Portal hypertensive gastric mucosa: an endoscopic study

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SUMMARY   The endoscopic features of the gastric mucosa in patients with cirrhosis have not been systematically investigated. In these patients, we observed an endoscopic aspect, consisting of multiple small erythematous areas, outlined by a subtle yellowish network (resembling a mosaic), mainly located in the proximal part of the stomach. We tested the value of this sign by comparing two groups: 100 patients with portal hypertension due to cirrhosis, and 300 control patients without signs of liver disease or portal hypertension. This endoscopic pattern was observed in 94 of the patients with cirrhosis, whereas oesophageal varices were seen in 78 only. In contrast, only one patient of the control group had this aspect. Moreover, this sign was also found in seven of eight patients with non cirrhotic portal hypertension, but was seen neither in 100 patients with chronic alcoholism but without liver disease, nor in 10 cirrhotic patients with end-to-side portacaval shunts. These endoscopic changes might be because of mucosal and/or submucosal oedema and congestion highlighting the normal *areae gastricae* pattern and related to raised portal pressure. We conclude that the mosaic pattern of the gastric mucosa is a sensible and specific sign for diagnosis of portal hypertension, whatever the cause.

In patients with cirrhosis, gastrointestinal bleeding related to portal hypertension may be caused by either ruptured oesophageal varices or acute gastric lesions.[2-4] Oesophageal varices mucosal changes in these patients are well documented and might have pronostic value.[5] In contrast, very little information is available on the gastric mucosa. We observed during upper endoscopic examination, of patients with cirrhosis, multiple erythematous areas, mainly in the fundus, rectangular or diamond-shaped (2–6 mm in diameter), outlined by a delicate white or yellowish network, resembling a mosaic (Figure). Moreover, during emergency endoscopy for upper gastrointestinal bleeding in patients with cirrhosis, we noticed multiple red spots located in the centre of these areas (Figure). The aim of the prospective study described is to determine if this sign has a true significance for the diagnosis of cirrhosis and/or portal hypertension and to test its sensitivity and specificity.

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Methods

PATIENTS

Five hundred and eighteen patients were investigated and were divided in five groups.

Group I consisted of 100 patients (64 men and 36 women, age: $53 \cdot 2 \pm 15 \cdot 7$ years, mean±1 SD) with histologically proven cirrhosis (alcoholic in 90 cases, postnecrotic in seven cases and biliary in three cases). The stages of the liver disease, estimated using the Child-Turcotte criteria,[6] were as follows: grade A: 21 patients; grade B: 42 patients; grade C: 37 patients. In the whole group, 32 patients were hospitalised because of gastrointestinal bleeding. Emergency endoscopy, carried out within 24 hours of admission, showed ruptured oesophageal varices in seven cases, acute mucosal lesions, as illustrated in Figure, in 20 cases (fundic in 14 cases, and diffuse in six cases), and chronic gastric or duodenal ulcer in five cases. Most of these patients had clinical manifestations of portal hypertension which was confirmed in all cases by ultrasound examination,[7] and by the demonstration of cirrhosis at the liver biopsy. Sixty three patients underwent transvenous liver biopsy[8] because of abnormal clotting. Mean hepatic venous pressure gradient in these patients was 18 mm Hg (range: 12–35).

Figure. *Endoscopic view of the fundic mucosa: multiple erythematous areas outlined by a yellowish network (mosaic appearance); inset: multiple red spots in the centre of these areas in a cirrhotic patient with recent gastric haemorrhage.*

Group II comprised 300 patients (180 men and 120 women; age: $51·7\pm14·1$ years), without alcoholism (alcohol intake <40 g/day). None of these patients had clinical or endoscopic signs of liver disease and portal hypertension. Endoscopic examination was undertaken for various upper digestive complaints.

Group III comprised 100 patients (62 men and 38 women, age: $51·7\pm14·1$ years), with chronic alcoholism (alcohol intake>80 g/day for at least two years). Clinical, biological, and adequate ultrasonic examination carried out in all cases did not support the presence of chronic liver disease or portal hypertension.

