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Review Article

Motor Function of The Gastrointestinal Tract and Biliary Tract in Diverticular Disease of the Small and Large Intestine

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Summery

The aim: Is to identify violations of the motor function of the gastrointestinal tract and the gastrointestinal tract in diverticular disease.

Material and Methods: The study included 12 patients with diverticular duodenal and colon disease. The ratio of women: men is 3:1, moreover, women aged 61.3 ± 7.4 years, men - 69.0 ± 8.1 years.. An objective examination reveals a thickening of the mucous and submucosal layer of the descending colon. The motor function of the colon and small intestine was analyzed electromyographically. Statistical analysis was performed using the Mann-Whitney small sample method at M±m, $p < 0.05$. The study showed that duodenal diverticula localized near the large duodenal papilla account for 16.7% and are observed in the development of duodenum ulcer and recurrent pancreatitis and hernias of the esophageal orifice of the diaphragm - in 8.3% of cases. Diverticular colon disease develops in the presence of chronic pancreatitis - in 66.7%, chronic cholecystitis and cholelithiasis - 50.1%, that is, within the Saint triad. Electromyography can be used to analyze the motility of the gastrointestinal tract and biliary tract in diverticular disease.

Keywords: Diverticular disease; Large intestine; Motor function; Small intestine

Diverticulum is a congenital or acquired protrusion of the wall of a hollow organ, bulging through the circular muscle layer beyond the intestinal wall [1] The presence of diverticula is the basis for the diagnosis of diverticular disease [2]. Diverticula of the small intestine are localized mainly in the duodenum and in every third patient are multiple, localized near the large duodenal papilla and may be acquired as a result of duodenal ulcer and recurrent pancreatitis. The frequency of diverticular colon disease increases with age: in adolescence, among patients with gastroenterological profile, it is 2.2% of patients, in adulthood - 3.9%, in old age - 10.5%, in senile age - up to 17.9% of cases [3]. Diverticula probably occur at the sites of penetration of small arteries into the mucous membrane of the colon, where, due to the relative weakness of the muscle wall, hernial protrusion of the mucous membrane and submucosal base occurs.The muscular wall of the intestine is thickened, the longitudinal bands (tenii) are thinned. Morphologically, the structure of muscle cells in diverticulosis is normal, but contains an excessive amount of elastic fibers between muscle cells and in the tissues [4].

Segmenting contractions of the intestine play a certain role in the pathogenesis of the formation of diverticula, which contributes to the delay in the advancement of the contents of the colon and more efficient absorption of water. It is important to reduce the threshold of visceral sensitivity of the colon with an increase in the threshold of visceral sensitivity of the sigmoid and rectum [5]. Diverticulosis is often combined with a hernia of the esophageal orifice of the diaphragm and gallstone disease – the so-called Saint's triad, which can occur in people with an innate amount of elastic fibers in the connective tissue of internal organs. Elastosis enhances gaustration and increases the spastic readiness of the intestine, especially with the increase of age-related changes in the circular muscles in the form of structural collagen disorders

and loss of tissue extensibility. Uncomplicated diverticular disease is either asymptomatic or with minimal clinical manifestations, intermittent abdominal pain, bloating, irregular fragmented stools (such as sheep) or loose stools. Diverticulitis occurs as a result of inflammation of the mucosa of the diverticulum with possible bleeding and perforation. Fecal masses in the absence of perforation are compressed, turn into concretions, which leads to chronic inflammation and destruction of the wall. There are pains in the lower left abdomen, leukocytosis, fever, nausea, vomiting.

The detection of diverticula was carried out endoscopically, irrigoscopically, on the basis of computed tomography of the abdominal cavity, separate studies of the motility of the colon were carried out. However, a comprehensive study of the motor function of the gastrointestinal tract (gastrointestinal tract) and biliary tract (biliary tract) in diverticular disease has not been conducted. The aim is to identify violations of the motor function of the gastrointestinal tract and the gastrointestinal tract in diverticular disease. Material and methods. The study included 12 patients with diverticular duodenal and colon disease. The ratio of women: men is 3:1, moreover, women aged 61.3 ± 7.4 years, men - 69.0 ± 8.1 years. With diverticulosis, chronic pancreatitis was noted, chronic cholecystitis in half of the cases, chronic bulbitis, unstable stools - in 33.4% of cases. With the development of diverticulitis, there were pronounced pains in the left half of the abdomen, hyperthermia. An objective examination reveals a thickening of the mucous and submucosal layer of the descending colon. The motor function of the colon and small intestine was analyzed electromyographically by installing bipolar silver electrodes on the anterior abdominal wall in the projection area of the organ under study. The amplitude-frequency characteristics of slow waves and spikes, the power of phase and tonic contractions, and the propulsive activity were analyzed using a Nihon Kohden electromyograph (Japan). The comparison group consisted of 9 patients suffering from chronic gastritis C. Statistical analysis was performed using the Mann-Whitney small sample method at M±m, $p < 0.05$.

