Histopathological study of gastric cancer: a retrospective study

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Abstract:

Background: Gastric cancer is one of the common causes of cancer, especially among older males. Its incidence and mortality vary greatly by geography and are highly dependent on food and Helicobacter pylori infection.

Objective: To describe the general pattern of primary gastric cancers in the western region of Odisha and compare the findings of patients' age, sex, gross features, and histological types to findings from other studies.

Methods: Over a five-year period, 82 cases of stomach cancer were included in this descriptive record-based study conducted in the Department of Pathology at VSSIMSAR, Burla. The diagnosis of gastric cancer was made on hematoxylin and eosin-stained sections and were categorized according to the WHO classification system.

Results: Out of 82 cases of Gastric cancer, 51 (62.19%) were males and 31 (37.80%) were females, with a male-to-female ratio of 1.6:1. The most common age group was 51–60 (40.24%), followed by 61–70 (23.17%). Pyloric antrum (73.17%) was the commonest site involved, followed by corpus (17.07%), and cardia (2.43%). Grossly, the most common type was an ulcerative lesion. Microscopically, according to WHO classification, tubular adenocarcinomas were the most common (75.6%), followed by signet ring cell carcinoma (12.19%), poorly cohesive carcinoma, non-signet ring cell type (7.31%), and mucinous carcinoma (2.43%).

Conclusion: The frequency of stomach cancers in the western region of Odisha exhibited demographic characteristics as well as gross features and histological types were comparable to those documented in other parts of the world.

Keywords: Gastric cancer, histopathological type, adenocarcinoma.

Introduction:

Gastric cancer is the fifth most common malignant tumor and the fourth leading cause of cancer-related death worldwide [1]. The incidence varies across different parts of the world owing to differences in cultural and food habits. In India, it is the fifth most common cancer among males and the seventh most common cancer among females [2]. Although there has

been a global decline in incidence and mortality over the past several decades, it remains severe in certain areas, such as Asia [3].

The etiology of gastric cancer is multifactorial and involves a number of environmental and lifestyle factors, including low socioeconomic status, infection with Helicobacter pylori (H. pylori), high intake of salty and smoked foods, low consumption of fruits and vegetables, consumption of fiber, tobacco use, alcohol use, low physical activity, obesity, radiation, gastric reflux disease, positive family history, and inherited predisposition. Conversely, diets rich in fresh fruit and vegetables, which are high in antioxidants and vitamin C, are associated with lower risk [4–7]. However, the cause of stomach cancer is still not fully understood [7]. The majority of gastric cancers are sporadic, while only a small percentage, less than 1%, are hereditary. Hereditary diffuse gastric cancer (HDGC) is a rare malignancy characterised by early-onset, highly-penetrant autosomal dominant inheritance mainly of the germline alterations in the E-cadherin gene (*CDH1*) and β-catenin (*CTNNA1*) [8].

Gastric cancer is difficult to diagnose largely because of the time lag between the onset of growth and the appearance of symptoms [9]. The early symptoms of gastric cancer are nonspecific and vague. The majority of individuals exhibit symptoms that are similar to those of benign peptic ulcers. Subsequently, these patients are diagnosed with late-stage gastric cancer or one of its complications [9]. Endoscopy is the most sensitive and specific diagnostic screening method [10]. However, mass screening for early detection of GC is expensive and recommended in only high-incidence areas. Histopathology remains the definitive diagnosis of gastric cancer. Among malignant tumors of the stomach, carcinoma is the most common, accounting for approximately 90–95% of cases. Next in order of frequency are lymphomas (4%), carcinoids (3%), and malignant spindle cell tumors (2%) [11].

Methods:

This was a descriptive record-based study conducted in the Department of Pathology, VSSIMSAR, Burla, during a period of five years from June 2018 to May 2023. A total of 82 patients with Gastric cancer who were diagnosed histopathologically in gastric endoscopic biopsies and resected samples were included. Ethical clearance was obtained from the institute before the start of the study. The inclusion criteria were all histopathologically diagnosed gastric carcinoma in gastric endoscopic biopsies and resected samples. Cases without detailed clinical and demographic data and metastasis to the stomach were excluded. Relevant clinical data were recorded from patient case sheets. Gross and histological findings of gastric cancer were retrieved from the histopathological record file. The gross features included topography and gross details of the tumor. Gross morphology was based on the Borrmann (1926) classification of polypoid, fungating, infiltrating, and ulcerative types. Diagnosis was made using hematoxylin and eosin-stained sections. The histopathology slides were reviewed and subclassification of gastric cancer was done based on the 2019 World Health Organization (WHO) classification system [12]. The results of this study were compared with those of other studies.