Group IV consisted of eight patients (six men and two women, age: $42·3\pm15·8$ years) with non-cirrhotic portal hypertension (portal or splenic venous obstruction in five cases, nodular regenerative hyperplasia in two cases, and congenital hepatic fibrosis in one case).

Group V consisted of 10 patients (seven men three women, age: $50·3\pm5·2$ years) with alcoholic cirrhosis, who underwent end-to-side portacaval anastomosis for gastrointestinal bleeding related to portal hypertension one to 10 years previously.

In all these patients, fibreoptic endoscopy (Olympus GIFQ, XQ10) was undertaken with examination of the oesophagus and of the gastric mucosa. It must be emphasised that the mosaic pattern can only be seen if the tip of the endoscope is close to the gastric mucosa. The endoscopists (authors listed above) were not informed of the clinical history of the patients. The presence and the size of oesophageal and/or gastric varices, according to the classification of Paquet,[9] and the presence or the absence of the mosaic pattern of the gastric mucosa, as described above (Figure), were recorded in each patient.

The one-dimensional statistical comparisons used the χ^2 test. The informational indices used were the sensitivity, the specificity, and the positive predictive value, defined by Vecchio.[10]

Results

The main endoscopic findings in the five groups of patients are indicated in the Table. In patients with portal hypertension due to cirrhosis (group I), oesophageal varices were demonstrated in only 78 cases, whereas the mosaic pattern of the gastric mucosa was found in 94 cases. The whole stomach was involved in 29 cases, and the fundus alone in 65 cases. In patients without alcoholism or clinical evidence of portal hypertension (group II), this aspect was observed on only one occasion, but it was localised in a restricted area around a malignant

Table 1 *Frequency of oesophageal varices and mosaic pattern of the gastric mucosa*

	Group I Cirrhosis (n=100)	Group II Controls (n=300)	Group II Chronic alcoholism (n=100)	Group IV Non-cirrhotic portal hypertension (n=8)	Group V Surgical portacaval anastomosis (n=10)
Oesophageal and/or gastric varices	78	0	0	8	0
Mosaic pattern of the gastric mucosa	94	1	0	7	0

ulceration of the antrum. The difference was highly significant ($p<0.0001$), and this pattern of gastric mucosa had, for the diagnosis of cirrhosis and/or portal hypertension in this series, a sensitivity of 94%, and a specificity of 99%. Thus, the positive predictive value was of 98%. In alcoholic patients of group III, varices and mosaic aspect of the gastric mucosa were not seen. In the eight patients with non-cirrhotic portal hypertension (group IV), the mosaic pattern was seen in seven cases. In the 10 patients of group V, with surgical portacaval anastomosis, varices were not found, and the gastric mucosa appeared normal in all cases.

The frequency of the mosaic pattern of the gastric mucosa was similar in patients with (92·3%) and without (100%) oesophageal varices, and in patients with (96·8%) and without (91·6%) acute gastrointestinal bleeding.

Discussion

In patients with sinusoidal portal hypertension, whatever the degree of liver failure (group I), or with presinusoidal or prehepatic portal hypertension (group IV), a particular pattern of the gastric mucosa was seen consisting of a mosaic of small (2–6 mm in diameter) erythematous areas delimited by a delicate and white or yellowish network. This has been occasionally described in patients with cirrhosis[11] undergoing endoscopy (Moulinier, personal communication). McCormack *et al*[12] recently included these endoscopic changes under the term of 'mild gastritis', which was noted in 37 of their 127 patients with portal hypertension of various aetiologies. In our experience, the specificity, sensitivity, and positive predictive value of this endoscopic sign of portal hypertension were very high. Portal hypertension *per se*, rather than cirrhosis or alcoholism, was the most likely cause of this endoscopic pattern because: (a) this sign was seen in patients with portal hypertension, but without liver disease (group IV); (b) in 10 cirrhotic patients with end-to-side portacaval anastomosis (group V), this endo-

scopic aspect was lacking; (c) this sign was seen in patients with alcoholic cirrhosis, although alcoholic consumption was discontinued for several months or years in 25 patients, as well as in patients with postnecrotic or biliary cirrhosis; (d) this was never observed in alcoholic patients without signs of portal hypertension. The causal role of haemorrhage in the pathogenesis of this sign may be excluded because it was present in the cirrhotic patients without gastrointestinal bleeding. The clinical value of this sign could be of importance for the endoscopic diagnosis of portal hypertension, because in 22% of our cirrhotic patients with this pattern, oesophageal varices were not demonstrated. Haemodynamic studies are needed to determine if this pattern is an early endoscopic sign of portal hypertension.

