Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v31i3.5032

GASTRIC CANCER PREVENTION; DETECTION OF PREMALIGNANT GASTRIC LESIONS AND SURVEILLANCE FOR EARLY DETECTION OF GASTRIC CANCER IN PAKISTAN

Nimra Sharif[1], Nadir Farid[2], Maheen Iqbal[3], Moeen Ul Haq[4], Muhammad Imran Farid[5*], Muhammad Siddique Karimi[6], Akash Kumar[7], Ahmed Samir Abdul Elhamid Ahmed Mostafa[8]

[1]M. Phil Scholar Department of Zoology Wildlife and Fisheries University of Agriculture, Faisalabad - Pakistan
[2]MBBS, FCPS General Surgery, Fellowship Liver Transplant and Hepatobiliary Surgery Pakistan Kidney and Liver Transplant, Lahore - Pakistan
[3]PGR Medicine Allama Iqbal Teaching Hospital, DG Khan - Pakistan
[4]FCPS Gastroenterology, Assistant Professor Gomal Medical College, Dera Ismail Khan - Pakistan
[5*]Department of Electrical and Computer Engineering, Air University, Islamabad - Pakistan
[6]Saidu Medical College, Swat - Pakistan
[7]Khairpur Medical College, Khairpur Mirs - Pakistan
[8]Consultant and Lecturer of Gastroenterology and Hepatology, Gastroenterology and Hepatology Department faculty of Medicine Delta University for Science and Technology, Egypt/ Dakahleia/ Mansoura

***Corresponding Author:** Muhammad Imran Farid
*Department of Electrical and Computer Engineering, Air University, Islamabad - Pakistan
Email: imran@mail.au.edu.pk

Abstract

Introduction: Gastric cancer poses a significant health burden worldwide, necessitating comprehensive prevention and early detection strategies. This retrospective cross-sectional study, spanning one year, aimed to evaluate the effectiveness of a gastric cancer prevention program in Pakistan. The primary focus was on detecting premalignant gastric lesions and implementing a surveillance system for early cancer detection.

Methodology: The study involved a meticulous analysis of data from a selected cohort of 120 participants. Basic demographic characteristics, clinical symptoms, biopsy results, and specific variables like genetic predisposition, socioeconomic status, and cultural practices were reviewed. Historical intervention data included health education sessions, dietary counseling, lifestyle recommendations, and *Helicobacter pylori* testing with eradication therapy. Statistical analysis, utilizing SPSS version 21, employed descriptive statistics and t-tests to identify significant differences among patients with benign, premalignant, and malignant lesions of the upper GI tract.

Results: The findings provided insights into the efficacy of past interventions. Age distribution revealed 20.8% were 40 years and below, 50% were between 41-64 years, and 29.2% were 65 years and above. The majority were female (58.3%), and ethnicity showed diversity. Overweight and

obesity prevalence was 58.3%, and 54.2% of participants were in-patients. Gastrointestinal symptoms varied, with heartburn (37.5%) and screening for varices (29.2%) being prominent.

Conclusion: The study contributes valuable insights into gastric cancer prevention in Pakistan. The past intervention program, encompassing education, lifestyle modifications, and *H. pylori* eradication, shows promise. The findings underscore the importance of tailored strategies considering demographic, clinical, and lifestyle factors.

Keywords: Gastric cancer prevention, premalignant lesions, surveillance, retrospective study, demographic characteristics, *Helicobacter pylori*.

Introduction

Gastric cancer, a significant contributor to the global cancer burden, poses a substantial health challenge in various regions, including Pakistan (1, 2). The prevention, detection, and early surveillance of premalignant gastric lesions play a pivotal role in reducing the incidence and mortality associated with this malignancy. Gastric cancer ranks among the leading causes of cancer-related morbidity and mortality worldwide (2), and Pakistan is no exception. According to global cancer statistics, stomach cancer is the fifth most common cancer and the third leading cause of cancer-related deaths globally (3).