Statistical analysis:

Descriptive statistics were used to analyse the data using SPSS version 20, and the results are presented as percentages and simple frequencies.

Results:

A total of 82 histologically confirmed cases from gastric endoscopic biopsies and resected samples were studied during 5 years period. Total 62.19% of the patients were male and 37.80% were female. The male-to-female ratio was 1.6:1. The most common age group was 51–60 years (40.24%), followed by 61–70 years (23.17%) (Table 1).

73.17% of the gastric cancers were in the pyloric antrum, 17.07% in the corpus (body), and 2.43% in the cardia. A total of 7.31% of cases involved the entire stomach (Table 2). The ulcerative type in 43 cases (52.43%) was the most common gross finding, followed by infiltrative 35 cases (34.14%), fungating 20 cases (20.39%), and polypoid 2 cases (2.43%). Of the 82 patients, 62 (75.60%) had tubular adenocarcinomas, 10 (12.19%) had signet ring cell carcinoma, 6 (7.31%) had poorly cohesive carcinoma non-signet ring cell type, 2 (2.43%) had mucinous adenocarcinoma, and 1 each had papillary adenocarcinoma and undifferentiated carcinoma (Table 3).

Table 1: Age-wise distribution of patients with gastric cancer.

Age group (in years)	Number of patients	Percentage (%)
31-40	14	17.07
41-50	16	19.51
51-60	33	40.24
61-70	19	23.17
Total	82	100

Table 2: Topographical distribution of gastric cancers.

Tumour site	Frequency	Percentage (%)
Pyloric antrum	60	73.17
Corpus	14	17.07
Complete	6	7.31
Cardia	2	2.43
Total	82	100

Table 3: Histopathological distribution of gastric cancers according to the WHO classification.

Histological types	No. of cases	Percentage (%)
Tubular adenocarcinoma	62	75.60
Mucinous adenocarcinoma	02	2.43
Papillary adenocarcinoma	01	1.21
Signet ring cell carcinoma	10	12.19

Poorly cohesive carcinoma, non-signet ring cell type	06	7.31
Carcinoma,undifferentiated, NOS	01	1.21
Total	82	100

Figure 1: Gross picture of carcinoma stomach showing infiltrative growth and localised thickening of the wall involving the pyloric antrum.
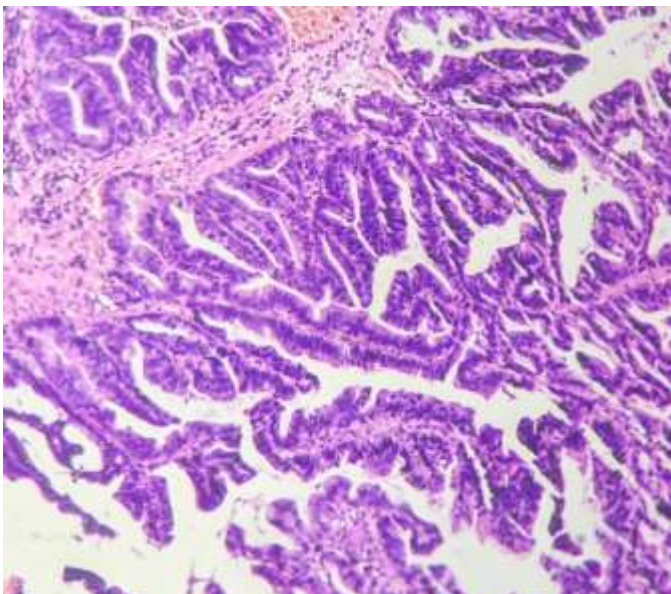