This endoscopic pattern might be related to changes in gastric vascularisation observed during portal hypertension: (a) the morphology of the gastric microcirculation is modified in patients with cirrhosis: the diameter of the submucosal arterioles and veins is larger in cirrhotics than in controls. Moreover, straightening of the spiral arterioles, arteriovenous anastomoses, and dilatation of precapillaries, mucosal capillaries, and mucosal veins are frequently observed[12 13] (b) a significant opening of arteriovenous shunting is found in every part of the gastric mucosa in rabbits with experimentally induced cirrhosis;[14] (c) surgically produced portal occlusion in the rat induces morphologic abnormalities of the gastric mucosa, including diffuse haemorrhagic congestion of the glandular area,[15 16] extensive oedema of lamina propria and submucosa.[17] These vascular changes, (especially oedema and congestion), termed 'congestive gastropathy' by McCormack *et al*,[12] probably highlight the normal *areae gastricae* pattern of the gastric mucosa, seen anatomically and radiologically in the normal fundus, but difficult to detect endoscopically.[18] In a short series of our patients, histologic and ultrastructural features of the fundic mucosa confirmed these observations: extensive oedema of the lamina propria and increase in the number and size of mucosal

capillaries were seen in all the seven patients with the mosaic pattern, but in none of the nine patients without portal hypertension.

The precise mechanisms are unclear, nevertheless the role of hypoalbuminaemia may be excluded because these changes were also present in patients with portal thrombosis, but without liver disease (group IV), and in patients with cirrhosis, but with good liver function (group I, grade A). The role of haemodynamic changes, such as increase in splanchnic blood flow, demonstrated in rats with portal hypertension due to chronic portal vein stenosis,[19] [20] might be considered. This hypothesis seems unlikely, however, because these changes are dramatically more marked in rats with end-to-side portacaval anastomosis,[21] [22] and we did not observe the mosaic pattern in patients with portacaval shunts. Moreover, the histologic changes described above are also observed in rats with portal hypertension due to acute portal vein stenosis,[16] [17] a model without increase in splanchnic blood flow.[23] Therefore, the role of portal hypertension *per se* in the development of this endoscopic aspect seems likely.

Acute gastric lesions are a well known cause of haemorrhage in cirrhotic patients, but their incidence ranges for 10–70% in several large series of patients with cirrhosis.[2-4] [24-29] These differences can be explained by the variable timing of the endoscopic examination,[29] but also by the uncertainty about the precise nature of these lesions. This fact is illustrated by the great number of denominations used in the literature: acute mucosal lesions,[3] or ulcers,[2] acute gastric erosions,[30] or ulcerations,[24] [28] acute erosive gastritis,[2] [26] haemorrhagic (erosive) gastritis.[27] [31] We suggest that the mosaic pattern of the gastric mucosa could be the underlying mucosal lesion from which gastric haemorrhage arises. In our patients admitted for bleeding, but without evidence of variceal rupture or gastroduodenal ulcer, many areas of the mosaic mucosa was marked by an haemorrhagic spot. This finding was not observed in patients without haemorrhage. These aspects have probably been previously interpreted as small superficial lesions, called for example red spots[32] or petechieae.[3] [29] Several arguments support the hypothesis that haemorrhage due to acute mucosal lesions is closely related to portal hypertension: (a) propranolol, a drug reducing portal pressure, prevents the risk of recurrent haemorrhage from acute gastric mucosal lesions in patients with cirrhosis and good liver function;[33] (b) bleeding from acute mucosal lesions is prevented in patients with portacaval shunts,[34-37] and in these patients the mosaic pattern was not observed. The mechanism of gastric haemorrhage related to portal hypertension remains unclear, but usefulness of cytoprotective agents[38] [39]

needs to be tested in man. Recording the presence and the intensity of the portal hypertensive gastric mucosa might be of interest in such therapeutic trials.

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