

# THE CONTENT OF PROTECTIVE BARRIER OF THE STOMACH IN PATIENTS WITH DUODENAL ULCER ASSOCIATED AND NON-ASSOCIATED WITH H. PYLORI INFECTION

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## ABSTRACT

The condition of the protective barrier of the stomach in patients with duodenal ulcer associated and non-associated with H. pylori infection has been studied. The state of gastric mucosal barrier was studied in 72 patients with peptic ulcer disease association with H. pylori and 26 patients without H. pylori by determining the content of insoluble glycoproteins and its fractions in the basal portion of the gastric juice. In a comparative perspective the state of these indicators were studied depending on the association with H. pylori and the severity of the disease.

In patients with H. pylori, damages of protective mucus barrier are characterized by the significant shortage of fucose, which is considered to be the main component of the insoluble glycoproteins. In patients without H. pylori, status of mucosal barrier is characterized by uniform and less significant reduction in the content of fractions of insoluble glycoproteins. In this patients the reduction of insoluble glycoproteins is not dependent on the frequency of exacerbation.

The content of fucose in the mucous gel of gastric juice is a diagnostic criterion for determining the frequency of recurrence of the disease in patients with H. pylori infection.

## UDC CODE & KEYWORDS

■ UDC: 616.3 ■ Peptic ulcer disease ■ H. pylori ■ Mucosal barrier

## INTRODUCTION

The content of insoluble mucus gel (IMG) in gastric juice is one of the indicators of functional usefulness of mucosal barrier. Between the content of the IMG in the gastric juice and the functional state of the mucous barrier, there is an inverse correlation. Increasing of IMG in gastric juice shows that the protective mucus barrier is defective and is excreted in large amount to gastric juice under the influence of "washing" action of hydrochloric acid, "mucolytic" effect of pepsin and other factors. In this respect, in violation of functional usefulness of protective mucus cover, an important role is probably played by the helicobacter association (Pasechnikov & Chukov, 2000; Cimmerman, 2008).

### The purpose of the study

To study the protective barrier of the stomach in patients with duodenal ulcer associated and non-associated with H. pylori infection.

### Material and methods

There were 72 patients under observation with duodenal ulcer disease (UD) in the exacerbation phase at the age of 18 to 50 years. The diagnosis was identified based on complaints, anamnesis, objective data and results of esophagogastroduodenoscopy (EGDS). Ulcer anamnesis ranged from 6 months to 15 years. According to data EGDS sizes of ulcers, which were located predominantly on the front and back of the duodenal bulb, ranged from 7 to 10 mm. The nature of ulcers was corresponded with acute phase of process. Patients with complications of peptic ulcer disease weren't included in the study.

Patients were divided into 2 groups. The first group consisted of 72 patients with UD associated with H. pylori 40 of which were men and 32 women. The second group consisted of 26 patients without association of H. pylori infection from which 20 were men and 6 women. Results of study in seven healthy volunteers were as control. The presence of H. pylori was determined by applying for gastric biopsy urease test and cytology (Bazhenov & Perepelova, 1994; Kiskun, 2002).

State of the gastric mucosal barrier was studied by determining the content of the IMG and its fractions in the basal portion of the gastric juice. Content of IMG was determined by the method Fisher & Borisov (1989). In order study the content of fractions of glycoproteins the IMG was suspended by 0.9% saline at the rate of 30 mg/ml. Sialic acid was determined by the method of Linevich (1962), fucose - by the method of PRabinowitz & Lilyushkin (1970) and protein - in. Lowry, Rosebrough, Farr, & Randoll (1959). The results obtained were processed using the Student t-test. Differences were considered significant at  $p < 0.05$ .

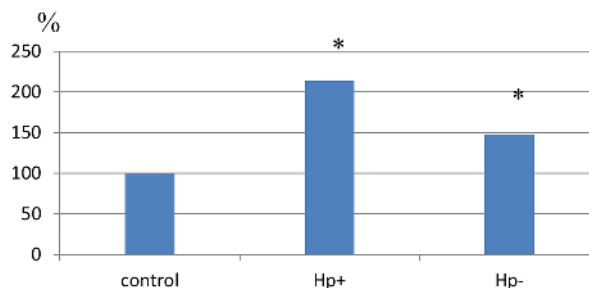
In a comparative perspective the state of these parameters were studied depending on the association with H. pylori and the severity of the disease. Disease severity was calculated from the classification Degtyareva (2004). Of the 72 patients of associated with H. pylori in 19 identified easy severity level (frequency of exacerbations once a year), in 43 patients with moderate severity (frequency of exacerbations 2 times a year) and in 10 patients with severe severity (frequency of exacerbations of 3 or more times a year).

