS values, with statistically significant differences (P<0.05). The complications include various categories such as hemorrhage, anastomotic leakage, wound complications, respiratory complications, urinary tract infections (UTI), and cardiac complications.

Table-4: Comparison of hospital stay and post-operative hospital stay among different mGPS categories (n=38).

Variables	mGPS 0 (n=21)	mGPS 1 (n=14)	mGPS 2 (n=3)	P value*
Mean hospital stay, days	14.86±2.08	15.71±1.86	17.01±2.65	0.177
Mean post-operative hospital stay, days	9.48±2.32	9.79±1.85	8.33±4.72	0.631

*P value measured by one-way ANOVA

This table presents a comparison of hospital stay and post-operative hospital stay across distinct mGPS categories (mGPS 0, mGPS 1, and mGPS 2) in a sample of 38 patients. The mean durations for hospital stay and post-operative hospital stay are provided for each category. Statistical analysis using one-way ANOVA indicates no significant differences in both measures across mGPS categories (P > 0.05) though there is an increasing trend of mean hospital stay with increasing mGPS score.

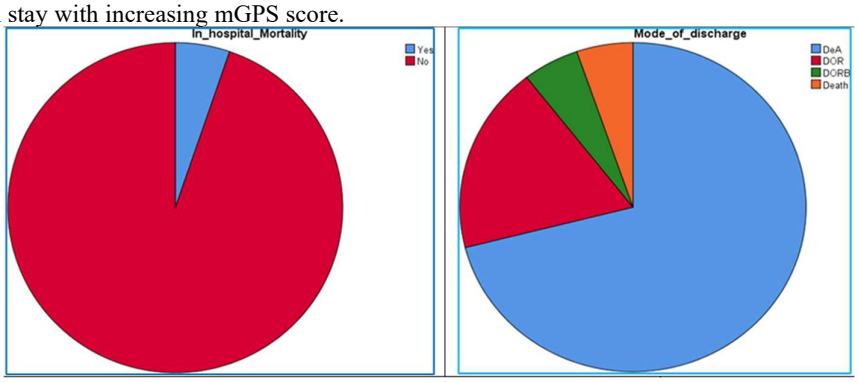


Figure-4: Post-operative hospital outcome in the gastric carcinoma patients (n=38).

Among all patients, 2 (5.3%) experienced death and 36 (94.7%) recovered. Among recovered patients, 71.1% were discharged with advice, 18.4% left on request, 5.3% were discharged on risk bond.

Table-5: Comparison of pre-operative and post-operative clinical features in patients (n=38)

Clinical features	Pre-operative n (%)	Post-operative n (%)	P value*
Nausea	13 (34.2%)	12 (31.6%)	0.807
Vomiting	18 (47.4%)	14 (36.8%)	0.353
Abdominal pain	26 (68.4%)	14 (36.8%)	0.005
Abdominal lump	4 (10.5%)	-	-
Hematemesis / melaena	5 (13.2%)	-	-
Loss of appetite	18 (47.4%)	7 (18.4%)	0.007

Weakness	26 (68.4%)	21 (55.3%)	0.238

*P value measured by chi-square test

The analysis unveils significant reductions in post-operative abdominal pain (P=0.005) and loss of appetite (P=0.007), signifying improved conditions after surgery. Additionally, the data demonstrates that other symptoms like nausea, vomiting, and weakness did not show statistically significant changes post- operatively.

