Reliability in endoscopic diagnosis of portal hypertensive gastropathy

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Abstract

AIM: To analyze reliability among endoscopists in diagnosing portal hypertensive gastropathy (PHG) and to determine which criteria from the most utilized classifications are the most suitable.

METHODS: From January to July 2009, in an academic quaternary referral center at Santa Casa of São Paulo Endoscopy Service, Brazil, we performed this single-center prospective study. In this period, we included 100 patients, including 50 sequential patients who had portal hypertension of various etiologies; who were previously diagnosed based on clinical, laboratory and imaging exams; and who presented with esophageal varices. In addition, our study included 50 sequential patients who had dyspeptic symptoms and were referred for upper digestive endoscopy without portal hypertension. All subjects underwent upper digestive endoscopy, and the images of the exam were digitally recorded. Five endoscopists with more than 15 years of experience answered an electronic questionnaire, which included endoscopic criteria from the 3 most commonly used Portal Hypertensive Gastropathy classifications (McCormack, NIEC and Baveno) and the presence of elevated or flat antral erosive gastritis. All five endoscopists were blinded to the patients’ clinical information, and all images of varices were deliberately excluded for the analysis.

RESULTS: The three most common etiologies of portal hypertension were schistosomiasis (36%), alcoholic cirrhosis (20%) and viral cirrhosis (14%). Of the 50 patients with portal hypertension, 84% were Child A, 12% were Child B, 4% were Child C, 64% exhibited previous variceal bleeding and 66% were previously endoscopic treated. The endoscopic parameters, presence or absence of mosaic-like pattern, red point lesions and cherry-red spots were associated with high interobserver reliability and high specificity for diagnosing Portal Hypertensive Gastropathy. Sensitivity, specificity and reliability for the diagnosis of PHG (%) were as follows: mosaic-like pattern (100; 92.21; High); fine pink speckling (56; 76.62; Unsatisfactory); superficial reddening (69.57; 66.23; Unsatisfactory); red-point lesions (47.83; 90.91; High); cherry-red spots (39.13; 96.10; High); isolated red marks (43.48; 88.31; High); and confluent red marks (21.74; 100; Unsatisfactory). Antral elevated erosive gastritis exhibited high reliability and high specificity with respect to the presence of portal hypertension (92%) and the diagnosis of portal hypertensive gastropathy (88.31%).

CONCLUSION: The most suitable endoscopic criteria for the diagnosis of PHG were mosaic-like pattern, red-point lesions and cherry-red spots with no subdivisions.
Portal hypertensive gastropathy (PHG) is characterized by an alteration in gastric mucosa that causes digestive hemorrhage in patients with portal hypertension (PH) of any etiology. Its incidence varies in the medical literature from 4% to 80% owing to a lack of consensus on endoscopic criteria for diagnosis.\(^7\)–\(^13\)

PHG is histologically characterized by the dilation and tortuosity of the submucosal vessels, the thinning of the vascular wall and the increased areas of gastric mucosa occupied by vessels.\(^7\)–\(^11\) These alterations stem from hemodynamic modifications caused by portal hypertension syndrome and are not related to inflammatory infiltration.\(^7\)–\(^10\)

McCormack et al\(^7\) first described PHG in 1985 and proposed the first classification, attributing a risk of bleeding of 38% to 62% for severe forms and 3.5% to 12% for mild forms of PHG. Although simplified, this classification is problematic for grading intermediate endoscopic findings.\(^7\)

In 1994, the New Italian Endoscopy Club (NIEC) proposed an alternative classification including a moderate aspect of PHG for grading intermediate endoscopic findings.\(^7\)–\(^8\)

Shortly after, in 1996, the Baveno Consensus, a scoring system for the most relevant aspects of PHG (the Baveno Score System), was developed and attributed a higher risk of bleeding in patients with the severe form of PHG and an odds ratio of 2.56.\(^2\)

The medical literature is not in agreement regarding the best classification and endoscopic criteria for diagnosing PHG, nor is there a consensus on its therapeutic management.\(^2\)–\(^8\)

The purpose of this study was to analyze reliability among endoscopists in diagnosing PHG and to determine which endoscopic criteria, from the most utilized classifications (McCormack, NIEC and Baveno), are most suitable for diagnosing PHG.

**MATERIALS AND METHODS**

In a prospective study, a total of 100 patients were selected from those undergoing upper digestive endoscopy between January and July 2009 at the Endoscopy Service - Santa Casa School of Medical Sciences (Santa Casa de São Paulo Medical School), São Paulo, Brazil. This study was approved by the local Research Ethics Committee, and patients were included only after signing informed consent forms.