On 26 patients examined without H. pylori in 16 patients were established with easy severity level and 10 of them were with moderate severity. In this group of patients a severe degree of severity wasn't observed.

## Results and discussion

The results of the study of insoluble mucus gel in the basal portion of the gastric juice in patients with UD associated and non-associated with H. pylori are shown in Figure 1.

Figure 1: The content of insoluble mucus gel in the basal portion of the gastric juice in patients with duodenal ulcer with the association and no association H. pylori



Note: Hp+ - a group of patients with H. pylori, Hp - the group of patients without H. pylori; \* -  $p < 0,05$

Source: Authors

According to the above chart in ulcer patients with H. pylori in gastric juice content of IMG increased by 113.4% as compared to the control group ( $60,99 \pm 1,15$  at a norm of  $28,57 \pm 1,67$  mg / ml) ( $P < 0.001$ ).

In the group of patients without H. pylori it was also observed that the content of the IMG in the basal portion of the gastric juice increased. However, these changes were less shown than in the group with H. pylori infection. Thus, in this group the increase of IMG from control values was at 47,6% ( $42,18 \pm 0,73$  at a norm of  $28,57 \pm 1,67$  mg / ml) ( $P < 0.001$ ).

Functional usefulness of protective mucus barrier depends on the ratio of carbohydrate and protein components in glycoproteins IMG. Sialic acids provide elasticity of IMG, and fucose its viscosity, so the study of the content of carbohydrate and protein fractions in suspension IMG presented special interest. The results of the study of the content of the fractions in patients with peptic ulcer disease associated and non-associated with H. pylori are shown in Table 1.

Table 1: The content of some fractions in the suspension of insoluble mucus gel in patients with peptic ulcer disease associated and non-associated with H. pylori

Groups	Number of examined	Sialic acids mg/ml	Fucose mg/ml	Protein mg/ml
Control	7	$5,64 \pm 0,32$	$6,52 \pm 0,21$	$18,40 \pm 1,06$
Peptic ulcer with Hp +	72	$5,81 \pm 0,13$	$3,05 \pm 0,06^*$	$17,18 \pm 0,23$
Peptic ulcer with Hp-	26	$3,44 \pm 0,09^*$	$3,92 \pm 0,09^*$	$11,15 \pm 0,34^*$

Note:  $p < 0.05$  from the control group

Source: Authors

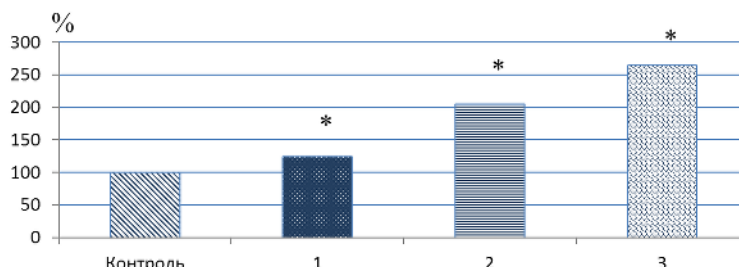
As it can be seen from the data the variation of ratio fractions is different in the groups of patients associated and non-associated with H. pylori.

In patients with H. pylori association decrease in the fucose was observed by 53.3%, whereas the content of sialic acid and protein did not differ from control values.

In the group of patients without H. pylori almost uniform reduction was observed in all fractions IMG. The content of sialic acid was low by 39.1%, fucose by 39.9% and protein by 39.5% from the control group.

Of particular interest was shown to the state of mucosal barrier in patients depending on the duration and severity of the disease. Since, when patients are separated according to duration of the disease in the group of patients they can meet patients with varying degrees of severity. So it was considered to study the state of mucosal barrier in patients with the association and the without H. pylori depending on the severity of the disease.