In Pakistan, gastric cancer contributes significantly to the cancer burden, and its incidence varies across different regions and ethnic groups. Studies have reported variations in the incidence of gastric cancer among different ethnicities in Pakistan (4). The diverse population, comprising Balochi, Punjabi, Pashto, Sindhi, and Urdu ethnicities, may exhibit distinct patterns in the prevalence and distribution of gastric lesions. Understanding these ethnic variations is crucial for tailoring preventive and screening measures to the specific needs of different demographic groups.

Gastric cancer is multifactorial, with various genetic, environmental, and lifestyle factors influencing its development (5). High salt intake, consumption of smoked and pickled foods, *Helicobacter pylori* infection, family history, and tobacco smoking are established risk factors (6). Prevention strategies often involve addressing modifiable risk factors and implementing targeted interventions.

In Pakistan, where certain dietary habits and infectious agents may contribute to the high incidence of gastric cancer, prevention strategies need to be culturally sensitive and context-specific (2, 7). Educational campaigns promoting healthy dietary practices, efforts to reduce *H. pylori* infection rates, and tobacco control initiatives are essential components of a comprehensive preventive approach (8).

The early detection of premalignant lesions and early-stage gastric cancer is pivotal for improving outcomes and reducing mortality. Surveillance strategies involve the systematic monitoring of individuals at increased risk, aiming to identify lesions before they progress to invasive cancer. Endoscopic screening, especially for high-risk populations, is a key element in early detection efforts (9).In healthcare landscape, challenges such as limited access to advanced diagnostic facilities, socioeconomic disparities, and a lack of awareness about the importance of early detection pose barriers to effective surveillance and screening programs (7, 10). Bridging these gaps requires a multidimensional approach, involving public health campaigns, capacity building in healthcare infrastructure, and targeted screening initiatives for high-risk populations.

Research on gastric cancer prevention, detection of premalignant lesions, and surveillance in Pakistan is evolving, but there remains a need for more extensive and systematic studies. The previous research indicates a growing awareness of the importance of early detection and prevention, with an increasing focus on understanding the epidemiology and risk factors unique to the Pakistani population (7, 11).

Recent studies have explored the prevalence of *H. pylori* infection, dietary patterns, and lifestyle factors among individuals with gastric lesions in different regions of Pakistan (2, 12). These

investigations contribute to our understanding of the context-specific factors influencing gastric cancer in the country. However, more research is needed to establish robust evidence-based guidelines for preventive strategies and early detection programs tailored to the Pakistani population.

While progress has been made in understanding gastric cancer in Pakistan, several gaps in knowledge persist. First, there is a need for large-scale epidemiological studies that encompass diverse ethnic groups and geographic regions to better characterize the burden of gastric cancer and its precursors. Second, the development of risk prediction models specific to the Pakistani population can aid in identifying high-risk individuals who would benefit most from surveillance and preventive interventions. Third, initiatives to enhance public awareness about the importance of early detection and healthy lifestyle choices can contribute to reducing the overall burden of gastric cancer.

Objective

The objective is to investigate and evaluate strategies for gastric cancer prevention, detect premalignant gastric lesions, and establish effective surveillance methods for early detection in the context of the Pakistani population.

Methodology

Study design

In this retrospective cross-sectional study spanning one year, our primary aim was to evaluate the effectiveness of a gastric cancer prevention program in Pakistan. We specifically focused on the detection of premalignant gastric lesions and implemented a surveillance system for early cancer detection. The study involved the retrospective analysis of data from a carefully selected cohort of 120 participants.

Data collection

The study design included a meticulous review of historical records, encompassing basic demographic characteristics, clinical symptoms relevant to gastrointestinal diseases, biopsy results, and specific variables like genetic predisposition, socioeconomic status, and cultural practices influencing gastric health. Furthermore, historical endoscopic examinations were scrutinized to identify and document existing premalignant gastric lesions among participants.

Intervention and Historical Data

The retrospective nature of the study allowed for the examination of historical intervention data. The multifaceted intervention program, implemented in the past, included health education sessions, personalized dietary counseling, lifestyle recommendations, and *Helicobacter pylori* testing with subsequent eradication therapy for eligible participants. Historical records were examined for regular endoscopic screenings at predefined intervals and robust follow-up examinations to monitor lesion progression or regression.