Figure 2: Papillary adenocarcinoma, showing elongated finger like processes with fibrovascular connective tissue cores, lined by columnar cells (H&E, X 200).
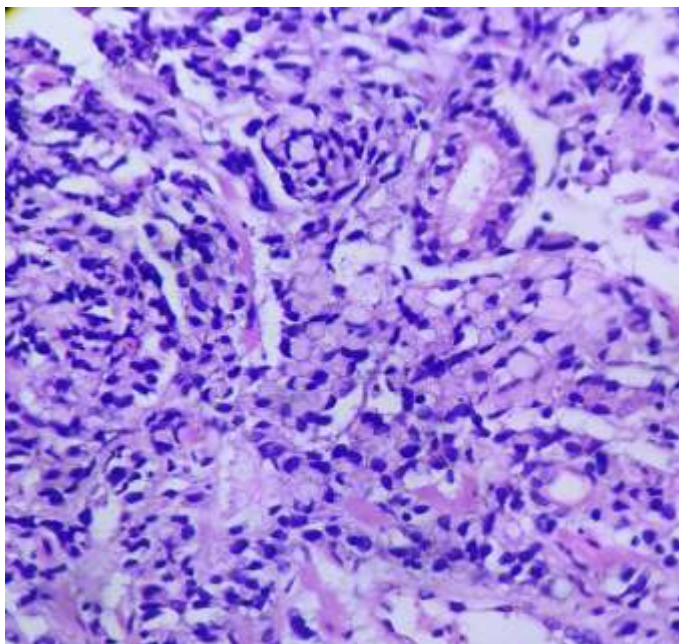
Figure 3: Signet ring cell carcinoma showing poorly cohesive predominant signet ring cells (H&E, X 400).

Discussion:

Gastric cancer remains a major cause of cancer-related mortality worldwide. Although its incidence is gradually decreasing, it remains high in Eastern Asian countries [1, 3]. This might be the result of geographical and cultural differences, along with differences in food habits. Diagnostic and therapeutic procedures have improved during the previous decade, but the prognosis for patients with gastric cancer remains poor, especially those in the advanced stages. The purpose of this study was to study the clinicopathological features of gastric cancer in the western regions of Odisha.

This study included 82 cases of gastric cancer, including 28 gastrectomy specimens and 52 gastric endoscopic biopsy specimens. The majority of cases were aged between 51 and 60 years (38.3%), followed by 61 to 70 years (23.17%). The youngest patient was 32 years old. The study is in accordance with the studies by Banik A et al and Mabula JB et al who also found peak age of incidence at 51-60 years [13, 14]. However, Chanda N et al in their study found peak incidence of gastric cancer in 5th decade [15] and Das A et al found peak incidence at 61–70 years [16].

These gastric carcinomas mostly affect men, who are twice as likely to develop them as women [13, 16]. Our study showed that 62.19% of males were affected by gastric cancer. The male-to-female ratio was 1.6:1, which is consistent with previous studies [17, 18]. Another study showed a sex ratio of 3.3:1 [19].

The pyloric antrum was the most common site (73.17%) for gastric carcinomas, followed by the body (17.07%) and cardia (2.43%). Our findings were consistent with those reported by

Sushma J et al who showed the commonest site of gastric cancer as the pyloric antrum in 73.04% cases. [20]. This is in contrast to a study that found the body of the stomach (40.7%) as the most common site of gastric cancer, followed by the pyloric antrum (35.5%) and cardiac region (23.8%) [21].

The gross appearance of advanced gastric carcinoma can be exophytic, ulcerated, infiltrative, or combined. Based on Borrmann's classification, the gross appearance of advanced gastric carcinomas can be classified as type I for polypoid growth, type II for fungating growth, type III for ulcerating growth, and type IV for diffusely infiltrating growth, which is also referred to as linitis plastica in signet ring cell carcinoma, when most of the gastric wall is involved by infiltrating tumor cells [22]. In our study, the ulcerative type of tumor was the most common in 43 cases (52.43%), followed by infiltrative type (Figure 2) 35 cases (34.14%), fungating type 20 cases (20.39%), and polypoid type 2 cases (2.43%). The findings are in concordance with those of Cassell and Robinson [23], who found that ulcerative type occurred in 51%, infiltrative in 32%, and polypoid in 17% of cases. This is in contrast with the study by Schindler et al. [24], who also found infiltrative lesions to be the most common (63.2%), followed by ulcerative (17.6%), fungating (16.3%), and polypoid lesions (2.9%).