Fifty sequential patients with portal hypertension of various etiologies previously diagnosed based on clinical, laboratory and imaging exams who presented with esophageal varices were selected (Table 1). All patients with clinical or endoscopic signs of upper hemorrhage were included in this study. A control group was formed, consisting of 50 sequential patients with dyspeptic symptoms referred for upper digestive endoscopy without portal hypertension or a previous history of hepatopathy or congestive cardiopathy, abdominal ultrasounds disclosing normal liver and spleen, and a portal vein caliber of less than 12 mm.

Exams were performed under sedation and digitally recorded. Six images were selected from recordings, consisting of two from the antrum, two from the gastric body and two from the gastric fundus (not showing varices). The images were then analyzed by five independent expert endoscopists with over 15 years of experience in the field, blinded to each other's comments and evaluations. An electronic questionnaire, which included endoscopic criteria from PHG classifications (McCormack, NIEC and Baveno) and recorded the presence or otherwise of elevated or flat antral erosive gastritis, was used to collect and collate the results (Figure 1). The results were independently analyzed to determine their relationship with PHG.

Figures 2–4 compare endoscopic aspects with their classifications.

Due to inconsistencies in the medical literature on the role of histological analysis of standard endoscopic biopsies for diagnosing PHG, we decided not to perform...
RESULTS

For criteria from the McCormack classification (Table 2), the mosaic-like pattern was associated with high reliability, specificity (90%) and positive predictive value (82.76%) for the presence of PH, as well as sensitivity and negative predictive values of 100% for the diagnosis of PHG. Fine pink speckling and superficial reddening both exhibited unsatisfactory reliability, as well as low specificity (86%) and high false positive values (7%) for the presence of PH. In addition, these criteria exhibited low specificity (76.62%) and high false positive values (18%) for the diagnosis of PHG.

On the NIEC classification (Table 3), pink and red mosaic-like patterns were associated with unsatisfactory reliability, but red center mosaic-like patterns exhibited high reliability, thus defining PHG as moderate.

For criteria from the Baveno classification (Table 4), only red marks demonstrated high reliability and specificity (92%) for the presence of PH and high reliability for the diagnosis of PHG.

Table 5 depicts the results of the statistical analysis of antral erosive gastritis and its variations, flat and elevated, in relation to the presence of portal hypertension and the diagnosis of portal hypertensive gastropathy. Antral elevated erosive gastritis exhibited high reliability and high specificity with respect to the presence of PH (92%) and the diagnosis of PHG (88.31%).

DISCUSSION

The analyzed classifications (McCormack, NIEC and BAVENO) comprise several common endoscopic aspects, albeit aspects that are occasionally analyzed from different perspectives, thereby affecting the level of agreement among the observers. Others classifications have been published, including pre- and post-treatment evaluations, but these classifications have been reported without exclusive diagnostic aspects.

The presence of any mosaic-like pattern, defined as polygonal areas with whitish reticular borders, is utilized in all three classifications studied. The McCormack Classification considers only its presence or absence but not variations in its inner polygonal area. In the present study, the mosaic-like pattern was associated with high reliability, specificity and positive predictive value for the presence of PH, as well as sensitivity and negative predictive values of 100% for the diagnosis of PHG, where its absence almost excluded this diagnosis. This finding corroborates the results of the study by Stewart et al\[24\] in which, out of the 100 patients diagnosed with PHG, 96 exhibited mosaic-like patterns.

Based on the NIEC classification, the mosaic-like pattern is subdivided into three and classified according to the color of the inner polygonal area as either pink, red center or red. In the present study, pink and red mosaic-like patterns were associated with unsatisfactory reliability, whereas a red center mosaic-like pattern had high reliability, defining PHG as moderate. Nevertheless, the red center may also be considered a red-point lesion or a cherry-red spot, characterizing the PHG as severe, thereby rendering this stratification of the pattern ambiguous and the NIEC classification inconsistent.

The Baveno Score System subdivides the mosaic-like pattern into two aspects: mild, corresponding to a pink mosaic-like pattern, and severe, which corresponds to a red mosaic-like pattern, which as mentioned above, was found to exhibit Unsatisfactory reliability and thus low agreement among observers. Although Stewart et al\[26\]...
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also demonstrated agreement among observers analyzing the presence or absence of the mosaic-like pattern, with a Kappa Index of greater than 0.75, concordance decreased when this aspect was subdivided according to variation in the inner polygonal area.

The present results demonstrated that fine pink

Figure 1 Electronic questionnaire.