Statistical Analysis

Key variables, including basic demographic characteristics, clinical symptoms, biopsy results, and historical screening records, played a crucial role in data retrieval. A meticulous review of historical records, endoscopy findings, histopathological reports, participant adherence to historical intervention protocols, and changes in historical lifestyle and dietary variables were considered. The statistical analysis, performed using SPSS version 21, involved descriptive statistics for basic demographic and health-related characteristics. T-tests of significance were applied to identify statistically significant differences in demographic characteristics among patients with benign, premalignant, and malignant lesions of the upper GI tract. A P-value of 0.05 or less was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the concerned department. Ethical considerations remained paramount throughout the study. Measures were implemented to ensure that historical participant data, including diagnostic and screening records, were anonymized and maintained with strict confidentiality.

Results

Table 1 provides a comprehensive overview of major variables in a study focused on gastric cancer, including the frequency and percentage distribution of participants across different categories. The age distribution shows that 20.8% of participants were 40 years and below, 50% were between 41-64 years, and 29.2% were 65 years and above. In terms of gender, the majority were female (58.3%) compared to male participants (41.7%).

Ethnicity distribution indicates diversity among participants, with Balochi, Punjabi, Pashto, Sindhi, and Urdu ethnicities representing 12.5%, 25%, 16.7%, 20.8%, and 25% of the total, respectively. The BMI distribution highlights the prevalence of different weight categories, with 8.3% classified as underweight, 33.3% as normal weight, 25% as overweight, and another 33.3% as obese.

The study also considered patient categories, revealing that 54.2% of participants were in-patients, while 45.8% were out-patients. Reported gastrointestinal symptoms varied, with percentages for chronic diarrhea (16.7%), dysphagia (12.5%), epigastric pain (25%), heartburn (37.5%), hematemesis (8.3%), hiccups (16.7%), iron deficiency anemia (20.8%), melena (12.5%), screening for varices (CLD) (29.2%), vomiting (12.5%), and weight loss (20.8%).

Table 1: Demographic and clinical characteristics of participants in the investigation of gastric cancer prevention and detection

Variable	Frequency (n)	Percentage (%)
Age		
40 years and less	25	20.8
41-64 years	60	50
65 years and above	35	29.2
Gender		
Male	50	41.7
Female	70	58.3
Ethnicity		
Balochi	15	12.5
Punjabi	30	25
Pashto	20	16.7
Sindhi	25	20.8
Urdu	30	25
BMI		
Underweight	10	8.3
Normal	40	33.3
Overweight	30	25
Obese	40	33.3
Patient Category or Type		
In-patient	65	54.2
Out-Patient	55	45.8

The reported gastrointestinal symptoms among participants in the study provide a comprehensive overview of the clinical presentation in the context of gastric health (figure 1). Chronic diarrhea was observed in 16.7% of individuals, while dysphagia, indicating difficulty in swallowing, was reported by 12.5%. Epigastric pain, a common symptom associated with gastric issues, was present in 25% of the participants. Heartburn, another prevalent symptom, was reported by 37.5%. Hematemesis,

characterized by vomiting blood, was noted in 8.3% of cases. Hiccups, iron deficiency anemia, and melena (dark stools) were reported by 16.7%, 20.8%, and 12.5%, respectively. Screening for varices, often associated with chronic liver disease, was conducted in 29.2% of participants. Vomiting and weight loss were reported by 12.5% and 20.8%, respectively. These findings highlight the diverse clinical manifestations of gastric health issues, emphasizing the importance of recognizing and addressing a range of symptoms for comprehensive patient care.