DISCUSSION

Globally, gastric cancer is the fourth most common malignancy and the second most common cause of cancer related death after lung cancer [18]. Despite improvements in chemotherapy, radiotherapy and endoscopic treatment, gastrectomy with D2 lymphadenectomy is considered the first treatment choice for advanced gastric cancer worldwide [19,20]. The objective of this study was to evaluate the significance of the Modified Glasgow Prognostic Score (mGPS) in predicting the short-term outcome of patients with operable gastric carcinoma. In our study among 38 study subjects, 11(28.9%) cases developed complications. This rate of complications was within the reported range of 20- 46% mentioned in the summary of a most recent systematic review and meta- analysis of 64 follow- up studies following gastrectomy for cancer by Li et al[21].Many studies on the association of age on postoperative outcome after gastrectomy has been published in recent time by Wakahara et al. [22] and others but their observations have been a subject of controversy and debate. In our series major complications and 30 days mortality were not associated with older age (> 60 years); p-value 0.643 and 0.490 respectively. Norero et al. [13] also found that older age (≥ 80, ≥ 70 and ≥ 65 years respectively) was not associated with higher grade (> IIIa) complications and 30 days mortality.The assessment of clinical features before and after surgery provided valuable insights into the impact of surgical intervention on the patients' symptoms. Among the symptoms evaluated, two, namely abdominal pain and loss of appetite, showed statistically significant improvements after surgery. This suggests that surgical treatment for gastric carcinoma can lead to a reduction in pain and an improvement in appetite, which are important aspects of a patient's quality of life. Appetite signal stimulated by Ghrelin which is mainly secreted by A-like cells mostly located in the fundus of the stomach [24]. A significant decline in ghrelin levels and a reduction in appetite in short-term follow-up after gastrectomy have been reported from prospective studies, with the effect being more pronounced in patients having undergone total gastrectomy compared to distal gastrectomy [25-28]. In this study, the analysis of CRP levels before and after surgery revealed a statistically significant change in CRP levels. The mean CRP levels increased from the pre-operative period (20.56±21.28mg/L) to the post-operativeperiod (27.78±25.68 mg/L), with a p value of 0.034, indicating statistical significance. This increase in CRP levels post-surgery can be attributed to the surgical trauma and the body's natural inflammatory response to the procedure [29]. Furthermore, it's worth noting that a substantial percentage of patients had CRP levels above 10 mg/L both before (44.7%) and after (71.1%) surgery, indicating the presence of underlying inflammation in many gastric carcinoma patients. Post-operatively, the percentage of patients with CRP levels above 10 mg/L increased significantly. This suggests that surgery may exacerbate the existing inflammatory state in these patients. Post-operative complications were observed in a considerable proportion of patients, with surgical site infection (10.5%), cardiac complications (2.6%), hemorrhage (2.6%), and anastomotic leakage/duodenal stump leakage (5.3%) being the most common. It is essential to note that these complications can significantly impact the post-operative recovery and overall prognosis of patients with gastric carcinoma. Proper management and early recognition of these complications are crucial to improving patient outcomes. Surgical site infections (SSIs) are a leading cause of nosocomial infectious complications, accounting for 14-16% of nosocomial infections overall and 38% of nosocomial infections among surgical patients [30]. SSIs after radical gastrectomy for GC are a clinically important issue as they are associated with prolonged hospitalization, increased treatment costs, decreased patient quality of life [30,31].Patients with higher mGPS scores, indicating a more severe systemic inflammatory response, may benefit from closer post-operative monitoring and tailored interventions to reduce the risk of complications. Some studies also show that mGPS may serve as a valuable prognostic factor of survival, independent of TNM stage for patients with esophageal cancer and colorectal cancer [8,35]. Recent meta-analysis indicate that GC patients with a mGPS≥1 have a worse prognosis than patients with a mGPS=0, thus the preoperative mGPS could serve as a prognostic factor to evaluate the survival of these patients [36].Regarding post-operative hospital outcomes, a substantial percentage of patients recovered and were discharged with appropriate medical advice. However, a notable portion of patients also experienced mortality was 2 (5.3%) the causes being cardiovascular issues 1 (50.0%) and septicaemia 1 (50.0%). This highlights the critical importance of post-operative care and follow-up for patients with gastric carcinoma, as these individuals may be at increased risk of post-operative complications and mortality. The statistical analysis, conducted using one-way ANOVA, yielded no significant differences in either hospital stay or post-operative hospital stay among the mGPS categories, with p values of 0.177 and 0.631, respectively. These results suggest that, on average, the mGPS score may not be a strong predictor of variations in the length of hospitalization for this particular patient cohort. However, it is essential to interpret these findings in a broader context and consider potential clinical implications. One noteworthy observation is the presence of an increasing trend in mean hospital stay with higher mGPS scores (14.86±2.08 days, 15.71±1.86 days and 17.01±2.65 days for mGPS 0, 1 and 2

respectively) which was more or less similar to Bruno et al [37] (12± 4.8 days) and Xiao et al. [34] (14.1 ± 4.5 days). While this trend did not reach statistical significance, it may still carry clinical relevance. It raises the possibility that patients with higher mGPS scores tend to have more complex medical conditions, potentially leading to prolonged hospital stays, although other factors not accounted for in this study could be at play.