Figure 2: The content of insoluble mucus gel in the basal portion of the gastric juice in patients with peptic ulcer disease with H. pylori depending on the severity of the disease



Note: 1 - easy severity level; 2 - moderate severity; 3 - severe severity, \* -  $P < 0.05$  from control

Source: Authors

As seen from above chart there is a strong dependence of the content of the IMG in the gastric juice on the severity of the disease. In patients with frequency of exacerbations once per year an increase was observed in the content of the IMG to 24,0% ( $35,45 \pm 1,07$  at a norm of  $28,57 \pm 1,67$  mg/ml) ( $P < 0.002$ ). In the group with frequency of exacerbations 2 times a year the results were more significant. In this group, the content was high in the IMG 105,0% ( $56,57 \pm 1,04$  at a norm of  $28,57 \pm 1,67$  mg/ml) ( $P < 0.001$ ). In patients with frequency of exacerbations of 3 or more times a year, an increase was observed in the content of the IMG to 164,6% ( $75,61 \pm 1,89$  at a norm of  $28,57 \pm 1,67$  mg/ml) ( $P < 0.001$ ). There was a positive correlation between the severity of disease and the IMG content in gastric juice ( $r = 0,65$ ).

Table 2 presents the results of the study of the contents of some fractions in the suspension of IMG in patients with peptic ulcer associated with H. pylori according severity.

Table 2: The content of some fractions in the suspension IMG on patients with peptic ulcer disease associated H. pylori depending from the severity

Groups	Number of examined	Sialic acids mg/ml	Fucose mg/ml	Protein mg/ml
Control	7	$5,64 \pm 0,32$	$6,52 \pm 0,21$	$18,40 \pm 1,06$
UD easy severity level	19	$5,61 \pm 0,14$	$3,86 \pm 0,13^*$	$17,01 \pm 0,36$
UD moderate severity	43	$5,72 \pm 0,08$	$2,77 \pm 0,12^*$	$16,90 \pm 0,32$
UD severe severity	10	$5,54 \pm 0,18$	$1,81 \pm 1,48^*$	$12,73 \pm 0,93^*$

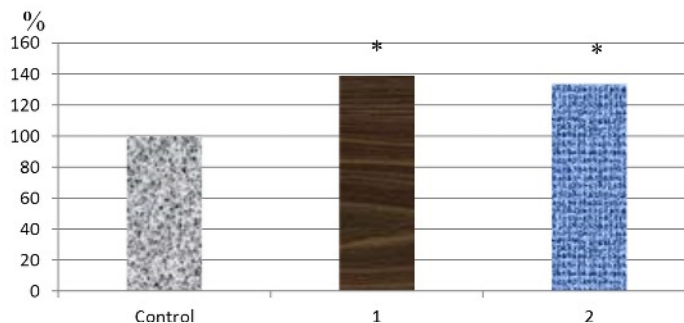
Note: \* -  $p < 0.05$  from the control group

Source: Authors

The results show that in patients with H. pylori infection, the increase of IMG in gastric juice is due to reduced carbohydrate main fractions - fucose. Thus, in patients with frequency of exacerbations 1 time per year, it was observed that the content of fucose decreased by 40.8%, with frequency of exacerbations 2 times a year by 57.6%, and frequency of exacerbations of 3 or more times a year by 72.3% from the control group. In all groups, the content of sialic acid did not differ. Only in patients with frequency of exacerbations of 3 or more times a year, a significant decrease was observed in the content of the protein by 44.5%. An inverse correlation was noted between the frequency of exacerbations and content of the fucose ( $r = -0,72$ ).

The study of the state of mucosal barrier, depending on the severity of the disease in patients without H. pylori showed slightly different results. In Figure 3 the results of the study of insoluble mucus gel in the basal portion of the gastric juice in patients without association of H. pylori have been illustrated.

Figure 3: The content of insoluble mucus gel in the basal portion of gastric juice in ulcer disease patients without association of H. pylori depend on the frequency of exacerbations



Note: 1 - easy severity level; 2 - moderate severity; \* -  $P < 0.05$  from control

Source: Authors

As we see from Figure 3, in patients with a frequency of exacerbations once per year an increase of IMG was observed for 38.6% from the control group ( $39,60 \pm 0,90$  at a norm of  $28,57 \pm 1,67$  mg/ml) ( $P < 0.001$ ). Similar changes were observed in the group of patients with frequency of exacerbations 2 times a year. The increase in the content of the IMG in this group was by 33,6% ( $38,17 \pm 1,4$  at a norm of  $28,57 \pm 1,67$  mg/ml) ( $P < 0.001$ ).