The classification of Gastric cancer is essential for better diagnosis and treatment. The most known and used classification was the one proposed by Lauren P. in 1965, who divided the gastric malignant epithelial tumors into five types, respectively intestinal, diffuse, mixed, indeterminate, and not defined [25]. The relative frequencies of the intestinal, diffuse, and indeterminate types were approximately 54 %, 32%, and 15%, respectively in one of the previous studies [26].

The latest WHO 2019 system has developed a more elaborate classification based on the histopathological and molecular characteristics of gastric adenocarcinomas, including the rare types that are identified in Lauren's classification as indeterminate or not defined gastric adenocarcinomas. Previous published research indicated the practical superiority of the Lauren classification, but currently, the WHO 2019 classification is being adopted because it provides more detailed information regarding the histopathological features of epithelial malignancies [27, 28].

The 2019 WHO classification recognises five main histological subtypes of gastric adenocarcinoma: tubular, papillary, poorly cohesive (including signet ring cell and other subtypes), mucinous, and mixed adenocarcinoma [12].

The tubular adenocarcinoma is the most common subtype [29] found in 42% of cases, most of them being low grade, according to the latest histopathological criteria. These cases are presented as tubular/glandular architecture with branched, tortuous, and anastomosed structures [29]. In our study using WHO classification, tubular adenocarcinoma was the predominant type, accounting for 75.60% of cases, followed by poorly cohesive carcinoma, signet ring cell type 12.19%, and poorly cohesive carcinoma, non signet ring cell type 7.31%.

Poorly cohesive carcinoma, signet ring cell type showed predominantly or exclusively signet ring cells (Figure 2). Poorly cohesive carcinoma, non-signet ring tumor cells morphologically resemble histiocytes, lymphocytes, and plasma cells [30]. In the WHO classification, poorly cohesive carcinoma, signet ring cell type, and poorly cohesive carcinoma, non signet ring cell types correspond to the diffuse type of the Lauren classification system [12].

In the present study, we identified two cases of mucinous carcinoma and one each of undifferentiated carcinoma and papillary adenocarcinoma. The papillary adenocarcinoma (Figure 3) was characterised by a papillary architecture with fibrovascular connective cores.

Other less common gastric cancers found in one of the studies are squamous cell carcinomas, lymphomas (non-Hodgkin), leiomyosarcomas, carcinoid tumours, and gastrointestinal stomach tumors (GIST) [31].

The World Health Organization (WHO) recently identified specific cancers based on their molecular phenotypes and histological characteristics [12]. Specific driver mutations have been identified in some rare gastric tumors, including the characteristic MALAT1-GLI1 fusion gene in gastroblastoma, EWSR1 fusions in clear gastrointestinal cell sarcoma, and malignant gastrointestinal neuroectodermal tumors. [12].

A near universal finding in young patients has been the high frequency of advanced lesions and undifferentiated tumors at presentation in comparison with older patients, which has often been attributed to a delay in diagnosis [32]. Gastric cancer in young patients spreads more rapidly and is more biologically aggressive than that in older patients [33]. The prognosis of young patients with gastric cancer is worse than that of older patients [32, 33].

At the population level, the two main primary prevention activities for gastric carcinoma could include improving dietary habits and lowering the incidence of H. pylori infection, which is the leading cause of Gastric cancer. The secondary prevention strategy is early detection using available resources, particularly the endoscopic method, which is considered the gold standard. Dietary intervention, such as increasing the consumption of fresh fruits and vegetables and limiting the consumption of salt and salt-preserved foods, may be effective in prevention. Lifestyle changes, such as increased physical activity and reduced smoking, may also reduce the risk of contracting the disease. Fruit and vegetables contain high levels of folate, carotenoids, vitamin C, and phytochemicals, which may play a protective role in the carcinogenesis process [4-6, 34].

Early detection and diagnosis of gastric cancer that is normally performed by a flexible endoscope can significantly improve the survival rate of patients [35]. Furthermore, staging can be performed using ultrasonography, abdominal CT, and endoscopic ultrasonography.

Currently, the most effective ways to prevent stomach cancer are to reduce risk factors, screen, and detect it early.

Conclusions

Our study demonstrated the pattern of gastric cancer seen in Western Odisha. The data revealed that the most common age group for gastric cancer was 41-50 years old, with a male predominance. The biopsy is necessary to determine the type and stage of gastric cancer. Due to a lack of clinical output, factors such as food habits, cultural differences, and so on were unable to be evaluated in order to study the etiology of gastric cancer. As a result, more research into risk factors can help identify various prevention strategies for stomach cancer, lowering both the incidence and mortality rates.