Figure 2 Endoscopic aspects of portal hypertensive gastropathy considered in the study and their corresponding classifications. A: Fine pink speckling - McCormack; B: Superficial reddening - McCormack; C: Diffuse hemorrhagic lesion - McCormack; D: Black brown spots - New Italian Endoscopy Club.
Figure 3 Endoscopic aspects of portal hypertensive gastropathy considered in the study and their corresponding classifications. A: Corresponds to "mosaic-like pattern" with different nomenclature in each classification as follows: mosaic-like pattern - McCormack; mild mosaic-like pattern - New Italian Endoscopy Club (NIEC); mild mosaic-like pattern - Baveno; B: Corresponds to "mosaic-like pattern" with different nomenclature in each classification as follows: red center mosaic-like pattern - McCormack; moderate mosaic-like pattern - NIEC; C: Corresponds to "mosaic-like pattern" with different nomenclature in each classification as follows: mosaic-like pattern - McCormack; severe mosaic-like pattern - NIEC; severe mosaic-like pattern - Baveno; D: GAVE - Baveno.

Figure 4 Endoscopic aspects of portal hypertensive gastropathy considered in the study and their corresponding classifications. A: Corresponds to "cherry-red spots" with different nomenclature in each classification as follows: discrete red spots - McCormack; cherry-red spots - New Italian Endoscopy Club (NIEC); B: Red-point lesions - NIEC; C: Isolated red marks - Baveno; D: Confluent red marks - Baveno.
Table 2 Analysis of the criteria from the McCormack classification for the presence of portal hypertension and portal hypertensive gastropathy

| Diagnosis | Fine pink speckling | Superficial reddening | Mosaic-like pattern | Cherry-red spots | Diffuse hemorrhagic lesion |
|-----------|---------------------|-----------------------|---------------------|------------------|--------------------------|
| PH        | PHG                 | PH                    | PHG                 | PHG              | PHG                      |
| Sensitivity | 48.00% | 56.52% | 64.00% | 69.57% | 48.00% | 100.00% | 22.00% | 39.13% | 8.00% | 17.39%
| Specificity | 86.00% | 76.62% | 80.00% | 66.23% | 90.00% | 92.21% | 98.00% | 96.10% | 100.00% | 100.00%
| PPV       | 77.42% | 41.94% | 76.39% | 38.10% | 82.76% | 79.31% | 91.67% | 75.00% | 100.00% | 100.00%
| NPV       | 62.32% | 85.51% | 68.97% | 87.93% | 63.38% | 100.00% | 55.68% | 84.09% | 52.08% | 80.21%
| Accuracy  | 67.27% | 72.00% | 72.00% | 67.00% | 69.00% | 94.00% | 60.00% | 83.00% | 54.00% | 81.00%
| False negative | 26.00% | 10.00% | 18.00% | 7.00% | 26.00% | 0.00% | 39.00% | 14.00% | 46.00% | 19.00%
| False positive | 7.00% | 18.00% | 10.00% | 26.00% | 5.00% | 6.00% | 1.00% | 3.00% | 0.00% | 0.00%
| Significance | $P < 0.001$ | $P = 0.03$ | $P < 0.001$ | $P = 0.002$ | $P < 0.001$ | $P < 0.001$ | $P = 0.002$ | $P < 0.001$ | $P = 0.059$ | $P = 0.002$
| Reliability ($\alpha$) | 0.430¹ | 0.430¹ | 0.532¹ | 0.532¹ | 0.799¹ | 0.799¹ | 0.753¹ | 0.753¹ | 0.574¹ | 0.574¹

¹Unsatisfactory; ²High. PPV: Positive predictive value; NPV: Negative predictive value; PH: Portal hypertension; PHG: Portal hypertensive gastropathy.

Table 3 Analysis of the criteria from the New Italian Endoscopy Club classification for the presence of portal hypertension and portal hypertensive gastropathy

