Original Article

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Pathology Section

Interobserver Agreement in Histopathological Assessment of the Operative Link on Gastritis Assessment and the Operative Link on Gastric Intestinal Metaplasia Staging: A Cross-sectional Study

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ABSTRACT

Introduction: Gastric Cancer (GC) is a major health concern in India, with Intestinal Metaplasia (IM) and atrophy being key risk factors. Early detection requires endoscopic surveillance and histopathological examination. After decades of utilising the Sydney System, the Operative Link on Gastritis Assessment (OLGA) and the Operative Link on Gastric Intestinal Metaplasia (OLGIM) were introduced. These systems classify gastritis histologically from stage 0 (lowest risk) to stage IV (highest-risk).

Aim: To assess interobserver agreement in the utility of OLGIM and OLGA.

Materials and Methods: The present cross-sectional study was done on 147 dyspeptic patients' biopsies. Two observers independently scored the samples using the two systems in the Department of Pathology at a tertiary care center and Medical College, Bengaluru, Karnataka, India, using archived cases from January 2025 to April 2025. Each biopsy on a single level was scored on a Visual Analogue Scale (VAS) of 0-3 for Gastric Atrophy (GA) and Intestinal Metaplasia (IM). Antral and corpus scores were grouped into stages I-IV. Kappa value was used to assess the interobserver agreement between the two scorers with respect to the final stage. Categorical variables were expressed as percentages. Interobserver agreement between the OLGA and OLGIM classification systems was assessed using the kappa statistic, with statistical significance evaluated by the Chi-square distribution and Statistical Package for the Social Sciences (SPSS) 22.0 software. A p-value <0.05 was considered statistically significant.

Results: The interobserver agreement was excellent, with kappa values of 0.958 for OLGIM and 0.937 for OLGA (p<0.05). There is no significant difference in the interobserver reproducibility of the two staging systems, though OLGIM shows better agreement.

Conclusion: A combined grading system offers improved risk stratification and can potentially be adopted in daily practice. Routine use of these systems will aid in early detection and surveillance of GCs.

Keywords: Gastric cancer, Precancerous lesions, Risk stratification

INTRODUCTION

In India, GC remains a leading health concern, with the Global Burden of Disease India study report from 1990 to 2016 showing that it accounted for 9% of the total cancer related Disability Adjusted Life Years (DALYs) in the country. The GC is more prevalent in men, accounting for 60.5% of cases, compared to 39.5% in women. Stomach cancers are prevalent in various regions of India [1]. GC can be categorised into two types: intestinal and diffuse. The intestinal form is linked to environmental, lifestyle changes and dietary factors, as well as *Helicobacter pylori* (*H.pylori*) infection. Chronic GA and gastric IM are considered significant precursors and risk factors for the development of intestinal type GC [2].

Early detection of GA and IM through gastrointestinal endoscopy can be a reliable indicator of precancerous conditions and GC [2]. But limited screening and poor detection often lead to delayed diagnosis, resulting in worse outcomes and survival rates. Improved screening and awareness are essential to combat this growing issue [1]. The Sydney system and the updated version, introduced 35 years ago and still in use in many centers, helps interpret biopsies from multiple sites of stomach and grades the histological parameters (including IM and *H.pylori*. density, the intensity of inflammation, atrophy) based on a "VAS" [3].

However, this pattern of reporting does not specifically highlight the patient's possible risk of developing GC. A modification of the OLGA staging system, the OLGIM staging system classifies patients with gastritis into stages that reflect an increasing risk of developing GC. These systems have demonstrated their validity in identifying high-risk populations through risk stratification and are useful for long-term follow-up. The inter observer variability has improved with the switch to OLGIM, a modification of OLGA [4].

It has also been observed that there is a poor interobserver agreement among general pathologists when it comes to diagnosing atrophy, whereas a moderate level of agreement is noted for the identification of IM [5]. Also, microscopic IM is considered the most dependable indicator of atrophy in gastric mucosa. According to MAPS guidelines, patients with mild to moderate GA or IM confined to antrum do not require surveillance, whereas those with extensive GA or IM in antrum or both antrum and corpus should undergo endoscopic surveillance every three years [6].