In studying the content of fractions IMG of patients of these groups the results were significantly different from the results obtained in patients with H. pylori. The obtained results of studying the contents of some fractions in the suspension IMG in ulcer disease patients without association H. pylori depending from the severity were shown in Table 3.

Table 3: The content of some fractions in the suspension IMG in ulcer disease patients without association H. pylori, depending on the severity of the disease

Groups	Number of examined	Sialic acids mg/ml	Fucose mg/ml	Protein mg/ml
Control	7	$5,64 \pm 0,32$	$6,52 \pm 0,21$	$18,40 \pm 1,06$
UD easy severity level	16	$3,46 \pm 0,11^*$	$3,82 \pm 0,12^*$	$11,26 \pm 0,42^*$
UD moderate severity	10	$3,40 \pm 0,16^*$	$4,17 \pm 0,11^*$	$10,88 \pm 0,56^*$

Note: \* -  $p < 0.05$  from the control group

Source: Authors

As it can be seen from this table, in both groups a significant decrease in all fractions IMG were observed. Changing the content of the fractions was uniform and on all indicators in both groups. In these groups, reduced content of the fucose was significantly less than in patients with H. pylori.

Analysis of the frequency of exacerbations in patients with peptic ulcer disease, depending on the association with H. pylori infection shows that the features of changes in reducing the barrier in patients with H. pylori infection is reflected in the course of the disease (Table 4).

Table 4: The frequency of exacerbations in patients with peptic ulcer disease, depending on the association of H. pylori infection

Groups of patients	Severity (number of patients and %)		
	UD easy severity level	UD - moderate severity	UD severe severity
Patients with the H. pylori association	19 26.4%	43 59.7%	10 13.9%
Patients without H. pylori association	16 61.5%	10 38.5%	–

Source: Authors

In patients with H. pylori association mainly moderate severity degree was observed at 59.7% and 13.9% of patients with severe degree.

In the group without association H. pylori in 61.5% of patients was easy severity level. Patients with moderate severity in this group were 38.5% and in patients with severe UD were not observed

As our research indicates, in patients with peptic ulcer disease with H. pylori status of the protective barrier gastroduodenal zone in radical differ from those in patients without association of H. pylori. In patients with H. pylori infection there was significantly more damage to the protective barrier than in patients without H. pylori. Damage to the protective barrier revealed in main significant decrease in the content of fucose which provides viscosity of cover mucous gel. There is a clear correlation between the content of fucose and severity of disease. Our results allow us to recommend determination of fucose in the mucous gel as a diagnostic criterion for determining the frequency of recurrence of the disease in patients with H. pylori.

Significant shortage of fucose in gastroduodenal mucosal barrier in patients with H. pylori is probably due to two mechanisms. Perhaps fucose as the main carbohydrate component is a breeding ground for H. pylori. Another mechanism may be the production of enzymes aimed at splitting fucose. This hypothesis is consistent with the results of Slomany, Piotrowski, & Okazaki (1989) that when cultured H. pylori in the environment discovered enzyme alpha-L-fukozidase.

As for the features of damage of mucosal barrier in patients with peptic ulcer without H. pylori, it is probably due to the high aggression of hydrochloric acid and pepsin in these patients. The proof of this assumption is the complete restoration of protective mechanisms during anti-ulcer therapy with omeprazole, which quickly locks the key factors of aggression (Khamraev, 2005).

## Conclusion

In patients with association of H. pylori, damages of protective mucus barrier are characterized by the significant shortage of fucose, which is considered to be the main component of the insoluble glycoproteins. The content of fucose in the mucous gel of gastric juice is a diagnostic criterion for determining the frequency of recurrence of the disease in patients with H. pylori infection.

In patients with peptic ulcer without association of H. pylori, status of mucosal barrier is characterized by uniform and less significant reduction in the content of fractions of insoluble glycoproteins. In this category of patients the reduction of insoluble glycoproteins in the mucus barrier is not dependent on the frequency of exacerbation.

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