Instrumentation for a Device to Recording Bioelectrical Signals of the Heart and Stomach

Hernández-Ledezma FU¹, Cordova-Fraga T¹, Hernández- Gonzalez MA², Solorio S², Sosa M¹, Vargas-Luna M³, Cano ME¹, and Bernal-Alvarado JJ¹, and Vargas-Luna FM¹

¹Instituto de Física, Universidad de Guanajuato
Loma del Bosque 103, Lomas del Campestre, 37150 León, Gto., Mexico.

²Hospital IMSS UMAE T1
López Mateos Blvd. and Insurgente Av., 37000 León, Gto., Mexico.

E-mail: francisco@licifug.ugto.mx

Abstract

The study of fourteen subjects, whose electrical heart and gastric activity was measured with a device implemented to carry out studies of cardiology and gastroenterology, is presented. The device contains an electro-gastroenterographer and an electrocardiographer and was used to record signals simultaneously from the heart and the gastrointestinal tract. The device was plugged into microprocessor and then to a computer. The behavior of the signal is similar to commercial systems but in this case, we have a portable device, which gives information about the electrical heart and gastric activity.

Keywords: ECG, electrogastroenterogram.

1. Introduction

Almost 40 % of diabetics have diabetic autonomic neuropathy with slow peristalsism and calcium metabolism altered, that result in myocardial ischemia. It is a fact that, diabetic autonomic neuropathy and angor pectoris symptoms are non specific [1].

In this study, the instrumentation of a portable system capable to record simultaneously the electrical heart and gastric electrical activity is presented.

2. Procedure

This device is plugged into a laptop or display through a microprocessor. Analogical to digital signal conversions is performed with the micro processor (Motorola, model MC68HC908GP32CP), which was programmed with a routine implemented in LabVIEW 8.2.1. Experimental data was recorded at rate frequency of 300 samples/second.

The electrical circuits were printed on an electronic plate. The analogical signal was filtered and amplified with OPAMP of common use [2]. The bioelectrical potentials also were obtained by means of electrodes of common use for both systems.

Fourteen healthy subjects were measured, all of which did not have gastric or heart diseases. The electrical device was isolated of the PC and the electrical feeder. Furthermore, the study protocol was approved by the bioethics committee of the Guanajuato University.

3. Results

P-QRS-T wave was similar in the electrical heart registry for all subjects (Fig 1), and the amplitude and behavior of the signals were similar when it was compared with a commercial electrocardiographer.
A signal analysis was also performed, in order to identify the heart frequency (Fig 2), of each volunteer. The gastric signal was processed too, with an average frequency of 3 cpm [3], see Figs 3 and Fig 4.

![Fig. 2 Power Spectral Density of Fig 1](image1)

![Fig. 3 Filtered signal of the gastric segment](image2)

**4. Discussion**

It is a problem to differentiate between signs and symptoms of diabetic autonomic neuropathy and myocardial ischemia. Which are similar innervated and are manifested by distended abdomen, pyrosis but outputs are different so a non invasive, low-cost, portrait diagnostic method is necessary to distinguish cardiovascular from gastrointestinal alterations [4, 5].

The system is portable and the behavior of the signals is identical to commercial devices, but in this case, there are two systems in one, so two diagnoses can be carried out simultaneously. The device is powerful and can be implemented in hospitals as a diagnostic or research system.

![Fig. 4. Power spectral Density of the gastric signal.](image3)

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**References**


