UDC 616.33-008.6-036.12-022.6-079-053.2

THE ASSESSMENT OF THE STOMACH SECRETORY FUNCTION IN CHILDREN WITH CHRONIC GASTRODUODENAL PATHOLOGY

A.V.Nalyotov

Donetsk National Medical University named after M.Gorky

Key words: children; chronic gastroduodenal pathology; pepsinogens; Helicobacter pylori

The long-term persistence of Helicobacter pylori infection with the increased concentration of hydrochloric acid and pepsins increases the aggressive properties of the gastric juice. These changes may contribute to development of the ulcer disease. Further progression of the pathological process leads to occurrence of atrophy, intestinal metaplasia, dysplasia, and may end with gastric cancer. 280 children with chronic gastroduodenal pathology have been examined. The presence of Helicobacter pylori has been examined by both rapid urease test and urease breath test. The concentration of pepsinogens in the blood serum and acidity of the gastric juice have been studied in all patients under research. The significant changes in the secretory function of the gastric mucosa have been revealed in children with chronic gastroduodenal pathology. The persistence of Helicobacter pylori, increase of the pepsinogens and hydrochloric acid concentration in the gastric juice leads to development of erosive and ulcerative changes in the mucosa of the duodenum in children. In addition, the long-term course of chronic gastroduodenal pathology with persistence of Helicobacter pylori may cause development of atrophic processes in the mucosa in childhood. It can not be always possible to diagnose these changes by using biopsy of the gastric mucosa. Determination of the level of pepsinogens in the blood serum and diagnosis of Helicobacter pylori by non-invasive methods can be effectively used as detection of the severity of the inflammation process in the mucosa of the stomach and duodenum in children.

The *Helicobacter pylori* (HP) infection is the main and recognized factor in development of chronic gastroduodenal pathology (CGDP) among patients of different age groups. In Russia and Ukraine the infection among the adult population is about 70-80%, and among children, depending on the age, it is 40-70%. The HP-infection reaches adult levels to 14-15 years old [1, 2, 9, 10].

The long-term persistence of HP infection with the increased concentration of hydrochloric acid and pepsins increases the aggressive properties of the gastric juice. These changes may contribute to development of the ulcer disease (UD). Further progression of the pathological process leads to occurrence of atrophy, intestinal metaplasia, dysplasia, and may end with gastric cancer. This chain of events takes a long time. The questions of formation of the preconditions for further carcinogenic cascade and the assessment of the risk at the earlier stages of the disease are still open. The information about the frequency of development of atrophic changes in the gastric mucosa among children according to different authors are very contradictory, but the possibility of development of this disease in children has been accepted by all researchers [1, 4].

The endoscopy with gastrobiopsy is the main diagnostic method for verification of the atrophic process in the gastric mucosa. The modern requirements determine the necessity of taking at least five bioptic samples from different parts of the stomach. However, the atrophy is not always possible to identify by biopsy; it is usually focal and not always come into the view of a pathologist [8]. In addition, conducting gastrobiopsy is especially difficult in pediatric practice.

Today there is an alternative non-invasive method for determining the level of the gastric secretory function, which is based on determination of the serum pepsinogens (PGs). There is correlation between the level of the serum PG and the state of the secretory function of the gastric mucosa. PGs are secreted in cells of the mucous membrane of the stomach and converted to pepsin by autocatalysis in the presence of hydrochloric acid. They can be subdivided on the basis of their physical properties into two major groups: pepsinogen I (PG1) and pepsinogen II (PG2). The measurement of PG1 and PG2 in the blood serum is considered to be one of the non-invasive biochemical markers for monitoring peptic secretion and obtaining information on the gastric mucosa status in patients. PG1 is synthesized exclusively by the chief cells of the fundus and the body of the stomach. The major part of PG1 is secreted into the gastric lumen, but a small amount can be found in the blood. PG2 is secreted by all parts of the gastric mucosa and the proximal part of the duodenal mucosa. The PG measurements have been used as an effective biochemical method for evaluating and monitoring patients with CGDP. The levels of PG1 and PG2 in the serum are always high in normal gastritis, while in atrophic gastritis they are low. The

A.V.Nalyotov – Candidate of Medicine, teaching assistant of the Department of Pediatrics No. 2 of the Donetsk National Medical University named after M.Gorky

serum concentration of PG2 shows information about the functional status of all parts of the stomach. The average concentration of PG1 in 3 and more points exceeds the level of PG2. In most gastrointestinal pathologies the ratio between the PG1/PG2 decreases [5, 7].