The need for the hour is to consistently apply these staging systems in routine diagnostic practice. Ultimately integrating the OLGA and OLGIM staging systems into routine reporting provides a structured and effective method for tracking and surveillance of gastric diseases progression and high-risk predisposing conditions for GCs. It also aids in clinical decision making and tailoring treatments, contributing to better patient care outcomes and improved patient understanding of their condition. While gastric endoscopic biopsies are routinely received in most tertiary care

centers, these risk stratification based staging systems are not widely and consistently used for fear of subjective interpretational differences. The aim of the present study was to assess inter observer agreement in the OLGA and the OLGIM based staging systems. The objectives were to evaluate the high-risk stages (III-IV) in both systems and to carefully elaborate on discordant cases for each system.

MATERIALS AND METHODS

The present cross-sectional study was conducted in the Department of Pathology at Tertiary care Centre and Medical College, Bengaluru, Karnataka, India, using archived cases from January 2025 to April 2025. Clearance from the Institutional Ethics Committee (IEC) was obtained prior to the study (approval reference number: MRMC/EC/SP-10/11-2024, dated 30th November 2024).

Inclusion criteria: All gastric corpus and antral endoscopic biopsies in adults, received in the Department of Pathology during the study period from patients clinically diagnosed with dyspepsia, were included in the study.

Exclusion criteria: Cases with metastatic and gastrointestinal cancers and those exhibiting dense inflammation on biopsy were excluded from the current study.

Study Procedure

Endoscopic biopsies performed in accordance with the updated Sydney system [7], from adult dyspeptic patients received in the Department of Pathology were analysed. The biopsies were appropriately fixed. Haematoxylin and Eosin (H&E) sections and special stains when relevant were used for final diagnosis. The final report was dispatched to the patient. The slides were additionally reevaluated and reviewed by two pathologists of near equal experience independently (P1 and P2). The two observers assessed the cases for the presence of GA and IM, graded them, and staged them using the OLGA and OLGIM staging systems, respectively, following which inter observer agreements were evaluated and analysed independently. The GA was scored based on OLGA staging system. Gastric IM was scored based on OLGIM staging system. Stages III and IV were considered high-risk stages [2,7].

In each biopsy, GA and IM are scored as percentage of glands exhibiting these features respectively. This was done on multiple serial (minimum of 5) perpendicular full thickness mucosal sections and with a minimum of 10 glands examined per section. The final score was determined as an average of features observed in multiple serial sections. The scoring is a 4-tiered scale for both GA and IM (No GA/IM=0%, Score=0; mild GA/IM=1-30%, Score=1, moderate GA/IM=31-60%, Score=2, severe GA/IM= >60%, Score=3). Dense inflammatory infiltration may prevent the proper assessment of appropriate gland GA or IM; therefore, such slides were excluded. The two observers were well oriented with reference to normal and pathological VAS, for consistent assessment of different phenotypes of GA and IM transformations [8].

STATISTICAL ANALYSIS

The data were entered into a Microsoft Excel spreadsheet and analysed using SPSS, version 22.0 IBM SPSS Statistics, Somers, NY, USA. The categorical variables were summarised in terms of percentage. Inter observer agreement between OLGA and OLGIM classification systems were measured using Kappa values. The Kappa value ranges from 0 to 1, with values below 0.5 indicating poor reliability, values between 0.5 and 0.75 reflecting moderate reliability, values between 0.75 and 0.9 representing good reliability and values above 0.9 signifying excellent reliability. A p-value of less than 0.05 was considered statistically significant, assuming all the relevant conditions of the statistical tests were met.

RESULTS

A total of 147 H&E slides were evaluated during the study period. Using The OLGA staging system, out of 147 cases, 91 cases showed no GA (61.90%) (stage 0), for both observers while 56 out of 147 cases (38.10%) exhibited GA (Stage I to IV). Out of the 56 cases of GA (i.e., Stage I to IV; excluding stage 0), 51 showed concordant observations (34.69% of 147 cases) between two observers and five cases (3.40% of 147 cases) showed discordant results between two observers with respect to stage [Table/Fig-1].

Category	OLGA cases		OLGIM cases	
Stage 0	91	61.90%	134	91.16%
Stage I	30	20.41%	6	4.08%
Stage II	12	8.16%	2	1.36%
Stage III	7	4.76%	3	2.04%
Stage IV	2	1.36%	1	0.68%
Discordant cases	5	3.40%	1	0.68%
Total cases	147	100%	147	100%

[Table/Fig-1]: Proportion of the total cases exhibiting Gastric Atrophy (GA) and Intestinal Metaplasia (IM).
The table shows the total concordant cases seen; OLGA: The Operative Link on Gastritis Assessment; OLGIM: The Operative Link on Gastric Intestinal Metaplasia Assessment

Using the OLGIM, out of 147 cases, 134 cases (91.16%) showed no IM (stage 0) for both observers while 13 (8.84%) out of 147 cases exhibited IM (Stage I-IV). Out of 13 cases of IM (i.e., Stage I-IV; excluding stage 0), 12 cases (8.16% of 147 cases) showed concordant observations and only one case (0.68% of 147 cases) showed discordant results between two observers. All the 13 cases also showed atrophic changes of glands of varying degrees [Table/Fig-1].