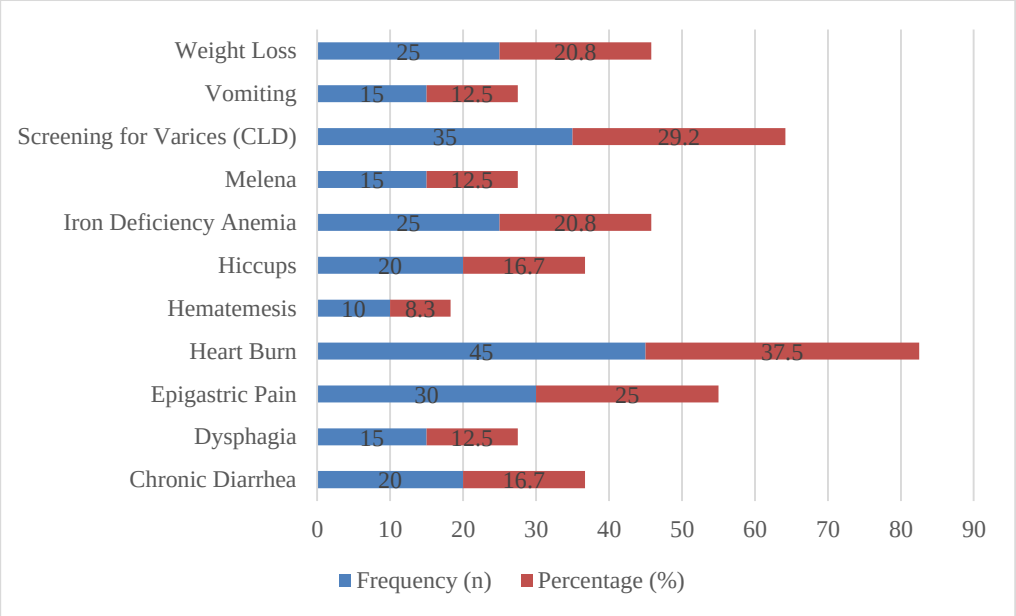

Figure 1: Reported GI Symptoms

Figure 2 presents the biopsy results of individuals undergoing evaluation for gastric lesions, categorizing findings into Inflammatory Lesions, Benign Lesions, and Premalignant or Malignant Lesions. Among those with a positive diagnosis, 48 individuals exhibited Inflammatory Lesions, 3 had Benign Lesions, and 69 were identified with Premalignant or Malignant Lesions. Notably, there were no instances of a negative diagnosis or uncertain/inconclusive results in the study. These biopsy outcomes emphasize the prevalence of inflammatory and potentially precancerous or malignant lesions, contributing valuable information for understanding the pathological spectrum in the context of gastric cancer detection and prevention.

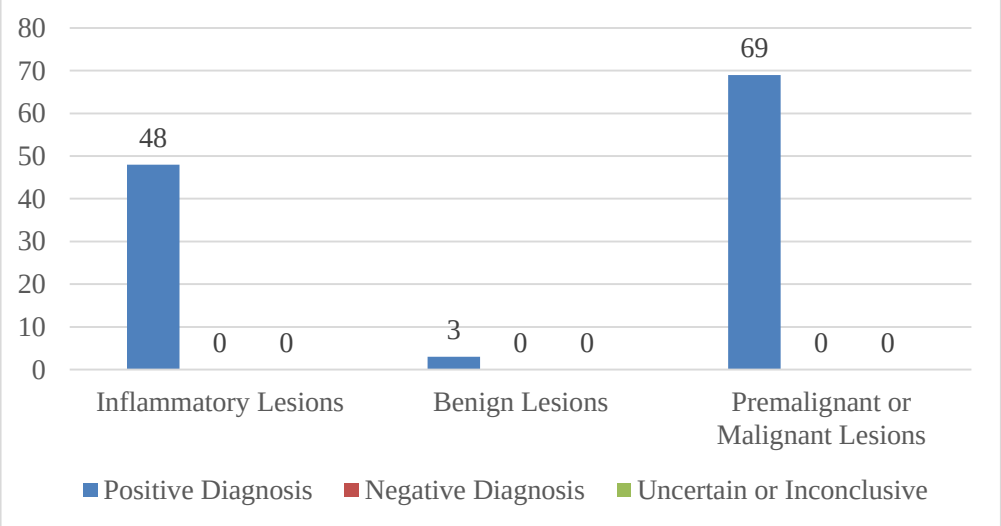

Figure 2: Biopsy Results in Gastric Lesion Evaluation: A Comprehensive Analysis of Inflammatory, Benign, and Premalignant/Malignant Lesions

Table 2 presents a detailed analysis of age distribution among individuals with Benign Lesions (n=3), Premalignant Lesions (n=69), and Malignant Lesions (n=28) in the context of gastric lesion evaluation. Among individuals with Benign Lesions, the distribution across age categories shows that 33.3% were 40 years and less, 33.3% were in the 41-64 years range, and another 33.3% were 65 years and above. In the group with Premalignant Lesions, the age distribution was 21.7% for 40 years and less, 36.2% for 41-64 years, and 27.5% for 65 years and above. For those with Malignant Lesions, the age distribution was 25% for 40 years and less, 32.1% for 41-64 years, and 42.9% for 65 years and above. The p-values associated with these distributions were 0.342, 0.126, and 0.59, respectively, indicating the statistical significance of age differences among individuals with different lesion types.