CONCLUSION

This study assessed the significance of mGPS for predicting short-term outcome of operable gastric carcinoma patients in a tertiary hospital of Bangladesh. The mGPS score varies significantly in postoperative patient. Besides, post-operative complications, especially anastomotic leakage, stomal obstruction, wound complication, and cardiac complication were associated with higher post-operative mGPS. Hence, it can be concluded that modified Glasgow Prognostic score has significant association with short-term outcome of patients with operable gastric carcinoma.

Limitations

- All samples were collected from a single centre,
- The sample size was small.
- Long term follows up was beyond the scope of the study.

Recommendations

Further multicenter study with larger sample size and longer follow up is recommended.
Modified Glasgow Prognostic score can be used to predict the short- term outcome of patient with operable gastric carcinoma.

Conflict of Interest: None.

Source of Fund: Nil.

REFERENCES

1. Siegel, R., Ma, J., Zou, Z. & Jemal, A., 2014. Cancer statistics, 2014. CA: A Cancer Journal for Clinicians, 64(1), 9–29.
2. Bray, F., Ferlay, J., Soerjomataram, I., Siegel, R.L., Torre, L.A. & Jemal, A., 2018. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA: A Cancer Journal for Clinicians, 68(6), 394–424.
3. Prashanth, R. & Adam, B., 2019. Epidemiology of gastric cancer: Global trends, risk factors and preventiRawla, P., &Barsouk, A. (2019). Epidemiology of gastric cancer: Global trends, risk factors and prevention. In PrzegladGastroenterologicznyPrzegladGastroenterologiczny, 14(1), 26–38.
4. Proctor, M.J., Morrison, D.S., Talwar, D., Balmer, S.M., O'Reilly, D.S., Foulis, A.K., et al., 2011. An inflammation-based prognostic score (mGPS) predicts cancer survival independent of tumour site: A Glasgow Inflammation Outcome Study. British Journal of Cancer, 104(4), 726–734.
5. Shapiro, T.A., Fahey, J.W., Dinkova-kostova, A.T., Holtzclaw, W.D., Stephenson, K.K., Wade, K.L., et al., 2006. Safety, tolernce and metabolims of broccoli sprouts glucinolates and isothiocyanates: a clinical phas I study. Nutrition and cancer, 55(1), 53–62.
6. Nozoe, T., Iguchi, T., Egashira, A., Adachi, E., Matsukuma, A. & Ezaki, T., 2011. Significance of modified Glasgow prognostic score as a useful indicator for prognosis of patients with gastric carcinoma. American Journal of Surgery, 201(2), 186–191.
7. Forrest, L.M., McMillan, D.C., McArdle, C.S., Angerson, W.J. & Dunlop, D.J., 2003. Evaluation of cumulative prognostic scores based on the systemic inflammatory response in patients with inoperable non-small-cell lung cancer. British Journal of Cancer, 89(6), 1028–1030.
8. Ishizuka, M., Kubota, K., Kita, J., Shimoda, M., Kato, M. & Sawada, T., 2012. Impact of an inflammation-based prognostic system on patients undergoing surgery for hepatocellular carcinoma: A retrospective study of 398 Japanese patients. American Journal of Surgery, 203(1), 101–106.
9. Vashist, Y.K., Loos, J., Dedow, J., Tachezy, M., Uzunoglu, G., Kutup, A., et al., 2011. Glasgow prognostic score is a predictor of perioperative and long- term outcome in patients with only surgically treated esophageal cancer. Annals of Surgical Oncology, 18(4), 1130–1138.
10. Zhang, C.X., Wang, S.Y., Chen, S.Q., Yang, S.L., Wan, L. & Xiong, B., 2016. Association between pretreatment Glasgow prognostic score and gastric cancer survival and clinicopathological features: A meta-analysis. OncoTargets and Therapy, 9(1), 3883–3891.
11. Lamb, G.W., Aitchison, M., Ramsey, S., Housley, S.L. & McMillan, D.C., 2012. Clinical utility of the Glasgow Prognostic Score in patients undergoing curative nephrectomy for renal clear cell cancer: Basis of new prognostic scoring systems. British Journal of Cancer, 106(2), 279–283.