Measure of Agreement

Concordant cases of OLGA: Out of the 51 concordant cases, 30 cases were agreed as Stage I (agreement of 85.71%), 12 as Stage II (agreement of 92.30%), 7 as Stage III (agreement of 100%), 2 as Stage IV (agreement of 100%) by the two observers independently with a kappa value of 0.937 (excellent agreement, $p<0.05$). Nine cases belonged to high-risk stage [Table/Fig-2].

Category	Pathologist 1	Pathologist 2	Total concurrent cases	Agreement of cases (%)
Stage 0	95	91	91	95.78
Stage I	30	35	30	85.71
Stage II	13	12	12	92.31
Stage III	7	7	7	100
Stage IV	2	2	2	100
Total cases	147	147		
Measure of agreement	KAPPA value	0.937	Excellent agreement	

[Table/Fig-2]: Comparison of the Operative Link on Gastritis Assessment (OLGA) given by Pathologist 1 and Pathologist 2, along with their derived agreement.

There was also low-grade dysplasia observed additionally by both pathologists in four cases.

Concordant cases of OLGIM: Out of 12 cases, six cases were agreed upon as Stage I (agreement of 85.71%), two cases as Stage II (agreement of 100%), three cases as Stage III (agreement of 100%), and one case as Stage IV (agreement of 100%) by the two observers independently with a kappa value of 0.958 (excellent agreement, $p<0.05$). As observed, four cases were high-risk cases more predisposed to GC. There was also low-grade dysplasia observed additionally by both pathologists in cases of Stage II and Stage III [Table/Fig-3].

Discordant cases of OLGA: Out of five discordant cases, four cases (2.72%) showed discrepancy between stage 0 and Stage I,

whereas one case (0.68%) showed discrepancy between Stage I and Stage II. All five cases were of low-risk stages [Table/Fig-4].

Category	Pathologist 1	Pathologist 2	Total concurrent cases	Agreement of cases (%)
Stage 0	134	135	134	99.25
Stage I	7	6	6	85.71
Stage II	2	2	2	100
Stage III	3	3	3	100
Stage IV	1	1	1	100
Total cases	147	147		
Measure of agreement	KAPPA value	0.958	Excellent agreement	

[Table/Fig-3]: Comparison of the Operative Link on Gastric Intestinal Metaplasia (OLGIM) given by Pathologist 1 and Pathologist 2, along with their derived agreement.

OLGA discordant cases	Pathologist 1	Pathologist 2
Case 1	Stage 0	Stage I
Case 2	Stage 0	Stage I
Case 3	Stage 0	Stage I
Case 4	Stage 0	Stage I
Case 5	Stage II	Stage I

[Table/Fig-4]: OLGA staging discordant cases.

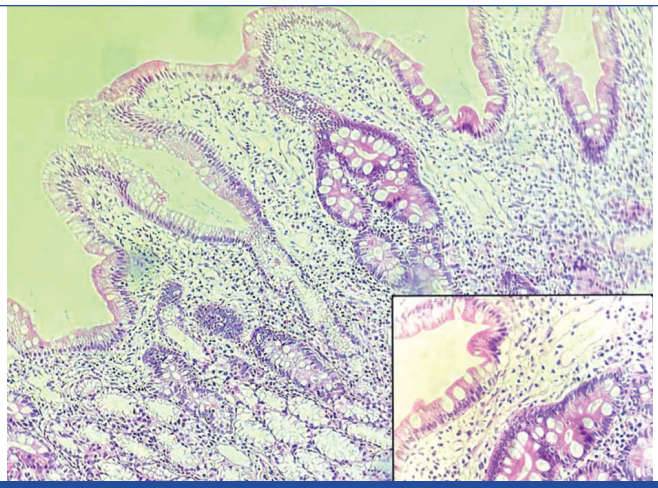
Discordant cases of OLGIM: The one discordant case was staged Stage I and stage 0 by pathologists 1 and 2, respectively.