Among individuals with Benign Lesions, 33.3% were male and 66.7% were female. For Premalignant Lesions, the sex distribution was 40.6% male and 59.4% female. In the group with Malignant Lesions, 53.6% were male, and 46.4% were female. The associated p-values for sex distribution in each lesion category were 0.234, 0.418, indicating the absence of statistically significant sex-related differences among individuals with different lesion types. These findings contribute valuable insights into the potential relationship between sex and the occurrence of gastric lesions, offering important considerations for further research and clinical understanding.

For individuals with Benign Lesions, there were no cases from the Balochi or Punjabi ethnicities, while Pashto, Sindhi, and Urdu ethnicities each constituted 33.3%, 33.3%, and 33.3% respectively. Among those with Premalignant Lesions, the distribution across ethnicities was 2.9% for Balochi and Punjabi, 27.5% for Pashto and Sindhi, and 8.7% for Urdu. For individuals with Malignant Lesions, the ethnicity distribution was 7.1% for Balochi and Punjabi, 35.7% for Pashto, 21.4% for Sindhi, and 28.6% for Urdu. The associated p-values for ethnicity distribution in each lesion category were 0.78, 0.78, 0.641, 0.267, and 0.114, indicating the absence of statistically significant ethnic-related differences among individuals with different lesion types.

For individuals with Benign Lesions, 33.3% were classified as underweight, 66.7% as normal weight, and none in the overweight or obese category. In the Premalignant Lesions group, 17.4% were underweight, 55.1% were normal weight, and 30.4% were overweight or obese. Among those with Malignant Lesions, 17.9% were underweight, 39.3% were normal weight, and 42.9% were overweight or obese. The associated p-values for BMI distribution in each lesion category were 0.567, 0.297, and 0.091, suggesting that there were no statistically significant differences in BMI among individuals with different lesion types.

Table 2 also offers a detailed exploration of the distribution of Patient Category among individuals with Benign Lesions (n=3), Premalignant Lesions (n=69), and Malignant Lesions (n=28) in the context of gastric lesion evaluation. For individuals with Benign Lesions, 33.3% were in-patients, and 66.7% were out-patients. In the Premalignant Lesions group, 23.2% were in-patients, and 76.8% were out-patients. Among those with Malignant Lesions, 50% were in-patients, and another 50% were out-patients. The associated p-value for Patient Category distribution was 0.045, signifying a statistically significant difference in the distribution of patient categories among individuals with different lesion types. These findings highlight the potential impact of patient category on the manifestation of gastric lesions, emphasizing the significance of considering clinical settings in understanding and managing gastric pathology.

Table 2: Analysis and Distribution of Key Variables among Individuals with Benign, Premalignant, and Malignant Gastric Lesions

Variable	Benign Lesions (n=3) Frequency (%)	Premalignant Lesions (n=69) Frequency (%)	Malignant Lesions (n=28) Frequency (%)	P-value
Age				
40 years and less	1 (33.3)	15 (21.7)	7 (25.0)	0.342
41-64 years	1 (33.3)	25 (36.2)	9 (32.1)	0.126
65 years and above	1 (33.3)	19 (27.5)	12 (42.9)	0.59
Gender				