12. La Torre, M., Nigri, G., Cavallini, M., Mercantini, P., Ziparo, V. &Ramacciato, G., 2012. The glasgow prognostic score as a predictor of survival in patients with potentially resectable pancreatic adenocarcinoma. Annals of Surgical Oncology, 19(9), 2917-2923.
13. Jiang, X., Hiki, N., Nunobe, S., Kumagai, K., Kubota, T., Aikou, S., et al., 2012. Prognostic importance of the inflammation-based Glasgow prognostic score in patients with gastric cancer. British Journal of Cancer, 107(2), 275– 279.
14. Gao, Y. & Huang, D., 2014. The value of the systematic inflammation-based Glasgow Prognostic Score in patients with gastric cancer: A literature review. Journal of Cancer Research and Therapeutics, 10(4), 799–804.
15. Ishizuka, M., Oyama, Y., Abe, A., Tago, K., Tanaka, G. & Kubota, K., 2014. Clinical significance of an inflammation-based prognostic system for gastric cancer patients with a preoperative normal serum level of carcinoembryonic Antigen. Anticancer Research, 34(12), 7219–7226.
16. Jeong, J.H., Lim, S.M., Yun, J.Y., Rhee, G.W., Lim, J.Y., Cho, J.Y., et al., 2012. Comparison of two inflammation-based prognostic scores in patients with unresectable advanced gastric cancer. Oncology (Switzerland), 83(5), 292–299.
17. Hsueh, S.W., Liu, K.H., Hung, C.Y., Kuo, Y.C., Tsai, C.Y., Hsu, J. Te, et al., 2019. Significance of the glasgow prognostic score in predicting the postoperative outcome of patients with stage III gastric cancer. Journal of Clinical Medicine, 8(9), 1-10.
18. De Martel, C., Forman, D. & Plummer, M., 2013. Gastric Cancer: Epidemiology and Risk Factors. Gastroenterology Clinics of North America, 42(2), 219–240.
19. Markar, S.R., Karthikesalingam, A., Jackson, D. & Hanna, G.B., 2013. Long- term survival after gastrectomy for cancer in randomized, controlled oncological trials: Comparison between west and east. Annals of Surgical Oncology, 20(7), 2328–2338.
20. Tanizawa, Y. & Terashima, M., 2010. Lymph node dissection in the resection of gastric cancer: Review of existing evidence. Gastric Cancer, 13(3), 137– 148.
21. Li J, Zhang Y, Hu DM, Gong TP, Xu R, Gao J. Impact of postoperative complications on long-term outcomes of patients following surgery for gastric cancer: A systematic review and meta-analysis of 64 follow-up studies. Asian J Surg. 2020 Jul;43(7):719-729. doi: 10.1016/j.asjsur.2019.10.007. Epub 2019 Nov 6. PMID: 31703889.
22. Wakahara T, Ueno N, Maeda T, Kanemitsu K, Yoshikawa T, Tsuchida S, Toyokawa A. Postoperative morbidity in elderly patients after gastric cancer surgery. Ann Gastroenterol. 2018 Sep-Oct;31(5):621-627.
23. Norero E, Quezada JL, Cerda J, Ceroni M, Martinez C, Mejía R, Muñoz R, Araos F, González P, Díaz A. Risk Factors for Sever Postoperative Complicatons After Gastrectomy for Gastric and Esophagogastric Junction Cancers. Arq Bras Cir Dig. 2019 Dec 20;32(4):e1473.
24. Schütte, K., Schulz, C. &Middelberg-Bisping, K., 2021. Impact of gastric cancer treatment on quality of life of patients. Best Practice and Research: Clinical Gastroenterology, 50–51(6), 1-7.
25. Takachi, K., Doki, Y., Ishikawa, O., Miyashiro, I., Sasaki, Y., Ohigashi, H., et al., 2006. Postoperative ghrelin levels and delayed recovery from body weight loss after distal or total gastrectomy. Journal of Surgical Research, 130(1), 1-7.
26. Takiguchi, S., Takata, A., Murakami, K., Miyazaki, Y., Yanagimoto, Y., Kurokawa, Y., et al., 2014. Clinical application of ghrelin administration for gastric cancer patients undergoing gastrectomy. Gastric Cancer, 17(2), 200– 205.
27. Sharma, L., Purohit, P.M., Pipal, D., Kothari, S., Srivastava, H. & Soni, A., 2017. Serum albumin as predictor of post-operative morbidity and mortality. International Surgery Journal, 4(3), 1078–1081.
28. Sproston, N.R. & Ashworth, J.J., 2018. Role of C-Reactive Protein at Sites of Inflammation and Infection. Frontiers in Immunology, 9(4), 1–11.
29. Paruk, F. & Chausse, J.M., 2019. Monitoring the post surgery inflammatory host response. Journal of Emergency and Critical Care Medicine, 3(2019), 47–47.
30. Mangram, A.J., Horan, T.C., Pearson, M.L., Silver, L.C. & Jarvis, W.R., 1999. Guideline for Prevention of Surgical Site Infection, 1999. Centers for Disease Control and Prevention (CDC) Hospital Infection Control Practices Advisory Committee. American journal of infection control, 27(2), 97–132.
31. Mangram, A.J., Horan, T.C., Pearson, M.L., Silver, L.C. & Jarvis, W.R., 1999. Guideline for Prevention of Surgical Site Infection, 1999. Centers for Disease Control and Prevention (CDC) Hospital Infection Control Practices Advisory Committee. American journal of infection control, 27(2), 97–132.
32. Lee KG, Lee HJ, Yang JY, Oh SY, Bard S, Suh YS, Kong SH, Yang HK. Risk factors associated with complication following gastrectomy for gastric cancer: retrospective analysis of prospectively collected data based on the Clavien-Dindo system. J Gastrointest Surg. 2014 Jul;18(7):1269-77.
33. Nevo Y, Goldes Y, Barda L, Nadler R, Gutman M, Nevler A. Risk Factors for Complications of Total/Subtotal Gastrectomy for Gastric Cancer: Prospectively Collected, Based on the Clavien-Dindo