Evaluating the high-risk stages (III-IV) in the study for both the systems, it was found that more cases (9 cases) of high-risk were found in the OLGA system than in the OLGIM system (only 4), if used independently. 42.85-50% more cases were classified as high-risk when OLGA and OLGIM were combined [Table/Fig-5].

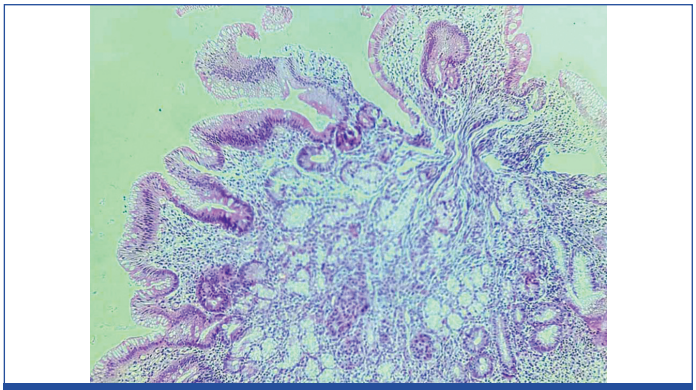
Category	OLGA	OLGIM	Percentage of cases with OLGA and OLGIM in high-risk stages
Stage III	7	3	42.85%
Stage IV	2	1	50.00%

[Table/Fig-5]: Comparison of high-risk stages detected by OLGA and OLGIM.

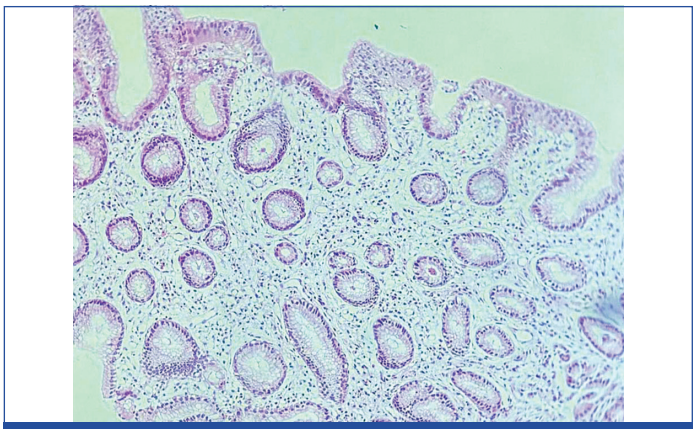
Overall, the present study detected GA in 56 cases with 30 cases (20.40%) diagnosed as having Stage I GA, 12 cases (8.16%) were Stage II, 7 cases (4.76%) were Stage III and 2 cases (1.36%) Stage IV [Table/Fig-1]. Overall, the present study detected IM in 13 cases with six cases (4.08%) diagnosed as having Stage I IM, two cases (1.36%) were Stage II, three cases (2.04%) were Stage III and one case (0.68%) Stage IV [Table/Fig-1]. The microscopic features of gastric IM and GA are provided for reference in [Table/Fig-6,7] and [Table/Fig-8,9], respectively.



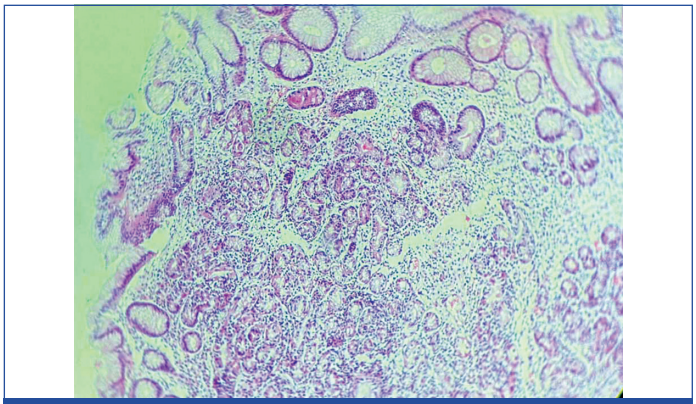
[Table/Fig-6]: Moderate gastric Intestinal Metaplasia (IM) (30-60%) in ANTRAL biopsy (antral IM score 2; OLGIM Stage III, H&E; 100x & inset - 400x).



[Table/Fig-7]: Moderate gastric Intestinal Metaplasia (IM) (30-60%) in CORPUS biopsy (Corpus IM score 2; OLGIM Stage III, H&E; 100x).