Conflict of interest:

The authors declare that they have no conflict of interest.

References:

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA: a cancer journal for clinicians. 2021 May;71(3):209-49.
2. Rao DN, Ganesh B. Estimate of cancer incidence in India in 1991. Indian journal of cancer. 1998 Mar 1;35(1):10-8.
3. Shin WS, Xie F, Chen B, Yu P, Yu J, To KF, Kang W. Updated Epidemiology of Gastric Cancer in Asia: Decreased Incidence but Still a Big Challenge. Cancers (Basel). 2023 May 6;15(9):2639.
4. Barker DJ, Coggon D, Osmond C, Wickham C. Poor housing in childhood and high rates of stomach cancer in England and Wales. British Journal of Cancer. 1990 Apr;61(4):575-8.
5. Hirohata T, Kono S. Diet/nutrition and stomach cancer in Japan. International Journal of Cancer. 1997;71(S10):34-6.
6. Correa P, Fontham ET, Bravo JC, Bravo LE, Ruiz B, Zarama G, Realpe JL, Malcom GT, Li D, Johnson WD, Mera R. Chemoprevention of gastric dysplasia: randomized trial of antioxidant supplements and anti-Helicobacter pylori therapy. Journal of the National Cancer Institute. 2000 Dec 6;92(23):1881-8.
7. Ilic M, Ilic I. Epidemiology of stomach cancer. World journal of gastroenterology. 2022 Mar 3;28(12):1187.
8. Kole C, Charalampakis N, Sakellariou S, Papaxoinis G, Apostolou KG, Machairas N, Papanikolaou IS, Schizas D. Hereditary Diffuse Gastric Cancer: A 2022 Update. J Pers Med. 2022 Dec 8;12(12):2032.
9. Layke JC, Lopez PP. Gastric cancer: diagnosis and treatment options. American family physician. 2004 Mar 1;69(5):1133-41.
10. Tashiro A, Sano M, Kinameri K, Fujita K, Takeuchi Y. Comparing mass screening techniques for gastric cancer in Japan. World J Gastroenterol. 2006;12(30):4873–4874.
11. Kumar, Cotran and Robbins. Pathological Basis of Disease. Published by Prism Books Pvt. Ltd., 1994, 5th edition, pp. 779.
12. WHO Classification of Tumours: Digestive System Tumours. Vol. 5 International Agency for Research on Cancer, World Health Organization, International Academy of Pathology, Elder DE; New York : 2019.
13. Banik A, Biswas L, Saha A, Ojha D. Carcinoma stomach in Eastern India—An audit from a tertiary health care center. J Can Res Ther 2024;20:39-45.
14. Mabula JB, McHembe MD, Koy M, Chalya PL, Massaga F, Rambau PF, Masalu N, Jaka H. Gastric cancer at a university teaching hospital in northwestern Tanzania: a retrospective review of 232 cases. World J Surg Oncol. 2012 Nov 27;10:257.
15. Nassima Chanda , A. R. Khan et al. Histopathology of Gastric Cancer In Kashmir – A Five Year Retrospective Analysis. JK SCIENCE. January-March 2007; 9 (1):21-23.
16. Das, A., Saha, M., Shil, B. C., Yasmin, R., Banik, G., Salam, M. U., & Minnat, B. (2014). Clinical Profile of Patients Presenting with Carcinoma Stomach in North-East District of Bangladesh. *Journal of Medicine*, *15*(2), 118–121.