Results

Diverticular Disease (DB) of the colon

The frequency of slow stomach waves with colon DB was 13.9 ± 2.4 \min (an increase of 152.7%, $p < 0.001$), the amplitude was 0.25 ± 0.003 mV (an increase of 66.7%, $p < 0.05$), the power of tonic contractions was 3.475 ± 0.410 (an increase of 321.2%, $p < 0.001$). The frequency of spikes was 1.8 ± 0.2 (an increase of 79.9%, $p < 0.05$), the amplitude was 0.12 ± 0.0011 mV (an increase of 20%, $p < 0.05$), the power of phase contractions was 0.216 ± 0.013 (an increase of 116%, $p < 0.002$), the propulsive activity was 16.04 ± 1.22 (an increase of 94%, $p < 0.04$). That is, with diverticular colon disease, pronounced hypermotor dyskinesia of the stomach was revealed. Electromyographically, at DB, the frequency of slow waves of the small intestine was 16.2 ± 1.4 \min (a decrease of 19%, $p < 0.05$), the amplitude was 0.25 ± 0.003 mV (an increase of 150%, $p < 0.001$), the power of tonic contractions was 4.05 ± 0.18 (an increase of 202.5%, $p < 0.001$). The frequency of spikes was 1.0 ± 0.004 (within the reference values), the amplitude was 0.2 ± 0.03 mV (an increase of 99.8%, $p < 0.003$), the power of phase contractions was 0.2 ± 0.015 (an increase of 99.7%, $p < 0.04$), the propulsive activity was 20.2 ± 1.7 (an increase of 107.5%, $p < 0.001$). That is, with DB of the colon, the propulsive activity of the small intestine is sharply increased, possibly due to the development of dysbiosis (Table 1).

Organ	Slow waves			Spike activity			Propulsive activity
	Frequency units/min	The amplitude of mV	The power of tonic contractions	Spike frequency	Amplitude of spikes mV	Power of phase reductions	
with DV of the colon	16,2 ± 1,4	0,25 ± 0,003	4,05 ± 0,18	1,0 ± 0,004	0,2 ± 0,03 мВ	0,2 ± 0,015	20,2 ± 1,7
With DV of the small intestine	10,0 ± 0,4	0,17 ± 0,002	1,7 ± 0,11	1,2 ± 0,05	0,07 ± 0,003	0,084 ± 0,006	20,23 ± 1,2

Table 1: Electromotor activity of the small and large intestine in various conditions.

In the right parts of the colon at DB, the frequency of slow waves was 13.0 ± 1.5 \ min (an increase of 18.2%, $p < 0.05$), the amplitude was 0.12 ± 0.002 mV (an increase of 20%, $p < 0.05$), the power of tonic contractions was 1.56 ± 0.18 mV (an increase of 41.8%. $p < 0.05$). The frequency of spikes was 1.1 ± 0.03 (an increase of 10%, $p < 0.05$), the amplitude was 0.12 ± 0.004 mV (an increase of 20%, $p < 0.05$), the power of phase contractions was 0.132 ± 0.012 (an increase of 32%, $p < 0.05$), the propulsive activity was 11.7 ± 0.13 (an increase of 6.4%, $p < 0.05$).That is, with DB of the colon, weakly expressed hypermotor dyskinesia of the right parts of the colon was revealed. In the left colon with DB, the frequency of slow waves was 14.0 ± 0.8 \ min (an increase of 133.4%, $p < 0.001$), the amplitude was 0.19 ± 0.005 mV (an increase of 89.8%, $p < 0.05$, the power of tonic contractions was 2.66 ± 0.24 (an increase of 334.3%,

$p < 0.001$). The frequency of spikes was 1.2 ± 0.02 (an increase of 20%, $p < 0.05$), the amplitude was 0.11 ± 0.004 mV (an increase of 10%, $p < 0.05$), the power of phase contractions was 0.132 ± 0.007 (an increase of 32%, $p < 0.05$), the propulsive activity was 20.15 ± 0.25 (an increase of 215%. $p < 0.001$). A powerful (possibly prestenotic) increase in the motility of the left colon was revealed in DB.

