Magnetic scanning of the gastroesophageal mechanical activity in two distension states

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Abstract

A study of the mechanical activity of the gastroesophageal segment in different states from gastric distension is shown. A couple of magnetic particles (3 mm of diameter and 7 mm of height, separated 7 cm one of the other) in the antrum was placed and they moved by the gastroesophageal region to monitoring the mechanical activity of this region with the help of a fluxgate magnetometer. Frequencies associated with the mechanical movement of the different gastroesophageal regions were obtained with the FFT algorithm. Obvious differences between the peristaltic frequencies of activity of the different gastroesophageal regions were obtained.

Keywords: Gastroesophageal, peristaltic activity, fluxgate.

1. Introduction

One of the medical procedures for determination of problems associated to the gastrointestinal system is the periodical evaluation of the gastroesophageal peristaltic activity [1]. Theoretical models have been proposed to describe the mechanical behavior in the gastroesophageal region. A useful technique to make studies in the gastrointestinal tract is implemented with magnetic markers which are monitored with magnetometers while they are inside of the human body, moving through the gastrointestinal tract [2-3].

2. Objective

In this work a study of the mechanical activity of the gastroesophageal segment of the gastrointestinal tract in 6 healthy subjects without any previous gastric pathology is presented.

3. Method

A couple of magnetic markers (3 mm diameter and 4 mm height), separated a distance of 7 cm and bounded to a graduated cord were put into the antrum by an endoscopy (Fig. 1). Also, the endoscopy was used to evaluate the gastroesophageal internal walls and discard problems which affected the motility of the gastroesophageal tract. A fluxgate magnetometer was used to measure the variations of the magnetic field originated by the peristaltic movement. The data were registered in LabVIEW environment at the sample rate of 30 Hz. Measurements were performed initially by 5 min, then the markers were moved 5 cm and a new measurement was performed. The stomach was monitored longitudinally in both basal and postprandial states. In the same way, we monitored the activity at the esophagus region.
4. Results

The means of the frequency of mechanical activity at the gastric region found in this work were 2.5 cpm in basal (fig. 2) state and 3 cpm in postprandial state (fig. 3), respectively. In the region of the esophagus, we found a mechanical activity of 1 cpm on average (fig 4).

Fig. 1: Position of the magnetic markers inside the stomach.

Fig. 2: Raw and filtered signal, (a) PSD of the frequency (b) of the mechanical gastric activity in fasting state at 60 cm from the mouth.

Fig. 3: Raw and filtered signal (a) and PSD of the frequency (b) of the mechanical esophagus activity in the distal region (30 cm from the mouth).

Fig. 4: Raw and filtered signal (a) and PSD of the frequency (b) of the mechanical esophagus activity in the distal region (30 cm from the mouth).

5. Discussion

The postprandial gastric mechanical activity was observed to change from a chaotic to a smooth behavior. This work presents a modality for evaluating the peristaltic activity at the gastroesophageal region which allows monitoring for long periods and different states of gastric distension.

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References