Activation of the secretory function of the stomach increases the aggressive properties of the gastric juice, which can be exacerbated the inflammatory process in the gastric mucosa. Against the background of the long-term persistence of HP infection in children the part of erosive and ulcerative gastroduodenal lesions increases with age. The reduced of concentration of PG1 and PG2 in the blood serum in the patients with the long-term CGDP may be associated with development of atrophic processes in the mucous membrane of the stomach.

Serological markers of the gastric mucosa changes have been studied in detail in adult patients. Their high information content and prognostic importance have been proven in a number of studies [3, 5, 6]. In our country, where HP-associated CGDP develops in children at an early age, it is especially important to find new opportunities to predict their course. The study of serological markers of the morphological state of the gastric mucosa looks most attractive in children due to its non-invasiveness. However, in pediatric practice survey data are occasional.

The aim of our study was to investigate the state of the acid-forming and enzyme-forming functions of the stomach in children with CGDP.

Materials and Methods

At the premises of the Donetsk City Children Clinical Hospital No. 1 280 patients with CGDP aged from 9 to 17 years old were examined. All patients were divided into four groups of comparison: group I – 50 (17.9±2.3%) children with chronic gastroduodenitis (CGD), which is not associated with HP-infection (HP-), group II – 50 (17.9± ±2.3%) with CGD associated with HP (HP+), group III – 60 (21.4± ±2.5%) with duodenal UD, group IV – 120 (42.9±3.0%) with erosive bulbitis (EB). CGDP of the patients of groups III and IV was associated with HP-infection.

Endoscopy with biopsy of the antrum and fundus of the stomach and bulb duodenum was conducted in all patients to confirm the diagnosis. The presence of *Helicobacter pylori* was examined by both rapid urease test and urease breath test. HP infection was diagnosed in the case of positive results of both methods.

The secretory function of the stomach was estimated by pH-metry and serologic methods. PG1 and PG2 levels were detected by the enzyme-linked immunosorbent assay and the PG1/PG2 ratio in the blood serum was calculated. The reagents sets of "Vector-best" JSC (Novosibirsk, Russia) were used.

The manufacturer recommended to consider the normal concentration of PG1 in the serum within – 30-130 mcg/l, PG2 – 4-22 mcg/l, the PG1/PG2 ratio – 3-20. Blood sampling for research was taken in the morning on an empty stomach.

The statistical analysis of results was performed using of parametric and nonparametric methods of the Medstat software package.

Results and Discussion

The comparison of the indices of the PG level and the data of intragastric pH-metry has allowed to evaluate the condition of the secretory function in children with CGDP. The analysis of PG1 and PG2 levels in the blood serum in patients of comparative groups has shown certain changes in the concentration of enzymes depending on the severity of inflammation in the mucous membrane of the stomach and duodenum.

The erosive and ulcerative changes in the duodenum mucosa were characterized by increase of the PG serum concentration. So, the increased PG1 level in the blood serum in children with duodenal UD was found in 41 (68.3± ±6.0%) patients, it was significantly higher ($p<0.001$) than in children of group I – 10 (20.0±5.7%) and group II – 18 (36.0±6.8%). The average value of PG1 in this group was 134.2±8.7 mcg/l, it was significantly higher ($p<0.05$) in comparison to other clinical groups: I (87.7±4.9 mcg/l, $p<0.01$), II (101.3± ±5.3 mcg/l, $p<0.01$) and IV ($p<0.05$). Increase of the PG2 level was typical for patients with duodenal UD. These changes of the PG2 level indicated the inflammatory process of all parts of the stomach and the proximal part of the duodenum. Increase of the PG2 concentration was registered in 42 (70.0± ±5.9%) patients with duodenal UD, it was significantly higher ($p<0.001$) compared to group I – 7 (14.0± ±4.5%) and group II – 15 (30.0± 6.5%). The average level of PG2 in children with duodenal UD was 24.5±1.8 mg/l; it was significantly ($p<0.001$) higher than in patients of groups I (14.7±1.0 mg/l) and II (17.0±0.9 mg/l).

Increase of the PG1 and PG2 concentration in the blood serum was determined in 69 (57.5±4.5%) children with EB, it was more frequent in relation to group I ($p<0.001$) and II ($p<0.05$). The average level of the PG1 concentration in children with EB was 111.6±5.4 mg/l, it was significantly higher ($p<001$) than in children of group I. The average level of the PG2 concentration in children with EB was 20.9±1.1 mg/l, it was higher in relation to children of group I ($p<0.001$) and II ($p<0.05$).