Classification System. Isr Med Assoc J. 2018 May;20(5):277-280.
34. Xiao H, Xie P, Zhou K, Qiu X, Hong Y, Liu J, Ouyang Y, Ming T, Xie H, Wang X, Zhu H, Xia M, Zuo C. Clavien-Dindo classification and risk factors of gastrectomy-related complications: an analysis of 1049 patients. Int J Clin Exp Med. 2015 May 15;8(5):8262-68.
35. Ma, Q., Liu, W., Jia, R., Jiang, F., Duan, H., Lin, P., et al., 2016. Inflammation- based prognostic system predicts postoperative survival of esophageal carcinoma patients with normal preoperative serum carcinoembryonic antigen and squamous cell carcinoma antigen levels. World Journal of Surgical Oncology, 14(1), 1–6.
36. Zhang, X., Chen, X., Wu, T., Zhang, Y., Yan, K., & Sun, X. (2015). Modified glasgow prognostic score as a prognostic factor in gastriccancer patients: a systematic review and meta-analysis. International journal of clinical and experimental medicine, 8(9), 15222–15229.
37. Bruno, L., Barni, L., Pacciani, S., Masini, G., Tofani, L., Tofani, F., et al., 2014. Complications Following Surgery for Gastric Cancer: Analysis of Prospectively Collected Data. Journal of Cancer Therapy, 05(14), 1454–1466.