[Table/Fig-8]: Moderate Gastric Atrophy (GA) (30-60%) in ANTRAL biopsy (Antral GA score 2; OLGA Stage III, H&E; 100x).



[Table/Fig-9]: Moderate Gastric Atrophy (GA) (30-60%) in CORPUS biopsy (Corpus GA score 2; OLGA Stage III, H&E; 100x).

DISCUSSION

The GA and IM increase the risk of GC. Atrophic gastritis is considered a precursor to IM, according to Correa's theory of gastric carcinogenesis, which outlines a multistep, multifactorial process. In this model, the progression starts with superficial gastritis, advancing through stages of atrophic gastritis, metaplasia, dysplasia, and ultimately leading to GC. This also correlates with our cases showing findings of atrophy in OLGIM staged specimens, indicating IM having progressed from them [9].

Atrophic transformation in gastric mucosa is the 'loss of appropriate glands', with two main phenotypes: 1) Vanishing glands; and 2) Metaplastic replacement. In vanishing glands of GA, glandular units shrink and lamina propria expands, reducing glandular mass without changing the epithelial phenotype. Metaplastic replacement is where native glands are replaced by intestinal or pseudopyloric glands, with loss of the original glandular type. In conditions like *H. pylori* gastritis, severe inflammation may obscure gland loss, making it difficult to determine if glands are genuinely lost or just hidden by the inflammatory infiltration. The present study, therefore, excludes slides with dense inflammation [8].

Gastric IM is a pathological condition in which the normal gastric mucosa transforms into intestinal-like epithelium. It can be classified into two subtypes based on histological features: Complete and incomplete IM. Complete IM closely resembles the small intestinal mucosa and is characterised by the loss of gastric mucins such as MUC1, MUC5AC and MUC6. Epithelium shows eosinophilic enterocytes with an identifiable brush border, well defined goblet cells, and occasionally Paneth cells at the base of the gland. This form of metaplasia represents a more differentiated, mature type of intestinal transformation. In contrast, incomplete IM also referred to as gastric type or mixed type IM, exhibits a combination of gastric and intestinal features. It contains both gastric foveolar cells and goblet cells and expresses both gastric and intestinal mucins simultaneously. The incomplete form is known for its higher proliferative index, indicating increased cell turnover and greater potential for abnormal cellular behaviour. The prognostic implications of these two subtypes remain uncertain, although retrospective studies suggest that incomplete IM may be associated with the high-risk of progression to GC [10]. Present study took into consideration the above histomorphological features.

According to Kyoto consensus, severity and extent of GA and IM are well established indicators of increased risk of GC development. And severe *H. pylori* induced corpus gastritis is also associated with the increased risk due to long standing gastritis causing multi step pathway of precancerous lesions. Dyspepsia is the commonest symptom of H pylori gastritis with atrophy and IM progressing from gastric antrum to corpus [11]. The previous classifications of gastritis are inconsistently used and often lack immediate prognostic or therapeutic value. They don't explicitly rank severity, which can lead to misinterpretation by clinicians and patients. To address this, the OLGA System was proposed similar to how hepatitis staging uses histology. The OLGA system integrates the atrophy score from the biopsy and atrophy topography from biopsy mapping to provide a more structured and clinically useful way of staging gastritis, improving diagnosis and treatment decisions [12].

Studies conducted by Rugge M et al., concluded that all neoplastic gastric lesions progressed from high-risk stages described by OLGA system, offering the first evidence that OLGA system can provide a clinical outcome based on risk stratification [12-14]. The present study also shows that using OLGA has observed an excellent interobserver agreement and shows agreement of all the high-risk stages (kappa=0.937). A study by el-Zimaity HMT et al., used OLGA system and concluded the agreement is less in active inflammation and poor for GA and recommended strict criteria for diagnosis [15]. Other studies also demonstrated low kappa values and poor interobserver agreement when atrophy was used to stage gastritis [16,17]. The present study has observed an excellent interobserver agreement for OLGA and shows agreement of all the high-risk stages. This may be due to the VAS tutorial taken by both pathologists prior to evaluating the slides, proving it to be a very valuable training tool in the diagnosis of OLGA.

A 2-6 per 1000 people per year have the risk of developing GCs from the premalignant lesions of IM. Hence, risk stratification provided important information. After OLGA had limited reproducibility and higher inter observer variability, OLGIM was introduced to diagnose IM in place of atrophy [11].

