Transcutaneous Electrogastrography in the Perioperative Period in Patients Undergoing Laparoscopic Cholecystectomy and Laparoscopic Non-Adjustable Gastric Banding

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Background: Transcutaneous electrogastrography (EGG) is a non-invasive method of examination that allows monitoring of gastric myoelectric activity. The goal of this prospective study was to describe changes in gastric motility in the early postoperative period in extremely obese patients, who underwent planned surgery – Laparoscopic Non-Adjustable Gastric Banding (LNGB) and to establish the specificity of observed differences for this intervention.

Patients and Methods: Myoelectric gastric activity was evaluated in the perioperative period in 20 extremely obese patients undergoing LNGB. The results of monitoring up to +24 h after the intervention were compared to a group of 15 healthy volunteers, and to a group of 20 patients undergoing laparoscopic cholecystectomy (LC). The recording was performed in both the patient and control groups 24 h before the operation and +5 h, +24 h and +48 h after the surgery, both in the fasting state and after stimulation with a liquid bolus. The data were recorded using the Microdigitrapper device and analyzed using the spectral analysis and Fourier transformation.

Results: The finding characteristic in the early postoperative period was a decrease in frequency of both spontaneous and stimulated gastric contractions (bradygastria) at +5 h after the intervention, that was followed by rapid return to baseline activity. In patients after LNGB, the normalization of motility was seen within 24 h, and in patients after LC within 48 h after the intervention. Tachygastria was not found in any patient who did not have complications, but on the contrary it was found in both patients with significant dyspepsia after LC.

Conclusions: In the early postoperative period after LNGB, significant changes in myoelectric gastric activity were seen and were characterized by transient bradygastria. Comparison with the reference group of patients after LC shows that the intensity and duration of basal and stimulated bradygastria has a non-specific relationship with the extent of tissue trauma caused by the intraabdominal surgery. It is not specific for the gastric banding itself. The method of measuring the basal stimulated EGG potentials can be used in routine surgical practice as an auxiliary method for evaluation of the functional status of the gastrointestinal tract after intraabdominal surgery.

Key words: Electrogastrography, gastric myoelectric activity, morbid obesity, bariatric surgery, laparoscopy, gastric banding, cholecystectomy.

Introduction

Laparoscopic gastric banding is a surgical treatment for extremely obese patients who do not respond adequately to diet and lifestyle recommendations. Gastric banding significantly affects morphological and functional status of the gastrointestinal (GI) tract. The functional variations after this type of intervention have not yet been studied sufficiently. It can be expected that early gastric motility changes are related to acute postoperative stress factors, common to intraabdominal operations, and factors caused by the operation on the stomach itself.
Electrogastrography (EGG) provides information on motility of the GI tract, or more specifically the stomach, by recording the myoelectric activity of the smooth muscles. In this study, a non-invasive EGG was used to evaluate early postoperative changes in gastric motility during the perioperative period of laparoscopic gastric banding.

In this paper, we present the results of a prospective study on patients who underwent Laparoscopic Non-Adjustable Gastric Banding (LNGB) for morbid obesity. The results in these patients are compared with a group of patients indicated for laparoscopic cholecystectomy (LC) and with data obtained from healthy volunteers.

The prospective study had the following endpoints:
1) To compare basal gastric motility in extremely obese patients before the surgical intervention with gastric motility of a healthy population;
2) To characterize changes in gastric motility found by EGG in the early postoperative period regarding their dynamics and amplitude of deviation;
3) To determine, by comparing with the control group (patients after LC), to what extent are the findings in patients with LNGB specific for this type of intervention or do they reflect a non-specific stress caused by the surgery?

According to the location of the recording electrodes, there is a non-invasive and invasive type of EGG. In the non-invasive EGG, the recording electrodes are applied to the surface of the patient’s body (transcutaneous EGG). During invasive monitoring, the electrodes are applied to the immediate vicinity of the muscle of the GI tract (serosa or mucosal EGG).

**Myoelectric Activity and Gastric Motility**

GI motility is controlled by rhythmically recurring electrical potentials referred to as electrical control activity (ECA). The ECA is a result of spontaneous depolarization of cells of the pacemaker – pace-setter potential (PSP). In humans these potentials propagate from a gastric pacemaker in the corpus aborally towards the pylorus at a frequency of three cycles per minute (3 cpm), and are called slow-waves. The electric control activity, or gastric electric activity (GEA), is accompanied by a second slow component with or without superimposed spikes, so-called electric response activity (ERA). Spikes represent high-frequency intermittent depolarization and are believed to be directly associated with gastric contractions. With transcutaneous EGG, only slow-waves can be detected.

Gastric motor activity can be detected in the fasting state and postprandially. During the fasting phase, periodic so-called interdigestive motions of periods from 90 to 120 minutes can be found. The background of these motions is a migrating motor complex (MMC). It originates autonomically in the myenteric plexus and is composed of three periodically recurring phases.

The first phase is period of motoric silence, and lasts approximately 60 minutes. The second phase is characterized by irregular contractions lasting about 30 minutes. The final phase lasting 15 minutes is typified by its distinct motor activity; gastric contraction in this phase may even be perceived painfully.

**Transcutaneous EGG**

The transcutaneous EGG curve is most often obtained using leads attached to the abdominal wall. Curves obtained from measuring the electric potential between two abdominal electrodes have a bipolar character, and this set-up provides the best quality signal. On the other hand, we cannot distinguish which of the two leads detects changes in electrical potential. This is not important if we are focus only on the frequency of the signal, and do not analyze the shape of the separate peaks or the phase shift of the curves.

Non-invasive EGG allows analysis of the frequency of gastric contractions, their regularity, amplitude and the reaction of the stomach to certain external stimuli, e.g. food or drugs.

**Frequency Characteristics of the EGG**

The physiological curve of myoelectric gastric activity consists of regular waves, which have a frequency of approximately 0.05 Hz, i.e. 3 contractions per minute (3 cycles per minute, 3 cpm). There is a broader definition of the physiological range – 2.4 to 3.7 cpm. Frequencies below this interval are called bradygastria, and higher frequencies are called tachygastria (Table 1).