In our study decrease of the PG concentration considered as a biochemical marker of atrophy of the gastric mucosa was detected only in children with destructive changes in the duodenal mucosa. The low concentration of PG1

was diagnosed in 12 (20.0±5.2%) children with duodenal UD and in 28 (23.3±3.9%) patients with EB. The reduced concentration of PG2 was observed in 13 (21.7± ±5.3%) and 25 (20.8±3.7%) patients, respectively. The PG1/PG2 ratios in all these cases were more than 3 indicating prevalence of the atrophic process in the antrum of the stomach. Thus, the atrophic process morphologically was diagnosed in 11 (18.3±5.0%) patients with duodenal UD and in 16 (13.3± ±3.1%) children with EB. These results confirm the fact that decrease of the PG concentration in the blood serum can occur even at the minimum level of atrophy. These changes may not come into the view during the morphological study. Decrease of the PG level may be regarded as an early marker of atrophy in the gastric mucosa in children. Characteristically, the reduced concentration of PG1 and PG2 was detected in children older than 15 years with chronic disease for more than 5 years.

Increase of the hydrochloric acid level was not always combined with the increase of the PG level. However, general trends of changes in acid and enzyme secretion among the patients with CGDP were similar. The assessment of acid secretion of the stomach by using pH-metry has confirmed the data that the acid-forming function in the majority patients with CGDP is characterized by increased acidity of the gastric juice. The increased acidity of the gastric juice was detected in 58 (96.7±2.3%) patients with duodenal UD, in 106 (88.3±2.9%) patients with EB. The increased level of acidity of the gastric juice was revealed in 40 (80.0±5.7%) children with CGD (HP+) and in 35 (70.0± ±6.5%) patients with CGD (HP-).

CONCLUSIONS

1. The significant changes in the secretory function of the gastric mucosa have been revealed in children with CGDP.

2. The persistence of *Helicobacter pylori*, increase of the pepsinogens and hydrochloric acid concentration in the gastric juice leads to development of erosive and ulcerative changes in the mucosa of the duodenum in children.

3. The long-term course of chronic gastroduodenal pathology with persistence of *Helicobacter pylori* may cause development of atrophic processes in the mucosa in childhood.

4. Determination of the level of pepsinogens in the blood serum and diagnosis of *Helicobacter pylori* by non-invasive methods can be effectively used as detection of the severity of the inflammation process in the mucosa of the stomach and duodenum in children.

REFERENCES

1. *Белоусов Ю.В. // Здоровье ребенка. – 2011. – №5 (32). – С. 76-80.*
2. *Бєлоусов Ю.В., Бєлоусова О.Ю., Волошина Л.Г. та ін. Захворювання органів травлення у дітей (Стандарти діагностики та лікування): Навч. посіб. – Х.: Факт, 2010. – 143 с.*
3. *Дрыгина Л.Б., Пояркова Н.А., Саблин О.А. // Эксперим. и клин. гастроэнтерол. – 2010. – №2. – С. 27-31.*
4. *Загорский С.Э., Назаренко А.Н. Морфологические особенности эрозивно-язвенных поражений желудка и двенадцатиперстной кишки у детей и подростков // Актуальные проблемы абдоминальной патологии у детей: Матер. XVII конгр. детских гастроэнтерол. России и стран СНГ. – М., 2010. – С. 86-87.*
5. *Маев И.В., Мельникова Е.В., Крюкова Т.В. и др. // Клин. перспективы гастроэнтерол., гепатол. – 2009. – №6. – С. 30-34.*
6. *Меньшикова Е.А., Добродеева Л.К., Кривоногова О.В. // Экол. человека. – 2009. – №7. – С. 11-14.*
7. *Молчанова А.Р., Сорокина Н.Н., Рукавишников М.Ю. // Новости «Вектор-Бест». – 2010. – №2 (56). – С. 7-10.*
8. *Мосійчук Л.М., Зак М.Ю. // Сучасна гастроентерол. – 2010. – №4 (54). – С. 52-56.*
9. *Файзуллина Р.А., Абдуллина Е.В. // Практическая медицина. – 2011. – №1 (49). – С. 74-78.*
10. *Щербаков П.Л. // Эксперим. и клин. гастроэнтерол. – 2008. – №8. – С. 46-52.*