Other study by Lee S et al., studied moderate to severe IM and concluded groups-3 and 4 were strongly linked to metachronous gastric neoplasm after Endoscopic Submucosal Dissection (ESD) for early GC. This highlights that the presence of advanced IM increases the risk of future GC development, even after initial treatment [18].

The replaced cells in IM are absent in gastric mucosa, making IM easily identifiable and associated with high interobserver agreement. OLGIM provides more accurate results for identifying high-risk patients for GC. The study by Capelle LG et al., also found that the inter observer agreement was moderate for dysplasia (kappa = 0.4), substantial for atrophic gastritis (kappa = 0.6), almost perfect for IM (kappa = 0.9) and demonstrated improved consistency across all stages of the OLGIM system when compared to the OLGA system [7].

Isajevs S et al., found that the interobserver agreement among GI pathologists for atrophy in the antrum and corpus was moderate (kappa =0.53), whereas it was nearly perfect for IM (kappa=0.82) [5]. The present study also showed an excellent agreement for the OLGIM staging system with (kappa=0.958).

A similar result by a cross-sectional study by Salazar BE et al., also showed better interobserver agreement with OLGIM as compared to OLGA [19]. The present study similarly showed more discordant cases with OLGA system and also a lesser inter observer agreement as compared to the OLGIM system, highlighting higher interobserver variability with OLGA. The discordancy was typically observed between stage 0 and Stage I, highlighting subjectivity in the histology of low-grade atrophy; however high-grade cases are uniformly identified.

Whereas, the OLGIM system only showed one discordant case between stage 0 and Stage I. Upon review, this case was found to have a patchy and focal area of early incomplete IM. Discrepancies in the diagnosis of IM predominantly arise when goblet cells are misidentified. These cells refer to as goblet cells, lack both the characteristic brush border epithelium. As a result, they appear to be distended gastric surface foveolar cells rather than true goblet cells. Given that pathology relies on subjective interpretation, achieving complete diagnostic consensus is nearly impossible [20].

Comparing the high-risk stages (III-IV) for both systems, it was noted that few cases of GA did not exhibit IM. It may likely mean that the GA has not yet progressed to IM as specified in the multistep Correa pathway. A study by Rugge M et al.. concludes that OLGIM staging is less sensitive than OLGA staging in the identification of patients at high-risk of GC [21]. A study by Na YS et al., further concluded elevated stages of both OLGA and OLGIM are significant independent predictors of the risk for metachronous GC, with the OLGIM system emerging as the more reliable tool for prognostication [22]. A study by Cho SJ et al., shows results pertaining to OLGIM stages from I to IV were significantly associated with increased risk of both intestinal and diffuse type GC, whereas OLGA staging association was more significant for intestinal type but not diffuse type GC [23].

Rabarison MR et al., conclude that a combined OLGA and OLGIM system with updated Sydney system is required in countries like Madagascar with low economic resources [24]. This can be applied to India as well where continuous endoscopic surveillance of the target population may prove to be a challenge. Patients with IM at a single location with high-risk of GC will require no surveillance if endoscopy excludes GA in advanced stages. And OLGA III or IV stages in both Antrum and Corpus will need a follow-up with high quality endoscopy every three years.

Hence, detection of high-risk stages by OLGIM necessitates a more rigorous follow-up protocol. Additionally, the combined presence of GA in both antrum and corpus also influences the surveillance strategy [6]. Many high-risk cases would have been missed if OLGA or OLGIM used alone. A study by Yue H et al., also concludes that a combined use of both systems has a better accuracy in routine practice [25]. The present study highlights excellent interobserver agreement in both OLGA and OLGIM staging systems for the high-risk stages, recommends training with the VAS for both systems to reduce interobserver subjectivity for lower stages and concludes that the two systems must be integrated for effective risk stratification.

Limitation(s)

The present study did not assess multiple step level biopsies to contain costs and save resources, which might have been ideal

for a completely accurate diagnosis. The sampling may rarely be inadequately representative, and gastric IM subtyping may require additional special stains for confirmation.

CONCLUSION(S)

The OLGIM staging system has demonstrated considerable efficacy in grading IM, offering excellent interobserver reliability as compared to the OLGA staging system. However, a combined OLGA and OLGIM system has the potential to detect more high-risk cases with a larger bracket of the target population falling under surveillance for early and treatable GC. By enabling more accurate stratification of risk, both systems provide a robust predictor for GC progression. When routinely incorporated into the histopathological reporting of gastric biopsies, their integrated use enhances clinical decision making, facilitates more targeted interventions, offering a better prognosis and survival for those at risk of GC.

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