DB of the Small Intestine

In the stomach with DB of the small intestine, the frequency of slow waves was 9.0 ± 1.5 \ min (an increase of 63.4%, $p < 0.05$), the amplitude was 0.17 ± 0.003 mV (an increase of 13.3%, $p < 0.05$), the power of tonic contractions was 1.53 ± 0.13 (an increase of 85.4%, $p < 0.05$). The frequency of spikes was 3.0 ± 0.07 (an increase of 199.8%, $p < 0.001$), the amplitude was 0.08 ± 0.0011 mV (a decrease of 20%, $p < 0.05$), the power of phase contractions was 0.24 ± 0.012 (an increase of 140%, $p < 0.001$), the propulsive activity was 6.4 ± 0.3 (a decrease of 22.9%, $p < 0.05$).That is, with DB of the small intestine, hypomotor dyskinesia of the stomach is observed. In the small intestine, the frequency of slow waves was 10.0 ± 0.4 \min (decrease by 49.8%, $p < 0.05$), the amplitude was 0.17 ± 0.002 mV (increase by 69.8%, $p < 0.05$), the power of tonic contractions was 1.7 ± 0.11 (decrease by 15%, $p < 0.05$). The frequency of spikes was 1.2 ± 0.05 (an increase of 20%, $p < 0.05$), the amplitude was 0.07 ± 0.003 mV (a decrease of 30%, $p < 0.05$), the power of phase contractions was 0.084 ± 0.006 (a decrease of 16%, $p < 0.05$), the propulsive activity was 20.23 ± 1.2 (an increase of 11.4%, $p < 0.05$) (Table 1).That is, with DB, hypermotor dyskinesia of the small intestine of moderate degree was detected.

In the right parts of the colon, the frequency of slow waves was 7.5 ± 0.5 \min (decrease by 46.7%, $p < 0.05$), the amplitude was 0.12 ± 0.0011 mV (increase by 20%, $p < 0.05$), the power of tonic contractions was 0.9 ± 0.05 (decrease by 18.2%, $p < 0.05$). The frequency of spikes was 0.8 ± 0.002 (decrease by 20%, $p < 0.05$), amplitude - 0.05 ± 0.01 mV (decrease by 50.1%, $p < 0.05$), power of phase contractions - 0.040 ± 0.002 (decrease by 60.1%, $p < 0.05$), propulsive activity - 22.5 ± 1.8 (increase by 104.6%, $p < 0.02$). That is, with DB of the small intestine, pronounced hypermotor dyskinesia of the right colon was revealed. In the left colon at DB, the frequency of slow waves was 9.0 ± 1.0 \min (an increase of 50.1%, $p < 0.05$), the amplitude was 0.15 ± 0.003 mV (an increase of 49.8%, $p < 0.05$), the power of tonic contractions was 1.35 ± 0.12 (an increase of 125%, $p < 0.001$). The frequency of spikes was 1.0 ± 0.04 (within the reference values), the amplitude was 0.1 ± 0.003 mV (within the reference values), the power of phase contractions was 0.1± 0.002 (within the reference values), the propulsive activity was 13.5 ± 1.5 (an increase of 125%, $p < 0.001$). That is, with DB of the small intestine, hypermotor dyskinesia of the colon was detected progrediently increasing in the distal direction.

The propulsive activity of choledochus in colon DB was 7.7 ± 0.8 (decrease by 14%, $p < 0.05$), the propulsive activity of the gallbladder was 10.0 ± 0.7 (increase by 20%, $p < 0.05$). That is, with DB of the colon, there is an increase in the passage of concentrated bile into the duodenum, which maintains a high level of motor activity of the intestine and prevents excessive bacterial growth in the small intestine. With DB of the small intestine, the propulsive activity of the choledochus was 13.7 ± 0.12 (an increase of 52.2%, $p < 0.05$), the propulsive activity of the gallbladder was 10.1 ± 1.7 (an increase of 20%, $p < 0.05$). That is, with DB of the small intestine, the passage of bile into the duodenum is increased compared to that with DB of the colon.

Conclusion

The study showed that duodenal diverticula localized near the large duodenal papilla account for 16.7% and are observed in the development of duodenum ulcer and recurrent pancreatitis and hernias of the esophageal orifice of the diaphragm - in 8.3% of cases. Diverticular colon disease develops in the presence of chronic pancreatitis - in 66.7%, chronic cholecystitis and cholelithiasis - 50.1%, that is, within the Saint triad. Separate studies of intestinal motility in colon diverticulosis are described in the literature: high-amplitude short-term peak waves were observed, which indicate sharp changes in intra-intestinal pressure caused by uncoordinated contractions of the intestinal wall with local spasm. The study showed that with diverticular disease, pronounced hypermotor dyskinesia of the stomach, small intestine and left colon was observed, which reflects the presence of dysbiosis of the small and large intestine. The development of hypermotor intestinal dyskinesia may contribute to the increased passage of bile acids through the biliary system and especially the increased release of concentrated bile during the contraction of the gallbladder. Antroduodenal coordination, which is normally 1: 4, with diverticular disease of the small intestine is 1: 3, with diverticular disease of the colon - 1 : 12.6, which indicates a different rate of evacuation of gastric contents in the proximal (in the small intestine) and distal (in the colon) variant of the colon with diverticular disease. Electromyography can be used to analyze the motility of the gastrointestinal tract and biliary tract in diverticular disease.

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