17. Manasa G C, Sunila, Manjunath GV et al. Histopathological study of gastric carcinoma with associated precursor lesions. Indian Journal of Pathology and Oncology, January - March 2016;3(1);26-31.
18. Lee GH, Joo YE, Koh YS, Chung IJ, Park YK, Lee JH, Kim HS, Choi SK, Rew JS, Park CS, Kim SJ. Expression of survivin in gastric cancer and its relationship with tumor angiogenesis. European journal of gastroenterology & hepatology. 2006 Sep 1;18(9):957-63.
19. Qurieshi MA, Masoodi MA, Kadla SA, Ahmad SZ, Gangadharan P. Gastric cancer in kashmir. Asian Pac J Cancer Prev. 2011;12(1):303-7.
20. Sushma, J.; Kartheek, B. V. S.; Lakshmi, A. B. Clinicopathological Study of Carcinoma Stomach over a Period of 5 Years. *Int J Res Med Sci* 2017, *5*, 558-562.
21. Malik GM, Mubarik M, Kadla SA, Durrani HA. Gastric cancer profile in Kashmiri population with special dietary habits. Diagnostic and therapeutic endoscopy. 2000 Jan 1;6:83-6.
22. Hu B, El Hajj N, Sittler S, Lammert N, Barnes R, Meloni-Ehrig A. Gastric cancer: Classification, histology and application of molecular pathology. J Gastrointest Oncol. 2012 Sep;3(3):251-61.
23. Cassell P, Robinson JO. Cancer of the stomach : a review of 854 patients.Br J Surg 1976; 63: 603-07.
24. Schindler R, Giere N. Gastric Surgery And Gastroscopy: Differential Diagnosis Of Benign And Malignant Lesions; Operability Of Tumors As Determined By Gastroscopy; Early Diagnosis Of Gastric Carcinoma; The Postoperative Stomach. Archives of Surgery. 1937 Oct 1;35(4):712-65.
25. Lauren, P. The two histological main types of gastric carcinoma: Diffuse and so-called intestinal-type carcinoma. An attempt at a histo-clinical classification. Acta Pathol. Microbiol. Scand. 1965, 64, 31–49.
26. Polkowski W, Van Sandick JW, Offerhaus GJ, Ten Kate FJ, Mulder J, Obertop H, Van Lanschot JJ. Prognostic value of Lauren classification and c-erb B-2 oncogene overexpression in adenocarcinoma of the esophagus and gastroesophageal junction. Annals of surgical oncology. 1999 Apr;6:290-7.
27. Berlth F, Bollschweiler E, Drebber U, Hoelscher AH, Moenig S. Pathohistological classification systems in gastric cancer: diagnostic relevance and prognostic value. World J Gastroenterol. 2014;20(19):5679–5684.
28. Gonzalez RS, Raza A, Propst R, Adeyi O, Bateman J, Sopha SC, Shaw J, Auerbach A. Recent Advances in Digestive Tract Tumors: Updates From the 5th Edition of the World Health Organization "Blue Book". Arch Pathol Lab Med. 2021;145(5):607–626.
29. Crețu OI, Stepan AE, Simionescu CE, Marinescu D, Stepan MD. Classification and Grading Systems in Gastric Adenocarcinomas. Curr Health Sci J. 2022 Jul-Sep;48(3):284-291.
30. Al-Samawi AS, Aulaqi SM. Histopathology of gastric cancer in Yemen: A seven years retrospective analysis. Sudan Journal of Medical Sciences. 2013;8(2):91-8.
31. Yin J, Song JN, Bai ZG, Cai J, Zhang J, Zheng Z, Wu HW, Ye PP, Gao X, Zhang ZT. Gastric cancer mortality trends in China (2006-2013) reveal increasing mortality in young subjects. Anticancer research. 2017 Aug 1;37(8):4671-9.
32. Bedikian AY, Khankhanian N, Heilbrun LK, Bodey GP, Stroehlein JR, Valdivieso M. Gastric carcinoma in young adults. Southern medical journal. 1979 Jun 1;72(6):654-6.
33. Matley PJ, Dent DM, Madden MV, Price SK. Gastric carcinoma in young adults. Annals of surgery. 1988 Nov;208(5):593.

34. Conti CB, Agnesi S, Scaravaglio M, Masseria P, Dinelli ME, Oldani M, Uggeri F. Early gastric cancer: update on prevention, diagnosis and treatment. International journal of environmental research and public health. 2023 Jan 25;20(3):2149.
35. Conti CB, Agnesi S, Scaravaglio M, Masseria P, Dinelli ME, Oldani M, Uggeri F. Early gastric cancer: update on prevention, diagnosis and treatment. International journal of environmental research and public health. 2023 Jan 25;20(3):2149.
36. Zhang C, Huang W, Xu X, Zuo S. Flexible endoscopic instrument for diagnosis and treatment of early gastric cancer. Med Biol Eng Comput. 2023 Nov;61(11):2815-2828.