| Pink alteration       | Red center alteration       | Red mosaic-like pattern | Red mosaic-like pattern | Red-point lesions | Cherry-red spots | Black-brown spots |
|-----------------------|-----------------------------|-------------------------|-------------------------|-------------------|-------------------|-------------------|
| Diagnosis             | PHH                         | PHH                     | PHH                     | PHH              | PHH              | PHH              |
| Sensitivity           | 26.00%                      | 52.17%                  | 16.00%                  | 34.78%           | 6.00%            | 13.04%           |
| Specificity           | 90.00%                      | 92.21%                  | 100.00%                 | 100.00%          | 100.00%          | 92.00%           |
| PPV                   | 72.22%                      | 66.67%                  | 100.00%                 | 100.00%          | 100.00%          | 77.78%           |
| NPV                   | 54.88%                      | 86.59%                  | 54.35%                  | 83.70%           | 51.55%           | 79.38%           |
| Accuracy              | 58.00%                      | 83.00%                  | 58.00%                  | 85.00%           | 53.00%           | 80.00%           |
| False negative        | 37.00%                      | 11.00%                  | 42.00%                  | 15.00%           | 47.00%           | 20.00%           |
| False positive        | 5.00%                       | 6.00%                   | 0.00%                   | 0.00%            | 0.00%            | 0.00%            |
| Significance           | $P < 0.033$                 | $P < 0.001$             | $P < 0.001$             | $P = 0.121$      | $P = 0.011$      | $P = 0.009$      |
| Reliability ($\alpha$) | 0.569¹                      | 0.569¹                  | 0.727¹                  | 0.727¹           | 0.079¹           | 0.079¹           |

¹Unsatisfactory; ²High. PPV: Positive predictive value; NPV: Negative predictive value; PH: Portal hypertension; PHG: Portal hypertensive gastropathy.

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speckling and superficial reddening from the McCormack classification were associated with unsatisfactory reliability and, thus, the low agreement among observers. These criteria also exhibited low specificity and high false positive values for the presence of PH, as well as low specificity and high false positive values for the diagnosis of PHG. This result indicated that fine pink speckling and superficial reddening also occurred in the group without PH, possibly corresponding to enanthematosus mucosal alterations unrelated to portal hypertension. McCormack et al., in his original article, emphasized that with the exception of the cherry-red spots, the endoscopic aspects he described for the diagnosis now called PHG were indistinguishable from gastritis.

PHG is classified according to its tendency to bleed. Nonetheless, diffuse hemorrhagic lesions and black brown spots (old mucosal hemorrhage) are utilized in the McCormack and NIEC classifications. This use reveals incoherence because these aspects are, concomitantly, both a cause (PHG) and a consequence (hemorrhage). Additionally, these parameters exhibited unsatisfactory reliability in the present study due to low inter-observer agreement. Occasionally, these tenuous hemorrhages may exhibit discrete clinical manifestations. In our study, patients with suspected digestive bleeding were excluded. The exclusion of these cases may partly explain the low statistical significance of these criteria.

Mucosal delimited red alterations are utilized in all three classifications. Red-point lesions are employed in the NIEC classification whereas cherry-red spots are used in both the McCormack (called discrete red spots) and NIEC classification. The Baveno score system groups red-point lesions and cherry-red spots together under red marks. We found that the presence or absence of red alterations was associated with high reliability due to high agreement among the endoscopists, high specificity and high positive predictive value in relation to the presence of PH and the diagnosis of PHG (Tables 2-4), thus demonstrating that these endoscopic aspects are related to PH and PHG.

The Baveno score system splits these parameters by grouping the alterations as either isolated or confluent. Nevertheless, there is no definition of the confluence criterion, thus leading to subjective interpretation and unsatisfactory reliability in the present study. Stewart et al., studying patients with PHG, demonstrated high inter-observer agreement in relation to the presence or absence of red marks and a kappa index of greater than 0.75, indicating desirable agreement. However, this level became unsatisfactory when used with the confluence criterion, splitting the red marks of the endoscopic aspect into isolated and confluent categories.
Although the current study demonstrated that GAVE (Baveno score system) exhibited 100% specificity and 0% false positive results, suggesting a strong association with portal hypertension and PHG, this relationship failed to reach statistical significance. Some authors claim that PHG and GAVE are distinct entities with no correlations between them.\cite{32-34}

Analysis of antral erosive gastritis and its variations, flat and elevated, revealed that antral elevated erosive gastritis exhibited high reliability and high specificity with relation to the presence of PH and the diagnosis of PHG, thereby suggesting an association with PHG. Assef et al\cite{25} observed a 37.5% rate of antral elevated erosive gastritis in patients with PHG. Using multivariate analysis, Auroux et al\cite{24} demonstrated that 31.2% of patients with portal hypertension had gastric erosions related to PHG and not to the presence of Helicobacter pylori, alcohol abuse, Child classification or the severity of esophageal varices. Further studies including histological analyses are warranted to confirm this association.

All endoscopic parameters analyzed exhibited low accuracy for the presence of PH (Tables 2-4). This low accuracy is due to the low negative predictive values of each separate parameter. Therefore, it is important to analyze all of the endoscopic parameters in conjunction with PH.