Male	1 (33.3)	28 (40.6)	15 (53.6)	0.234
Female	2 (66.7)	41 (59.4)	13 (46.4)	0.418
Ethnicity				
Balochi	0 (0.0)	2 (2.9)	2 (7.1)	0.78
Punjabi	0 (0.0)	2 (2.9)	2 (7.1)	0.78
Pashto	1 (33.3)	19 (27.5)	10 (35.7)	0.641
Sindhi	1 (33.3)	19 (27.5)	6 (21.4)	0.267
Urdu	1 (33.3)	6 (8.7)	8 (28.6)	0.114
BMI				
Underweight	1 (33.3)	12 (17.4)	5 (17.9)	0.567
Normal	2 (66.7)	38 (55.1)	11 (39.3)	0.297
Overweight or Obese	0 (0.0)	21 (30.4)	12 (42.9)	0.091
Patient Category				
In-patient	1 (33.3)	16 (23.2)	14 (50.0)	0.045
Out-Patient	2 (66.7)	53 (76.8)	14 (50.0)	0.045

The presented table (Table 3) conducts a comprehensive analysis of mean values among different subtypes of gastric cancer, specifically focusing on Gastric Adenocarcinoma, Gastroesophageal Junction Adenocarcinoma, Esophageal Squamous Cell Carcinoma, and Other Upper Gastrointestinal (GI) Malignancies. The p-values associated with each variable indicate the statistical significance of differences between these cancer subtypes. For Age, the p-values range from 0.389 to 0.789, while for Gender, Ethnicity, and BMI, the p-values vary between 0.421 and 0.754. Patient Category demonstrates a slightly lower p-value of 0.295. These findings contribute valuable insights into potential variations in demographic and clinical characteristics among different subtypes of gastric cancer, offering a basis for further investigation and understanding of the intricate factors influencing the development of specific gastric malignancies.

Table 3: Analysis of Mean Gastric Cancer Subtypes

Variable	GA vs GJAC	GA vs ESCC	GA vs OUGM	GJAC vs ESCC	GJAC vs OUGM	ESCC vs OUGM
Age	0.654	0.789	0.421	0.532	0.601	0.389
Gender	0.754	0.564	0.678	0.421	0.295	0.612
Ethnicity	0.612	0.754	0.295	0.678	0.564	0.421
BMI	0.678	0.421	0.754	0.295	0.564	0.612
Patient Category	0.295	0.754	0.678	0.421	0.612	0.11

GA vs GJAC: Gastric Adenocarcinoma vs Gastroesophageal Junction Adenocarcinoma, GA vs ESCC: Gastric Adenocarcinoma vs Esophageal Squamous Cell Carcinoma, GA vs OUGM: Gastric Adenocarcinoma vs Other Upper GI Malignancies, GJAC vs ESCC: Gastroesophageal Junction Adenocarcinoma vs Esophageal Squamous Cell Carcinoma, GJAC vs OUGM: Gastroesophageal Junction Adenocarcinoma vs Other Upper GI Malignancies and ESCC vs OUGM: Esophageal Squamous Cell Carcinoma vs Other Upper GI Malignancies

Discussion

Gastric cancer poses a significant global health challenge, and its impact is particularly pronounced in regions like Pakistan. Strategies for preventing gastric cancer, detecting premalignant lesions, and implementing surveillance for early detection are critical components in mitigating its burden. The study's demographic and clinical findings align with similar studieson gastric cancer epidemiology and risk factors. The observed age distribution, with a significant proportion (50%) falling in the 41-64 years range, is consistent with studies emphasizing the higher incidence of gastric cancer in middle-aged and older populations (13). This underscores the relevance of targeted screening and prevention efforts in this age group to enhance early detection. This aligns with the well-established understanding that the risk of gastric cancer increases with age.

Despite global trends indicating a higher incidence of gastric cancer in males, the observed gender distribution in the Pakistani context reveals a higher percentage of females. The gender distribution, contrary to global trends, shows a higher percentage of females. While the studies generally reports

a higher incidence in males, regional variations and factors influencing healthcare-seeking behavior could contribute to this observed pattern (14). Further investigation is required to understand the underlying reasons for this gender distribution.
Pakistan's diverse ethnic landscape, comprising Balochi, Punjabi, Pashto, Sindhi, and Urdu ethnicities, introduces unique considerations in the prevalence and distribution of gastric lesions. Song et al. emphasize the role of genetic and environmental factors in shaping gastric cancer prevalence among different ethnic groups (15). The study's approach to considering ethnicity provides a nuanced understanding of the disease's impact on diverse populations in Pakistan. This ethnic lens can contribute to tailored preventive and screening strategies, recognizing the distinct risk profiles associated with various ethnic backgrounds.

