Recording of the spinal neurovascular response triggered by a non-noxious peripheral nerve stimulation in patients with diabetes mellitus

Juan Esteban Oyarzún1,2, Raul Caulier Cisterna1,2, Juan Pablo González Appelgren1, Antonio Eblen-Zajjur A3; Sergio Uribe1,2,4
1Centro de Imágenes Biomédicas, Pontificia Universidad Católica de Chile, Santiago, Chile
2Millennium Nucleus for Cardiovascular Magnetic Resonance, Santiago, Chile
3Translacional Neurociencia Lab, Facultad de Medicina, Universidad Diego Portales, Santiago, Chile
4Radiology Department, School of Medicine, Pontificia Universidad Católica de Chile, Santiago, Chile

Abstract

Background: Chronic and neuropathic pain are frequent and difficult to treat complications in Diabetes mellitus (DM). These sensory disfunction are not only induced by sensory, motor and autonomic peripheral nerve fibers lesions but also by spinal dorsal horn neuronal network alterations. Functional near-infrared spectroscopy (fNIRS) is used for the evaluation of brain cortical activity measuring changes on oxyhemoglobin (O₂Hb) induced by the neuronal activity. We implemented a fNIRS technique to evaluate the spinal cord neurovascular response (NVR) triggered by peripheral nerve stimulation. Objective: To characterize changes in the spinal NVR in DM patients using fNIRS. Methods: Non-invasive, spinal fNIRS technique was implemented with 8 recording channels located at vertebral levels in 19 type 2-DM patients (more than 14 years of diagnosis) and 37 healthy volunteers. Single electrical pulse was applied to the left median nerve at the wrist skin. Median nerve conduction velocity (NCV) was also evaluated. Results: DM patients show lower amplitude values of NVR in all vertebral levels compare to the healthy group. The DM patients show normal median NCV. Other NVR parameters such as rise-time and duration were also abnormally reduced. These findings are consistent with the notion of a diffuse functional deterioration of the spinal neural-vascular-coupling process, but also of a disfunction of the spinal dorsal horn neuronal network associated to long lasting DM. Conclusion: The results strongly suggest the sensibility of the implemented spinal fNIRS to detect spinal functional changes in DM patients, mainly characterized by reduced amplitude, rise-time and duration of the spinal NVR triggered by median nerve electrical stimulation.

Methodology

Aim

Characterize changes in the spinal NVR in DM patients using fNIRS

Results

Table 1: clinical and anthropometric measurements of patients with diabetes mellitus (DM) compared with the control group (CG). F: Woman; M: Man; BMI: body mass index; NCV: nerve conduction velocity.

This study was supported by FONDEF ID180064, Fondecyt 1181057 and the Millennium Nucleus on Cardiovascular Magnetic Resonance, ANID, Fundación COPEC-UC 2018R.1030 and Fondecyt Postdoctorado 2021 #3210305.00