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Non-invasive method of diagnosis of the hiatal hernia

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Abstract

Introduction. The relationship between the hiatal hernia and the gastroesophageal reflux disease (GERD) is established. It is advisable to develop an accessible non-invasive diagnostic method for this combined pathology.

Materials and methods. The results of the diagnosis of hiatal hernia, associated with GERD, were analyzed with the help of the determination of ionized calcium in saliva.

Results and discussion. It has been established that in the saliva of patients with hiatal hernia, the calcium content was increased by 100.9% compared to the control group. Such a significant increase in the level of calcium in the saliva of patients with hiatal hernia may be due to the fact that the development of this pathology is a disorder of calcium homeostasis.

Conclusions. It has been found that the calcium content in the saliva of patients with hiatal hernia exceeded the norm almost twice. Thus, the determination of calcium content in saliva can be used as a simple non-invasive diagnostic marker of hiatal hernia associated with GERD.

Keywords: hiatal hernia; gastroesophageal reflux disease; diagnostics

Introduction

The problem of hiatal hernia, combined with gastroesophageal reflux disease today is considered as one of the challenging issues, as evidenced by the large number of publications, both domestic and foreign [1, 4, 6, 12]. Probably the difficulty in diagnosing hiatal hernia and GERD can be explained by frequent atypical course of the disease, the presence of concomitant pathology and the absence of a "gold standard" of surveys.

The main reason for the hiatal hernia combined with GERD is a disorder in the functioning of the anti-reflux barrier, which includes: the lower esophageal sphincter, the abdominal segment of the esophagus, the esophageal hiatus, the gastrophrenic ligament, and the cardiac notch. With the severe GERD course acid damage to the esophagus leads to a decrease in its contractility and tone of the lower esophageal sphincter (LES), they do not restore after cicatrization of erosion under the influence of pharmacological therapy. Sliding hiatal hernia causes incontinence of the phrenicoesophageal apparatus and increases the diameter of the esophageal hiatus. In this case, the cardiac section of the stomach is shifted to the chest cavity through the esophageal hiatus. The mixed type hiatal hernia occurs more often than the typical paraesophageal hernia. In this case, there is a general atonia of the phrenoesophageal membrane in conjunction with its local disruption, for this reason not only esophagogastric junction slips up through the esophageal opening, but also to a greater or lesser extent part of the stomach [4].

At present, postoperative lethality after hiatal hernia open repair surgery remains high enough – 25% [8]. The failure of the esophagogastric junction is 55-70% of the total number of complications, and the mortality from the esophagogastric bleeding is 22-34% [7]. Large and giant hiatal hernias are associated with GERD in 50-90% and constitute a high risk of complications, such as esophagogastric ulceration and bleeding (2-10%), metaplasia (5-20%) and esophageal adenocarcinoma (0.5-6%), stricture (7-25%), perforation (0-4%), compression of the mediastinum [11].

According to the algorithm recommended by the American Gastroenterological Association in 2008 and 2013, in the presence of typical GERD symptoms, endoscopy of the upper digestive tract cannot be mandatory [9]. The "golden standard" of diagnostics for a long time has been considered a daily esophageal pH monitoring [10]. However, the high cost, invasiveness, inconvenience during the examination which cannot be completely eliminated even if Bravo radio capsule is used, substantiate the feasibility of finding new diagnostic techniques.

The search for new morphological signs of damage to the esophageal mucosa by the gastric material continues. First, this will allow the non-erosive GERD to be distinguished from

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functional heartburn, and second, to control the effectiveness of therapy, including the use of proton pump inhibitors (PPIs) [10]. An electron microscopic evaluation of the esophagus mucosal biopsy material can be recommended as the primary method for detecting early esophageal changes [2]. The method has a significant advantage in controlling treatment with PPI compared to pH-metric technique due to the possibility of direct evaluation of the lesion. However, the obstacle to widespread introduction into clinical practice is the cost of examination and the lack of special equipment in health care facilities.

Recently, much attention has been paid to the study of preepithelial defense of the esophagus mucosa from the aggressive content of reflux material. Preepithelial defense includes saliva and secretion of esophageal submucosal glands, which first come in contact with aggressive factors. Saliva plays an important role in ensuring the effective chemical clearance of the esophagus, maintaining the homeostasis of the viscoelastic gel layer of the esophageal mucosa. There is also a reflexive relationship between receptor apparatus of the esophageal mucosa and efferent nerve fibers of the salivary glands, which can be broken in the presence of GERD [5]. Previous studies have shown a statistically significant decrease in the level of ionized calcium in saliva in patients with GERD compared to healthy individuals [3]. Consequently, it is important to study the content of specific components of saliva in patients with hiatal hernia and GERD.

The aim of the research is to determine significance and give estimate to the non-invasive method of diagnostics of hiatal hernia.

Materials and methods

There were analysed the results of the diagnostics method of hiatal hernia associated with GERD in 34 patients who were undergoing inpatient treatment in the clinic of surgery and endoscopy of the Faculty of Postgraduate Education during 2017-2018 including 18 men and 16 women. Patients' age ranged from 25 to 69 years (the average age was 45 ± 2.1). The content of calcium in saliva was measured using Arsenazo III calcium-sensitive dye photometrically at a wavelength of 590-650 nm.

Normal values of calcium levels in human saliva are found in 22 healthy volunteers.

Results and their discussion

When performing esophagogastroduodenoscopy, radiographic examination of the gastro-intestinal canal with barium sulfate, computer diagnostics of the organs of the abdominal cavity, hiatal hernia was diagnosed in 34 patients, GERD in 32 patients, which amounts 94.1%; esophagogastric bleeding in 8 patients (23.5%); stomach ulcer and duodenal ulcer in 2 patients (5.9%); gallstone disease in 3 patients (8.8%); obesity in 2 patients (5.9%). In four patients, several pathologies were detected at once.

In the saliva of the patients with hiatal hernia calcium was between 0.4 to 5.9 and the average was 2.17 mmol/l. In the control group, content of calcium ranged between 0.57 to 1.72 and the average was 1.08 mmol/l. Therefore it has been found that in the saliva of the patients with hiatal hernia calcium content increased compared to the control group by 100.9% ($p < 0.001$), i.e. calcium was higher almost twice than the norm. Probably, such a substantial increase in the level of

calcium in saliva of patients with hiatus hernia may be due to the fact that the development of this pathology involve disorder of calcium homeostasis, but for confirmation of this hypothesis further research is needed.

So, since calcium is an important electrolyte, which promotes trophic support of submucosal layer of the esophagus, stimulates the secretion of mucus and bicarbonates by superficial epithelial cells, and its reduced concentration leads to disorder of the motor functions, the study of the concentration level of this electrolyte in the saliva of the patients with GERD and hiatal hernia provides a possibility of early non-invasive diagnostics of this combined pathology.

Conclusions

1. It has been found that in the saliva of patients with hiatal hernia associated with GERD, calcium content was increased in comparison with the control group by 100.9% ($p < 0.001$).
2. Thus, estimation of calcium content in saliva can be used as a simple non-invasive diagnostic marker of hiatal hernia associated with GERD.

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