The observed prevalence of overweight and obesity among participants (58.3%) is in line withglobal trends associating higher BMI with increased gastric cancer risk (16, 17). Lifestyle factors, including dietary habits and physical activity, are known contributors to gastric cancer. Addressing these factors becomes crucial in the context of prevention strategies for the Pakistani population. Educational campaigns promoting healthy dietary practices and initiatives for weight management can play a pivotal role in reducing the incidence of gastric cancer.

The majority of participants being in-patients (54.2%) underscores the critical role of healthcare settings in managing gastric cancer cases. In line with a recent study, it shows role of healthcare settings in managing gastric cancer cases (18). The prevalence of in-patient cases may reflect challenges associated with late-stage presentations, potentially due to delayed healthcare seeking or limited access to screening services. Efforts to enhance early detection and awareness campaigns targeting both the public and healthcare professionals are imperative to address this issue.

The reported gastrointestinal symptoms, including heartburn (37.5%) and screening for varices (29.2%), align with literature emphasizing the importance of recognizing symptoms for early detection and intervention in gastric cancer cases. Heartburn, a common symptom associated with gastroesophageal reflux disease, can serve as an early indicator, prompting individuals to seek medical attention (19, 20). Screening for varices, often related to chronic liver disease, highlights the interconnectedness of various health conditions contributing to gastric cancer risk. This underscores the clinical relevance of symptomatic presentations and the need for comprehensive diagnostic considerations in the Pakistani context.

Future Perspective

The current exploration of gastric cancer in the Pakistani population unveils crucial insights, yet avenues for future research remain abundant. Investigating the molecular and genetic underpinnings of gastric cancer within distinct ethnic groups can unravel personalized risk factors, guiding more targeted prevention and early detection strategies. Furthermore, longitudinal studies assessing the impact of evolving lifestyle patterns on gastric cancer incidence can inform dynamic preventive measures. Integrating artificial intelligence and advanced imaging technologies into diagnostic protocols may enhance early detection accuracy, particularly in resource-constrained settings. Additionally, exploring the effectiveness of community-based interventions and awareness campaigns tailored to specific cultural contexts can contribute to a more holistic approach to gastric cancer prevention in Pakistan.

Conclusion

The current study delved into demographic and clinical aspects, presenting a detailed analysis of age distribution, gender disparities, ethnic variations, and the influence of patient categories on lesion manifestation. A higher percentage of affected femaleswas found, emphasizing the need for a context-specific understanding of gastric cancer epidemiology. The biopsy results provided crucial

insights into the pathological spectrum, highlighting the prevalence of inflammatory and potentially malignant lesions. Age emerged as a significant factor influencing the type of lesions, emphasizing the importance of age-specific screening and preventive measures. The study also conducted a comprehensive analysis of mean values among different subtypes of gastric cancer, contributing valuable insights into the intricate factors influencing the development of specific malignancies. Overall, the findings contribute nuanced perspectives to the field, laying the foundation for tailored strategies in gastric cancer prevention and early detection in the unique context of Pakistan.