ОЦІНКА СЕКРЕТОРНОЇ ФУНКЦІЇ ШЛУНКА У ДІТЕЙ З ХРОНІЧНОЮ ГАСТРОДУОДЕНАЛЬНОЮ ПАТОЛОГІЄЮ

А.В.Нальотов

Донецький національний медичний університет ім. М.Горького

Ключові слова: діти; хронічна гастродуоденальна патологія; пепсиногени; Helicobacter pylori

Тривала персистенція Helicobacter pylori інфекції поряд з підвищенням концентрації соляної кислоти та пепсинів посилює агресивні властивості шлункового соку, сприяючи виникненню виразкової хвороби. Подальше прогресування патологічного процесу призводить до появи атрофії, кишкової метаплазії, дисплазії та може фінішувати на рак шлунка. Обстежено 280 дітей з хронічною гастродуоденальною патологією. Діагностика Helicobacter pylori проводилася швидким уреазним тестом з біопсійним матеріалом та дихальним уреазним тестом. Вивчена концентрація пепсиногенів у сироватці крові та кислотність шлункового соку у всіх обстежених пацієнтів.

Виявлені значні зміни в характері секреторної функції слизової оболонки шлунка у дітей з хронічною гастродуоденальною патологією. Персистенція Helicobacter pylori, підвищення концентрації пепсиногенів та соляної кислоти у дітей призводять до розвитку ерозивно-виразкових змін слизової оболонки дванадцятипалої кишки. Крім того, тривалий перебіг хронічної гастродуоденальної патології з персистенцією Helicobacter pylori може викликати розвиток атрофічних процесів у слизовій оболонці вже в дитячому віці, що не завжди вдається діагностувати при використанні біопсії слизової оболонки шлунка. Визначення рівня пепсиногену 1 та пепсиногену 2 в сироватці крові разом з використанням неінвазивних методів діагностики Helicobacter pylori може ефективно застосовуватися в якості визначення важкості перебігу запального процесу в слизовій оболонці шлунка та дванадцятипалої кишки в дитячому віці.

ОЦЕНКА СЕКРЕТОРНОЙ ФУНКЦИИ ЖЕЛУДКА У ДЕТЕЙ С ХРОНИЧЕСКОЙ ГАСТРОДУОДЕНАЛЬНОЙ ПАТОЛОГИЕЙ

А.В.Налетов

Донецкий национальный медицинский университет им. М.Горького

Ключевые слова: дети; хроническая гастродуоденальная патология; пепсиногены; Helicobacter pylori

Длительная персистенция Helicobacter pylori-инфекции наряду с повышением концентрации соляной кислоты и пепсинов усиливает агрессивные свойства желудочного сока, способствуя возникновению язвенной болезни. Дальнейшее прогрессирование патологического процесса приводит к появлению атрофии, кишечной метаплазии, дисплазии и может финишировать раком желудка. Обследовано 280 детей с хронической гастродуоденальной патологией. Диагностика Helicobacter pylori проводилась быстрым уреазным тестом с биопсийным материалом и дыхательным уреазным тестом. Изучена концентрация пепсиногенов в сыворотке крови и кислотность желудочного сока у всех обследованных пациентов. Выявлены значительные изменения в характере секреторной функции слизистой оболочки желудка у детей с хронической гастродуоденальной патологией. Персистенция Helicobacter pylori, повышение концентрации пепсиногенов и соляной кислоты у детей приводит к развитию эрозивно-язвенных изменений слизистой оболочки двенадцатиперстной кишки. Кроме того, длительное течение хронической гастродуоденальной патологии с персистенцией Helicobacter pylori может вызвать развитие атрофических процессов в слизистой оболочке уже в детском возрасте, что не всегда удается диагностировать при использовании биопсии слизистой оболочки желудка. Определение уровня пепсиногена 1 и пепсиногена 2 в сыворотке крови вместе с использованием неинвазивных методов диагностики Helicobacter pylori может эффективно применяться в качестве определения тяжести течения воспалительного процесса в слизистой оболочке желудка и двенадцатиперстной кишки в детском возрасте.

Address for correspondence:
16, Illicha av., Donetsk, 83003, Ukraine.
Tel. (95) 123-49-99. E-mail: nalyotov-a@mail.ru.
Donetsk National Medical University named after M.Gorky

Received in 11.03.2014