Regarding criteria for the diagnosis of PHG, the mosaic-like pattern with red center, cherry-red spots and red-point lesions showed accuracies of 94%, 83%, 85%, 83% and 81%, respectively. Of these criteria, only the mosaic-like pattern offered high sensitivity (100%). As explained earlier, the subdivision of the mosaic-like pattern leads to low inter-observer agreement, whereas the mosaic-like pattern with red center is an incoherent subdivision, at the same time representing a mosaic-like pattern and a red point lesion or cherry red spot.

The unsatisfactory reliability and low inter-observer agreement of the analyzed classifications corrobore the findings reported in other studies. Yoo et al\cite{23} analyzed McCormack and NIEC classifications and observed low kappa indices of 0.52 and 0.44, respectively, indicating low inter-observer agreement given that a desirable Kappa index is greater than 0.75. Stewart et al\cite{23} analyzing the Baveno classification, found an unsatisfactory rate of agreement when mosaic-like patterns and red marks were subdivided.

It is clear that all three investigated classifications have inadequate endoscopic parameters. Nevertheless, analyzing binary criteria such as the presence or the absence of the mosaic-like pattern, red-point lesions and cherry-red spots, the diagnosis of PHG yields high inter-observer agreement and high specificity. This approach can prove useful for future research on the natural history of this disease and related factors, thus helping to clarify some of the current controversies, including studies with his-

**Table 4** Analysis of the criteria from the Baveno classification for the presence of portal hypertension and portal hypertensive gastropathy

|                          | Pink mosaic-like pattern | Red mosaic-like pattern | Isolated red marks | Confluent red marks | GAVE |
|--------------------------|--------------------------|-------------------------|--------------------|---------------------|------|
| Diagnosis                | PH                       | PHG                     | PH                 | PHG                 | PHG  |
| Sensitivity              | 26.00%                   | 52.17%                  | 6.00%              | 13.04%              |      |
| Specificity              | 90.00%                   | 92.21%                  | 100.00%            | 100.00%             |      |
| PPV                      | 72.22%                   | 66.67%                  | 100.00%            | 100.00%             |      |
| NPV                      | 54.88%                   | 86.59%                  | 51.35%             | 79.38%              |      |
| Accuracy                 | 58.00%                   | 83.00%                  | 53.00%             | 80.00%              |      |
| False negative           | 37.00%                   | 11.00%                  | 47.00%             | 20.00%              |      |
| False positive           | 5.00%                    | 6.00%                   | 0.00%              | 0.00%               |      |
| Significance             | P = 0.033                | P < 0.001               | P = 0.121          | P = 0.011           |      |
| Reliability (α)          | 0.5690                   | 0.5691                  | 0.0790             | 0.0791              |      |

|                         | False positive           | Accuracy               | NPV                  | PPV                  |
|-------------------------|--------------------------|------------------------|----------------------|----------------------|
| False positive          | 5.00%                    | 6.00%                  | 0.00%                | 0.00%                |
| Significance            | P = 0.033                | P < 0.001              | P = 0.011            | P = 0.011            |
| Reliability (α)         | 0.5690                   | 0.5691                 | 0.0790               | 0.0791               |

1Unsatisfactory; 2High. PPV: Positive predictive value; NPV: Negative predictive value; PH: Portal hypertension; PHG: Portal hypertensive gastropathy.

**Table 5** Analysis of antral erosive gastritis in the presence of portal hypertension and portal hypertensive gastropathy

|                        | Antral erosive gastritis | Antral elevated erosive gastritis | Antral flat erosive gastritis |
|------------------------|--------------------------|----------------------------------|-------------------------------|
| Diagnosis              | PH                       | PHG                              | PHG                           |
| Sensitivity            | 34.00%                   | 39.13%                           |                                |
| Specificity            | 84.00%                   | 79.22%                           |                                |
| PPV                    | 68.00%                   | 36.06%                           |                                |
| NPV                    | 56.00%                   | 81.33%                           |                                |
| Accuracy               | 59.00%                   | 70.00%                           |                                |
| False negative         | 33.00%                   | 14.00%                           |                                |
| False positive         | 8.00%                    | 16.00%                           |                                |
| Significance           | P = 0.032                | P = 0.046                        | P = 0.016                     |
| Reliability (α)        | 0.8401                   | 0.8402                           | 0.8621                        |

1Satisfactory; 2High. PPV: Positive predictive value; NPV: Negative predictive value; PH: Portal hypertension; PHG: Portal hypertensive gastropathy.
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