References

1. Rahman R, Asombang AW, Ibdah JA. Characteristics of gastric cancer in Asia. World journal of gastroenterology: WJG. 2014 Apr 4;20(16):4483.
2. Singh K, Ghoshal UC. Causal role of Helicobacter pylori infection in gastric cancer: an Asian enigma. World Journal of Gastroenterology: WJG. 2006 Mar 3;12(9):1346.
3. Arnold M, Ferlay J, van Berge Henegouwen MI, Soerjomataram I. Global burden of oesophageal and gastric cancer by histology and subsite in 2018. Gut. 2020 Sep 1;69(9):1564-71.
4. Coupland VH, Lagergren J, Konfortion J, Allum W, Mendall MA, Hardwick RH, Linklater KM, Møller H, Jack RH. Ethnicity in relation to incidence of oesophageal and gastric cancer in England. British journal of cancer. 2012 Nov;107(11):1908-14.
5. Royaidar J, Khalid H, Fatima H. Development of Novel Biomarkers for Early Detection of Cancer. Innovative Research in Applied, Biological and Chemical Sciences. 2023 Jul 1;1(1):9-13.
6. Correa P, Piazuelo MB, Camargo MC. The future of gastric cancer prevention. Gastric cancer. 2004 Mar;7: 9-16.
7. Ali A, Manzoor MF, Ahmad N, Aadil RM, Qin H, Siddique R, Riaz S, Ahmad A, Korma SA, Khalid W, Aizhong L. The burden of cancer, government strategic policies, and challenges in Pakistan: A comprehensive review. Frontiers in nutrition. 2022 Jul 22; 9:940514.
8. Sankaranarayanan R, Boffetta P. Research on cancer prevention, detection and management in low-and medium-income countries. Annals of oncology. 2010 Oct 1;21(10):1935-43.
9. Cheung KS, Chan EW, Wong AY, Chen L, Seto WK, Wong IC, Leung WK. Statins were associated with a reduced gastric cancer risk in patients with eradicated Helicobacter pylori infection: A territory-wide propensity score matched study. Cancer Epidemiology, Biomarkers & Prevention. 2020 Feb 1;29(2):493-9.
10. Sankaranarayanan R, Ramadas K, Qiao YL. Managing the changing burden of cancer in Asia. BMC medicine. 2014 Dec;12(1):1-7.
11. Aziz S, König S, Umer M, Akhter TS, Iqbal S, Ibrar M, Ur-Rehman T, Ahmad T, Hanafiah A, Zahra R, Rasheed F. Risk factor profiles for gastric cancer prediction with respect to Helicobacter pylori: A study of a tertiary care hospital in Pakistan. Artificial Intelligence in Gastroenterology. 2023 Jun 8;4(1):10-27.
12. Zaidi SF. Helicobacter pylori associated Asian enigma: Does diet deserve distinction?. World Journal of Gastrointestinal Oncology. 2016 Apr 4;8(4):341.
13. Shah SC, McKinley M, Gupta S, Peek Jr RM, Martinez ME, Gomez SL. Population-based analysis of differences in gastric cancer incidence among races and ethnicities in individuals age 50 years and older. Gastroenterology. 2020 Nov 1;159(5):1705-14.
14. Ferlay J, Soerjomataram I, Dikshit R, Eser S, Mathers C, Rebelo M, Parkin DM, Forman D, Bray F. Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. International journal of cancer. 2015 Mar 1;136(5):E359-86.
15. Song Y, Liu X, Cheng W, Li H, Zhang D. The global, regional and national burden of stomach cancer and its attributable risk factors from 1990 to 2019. Scientific Reports. 2022 Jul 7;12(1):11542.

16. Jang J, Lee S, Ko KP, Abe SK, Rahman MS, Saito E, Islam MR, Sawada N, Shu XO, Koh WP, Sadakane A. Association between body mass index and risk of gastric cancer by anatomic and histologic subtypes in over 500,000 East and Southeast Asian Cohort participants. Cancer Epidemiology, Biomarkers & Prevention. 2022 Sep 2;31(9):1727-34.
17. Wong MC, Huang J, Chan PS, Choi P, Lao XQ, Chan SM, Teoh A, Liang P. Global incidence and mortality of gastric cancer, 1980-2018. JAMA network open. 2021 Jul 1;4(7):e2118457-.
18. Ajani JA, D'Amico TA, Bentrem DJ, Chao J, Cooke D, Corvera C, Das P, Enzinger PC, Enzler T, Fanta P, Farjah F. Gastric cancer, version 2.2022, NCCN clinical practice guidelines in oncology. Journal of the National Comprehensive Cancer Network. 2022 Feb 1;20(2):167-92.
19. Pasechnikov V, Chukov S, Fedorov E, Kikuste I, Leja M. Gastric cancer: prevention, screening and early diagnosis. World journal of gastroenterology: WJG. 2014 Oct 10;20(38):13842.
20. Sitarz R, Skierucha M, Mielko J, Offerhaus GJ, Maciejewski R, Polkowski WP. Gastric cancer: epidemiology, prevention, classification, and treatment. Cancer management and research. 2018 Feb 7:239-48.