NEUROPHYSIOLOGICAL CHANGES IN THE AFFERENT SOMATOSENSORY SYSTEM INDICES IN THE CASE OF VERTEBROGENIC SPINE PATHOLOGY IN MINERS

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Abstract
Objectives: The aim of the paper was to prove that job conditions impact the state of the afferent part of the somatosensory system in miners. Materials and Methods: Data analysis of the electrophysiological examination of the syndrome in 148 patients, aged from 28 to 55 years, with a mild, moderate and severe degree of the pain syndrome was performed. The control group included 28 people without any pain symptoms. The method used was that of somatosensory stimulated potential (SSP) with the potentials amplitude and latency main components taken into consideration. Results: It was proven that the true decrease of the somatosensory stimulated potential SSP N22 (p < 0.05) component amplitudes by 41%; N30 component amplitude tend to decrease by 26%. This proves that the true N22 (p < 0.01) component latency increase by 63.8% corresponds to afferent excitation wave conductibility under the pain syndrome of vertebral pathology through sensitivity pathways mainly in the posterior spinal cord columns and then, through the parts of the brain stem, involving the cerebral cortex, which is confirmed by the fact that the P38 and P46 components amplitudes tend to decrease. In addition to this, the proven N10–N13 (p < 0.05), N13–N20 (p < 0.05), N10–N20 (p < 0.05) intervals increases by 43.5–41.8–38.7%, respectively, correspond to the nervous impulse conductibility through the peripheral nervous system structures and allow to reveal the subclinical slowdown of impulse conductibility, which indicates that the conducting system is changed even under a mild pain syndrome. Conclusions: It was found that the data obtained allow for the better understanding of how the neuropathological pain syndrome under vertebral spine pathology is formed.

Key words:
Miners, Vertebral pathology, Pain syndrome, Somatosensory Stimulated Potential (SSP), Pain reception, Afferent neurons

INTRODUCTION

Lumbosacral pathology is responsible for 30% of the incidence rate of non-occupational diseases, 20% of the nervous system diseases and more than 80% of the peripheral nervous system diseases [1,2]. Almost 80% of all health care costs account for the back pain treatment. The spread of occupational peripheral nervous system diseases among the people of active working age is highly detectable and often is the cause of temporary or complete disability. These are the most common cases, after cardio-vascular events and pathology of joints, which cause limiting disability in people younger than 45 years old. The analysis of the rate of lumbalgia in patients with vertebral pathology showed that the low back pain syndrome is a problem caused by a set of factors, workplace conditions being the risk factors [3,4].

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The study of the way spinal stem mechanisms form reflex motor reactions to a complex of negative factors of working place is, undoubtedly, of big importance. The present day knowledge about pain and analgesic mechanisms is based on the data of anatomical morphological and neurophysiologic examinations. Looking at the problem as a whole, one can state that pathophysiologic mechanisms of lumbo-sacral radiculopathy in miners with the pain syndrome have not been adequately studied [5,6].

The characteristics and the degrees of the peripheral, segment and central sensorimotor system level changes teamed with emotional impact disorders under occupational vertebral diseases remain underestimated, which complicates the examination of disability and the identification of the link between the disease and the job; it also influences the choice of an adequate and efficient individual treatment and rehabilitation program [7,8].

The issues stated above, which are of practical importance, call for the introduction of evidence based differentiated approaches into clinical practice, the methods to be used in treatment and expert decision-making taking into consideration the degree of professional locomotorium pathology.

OBJECTIVES

The aim of the research was to prove that job conditions impact the state of the afferent part of the somatosensory system in miners.

MATERIALS AND METHODS

The patients with the vertebral pain syndrome and those with lumbosacral pathology were all miners from the Jezkazgan Mining and Metallurgical Plant, Kazakhmys Inc. and coal miners from JSC Arselor Mittal. There was a control group of 28 patients with no pain syndrome and no vertebral pathology record. All the patients underwent neurological and electrophysiological examinations.

The examined patients were divided into three groups according to the severity degree of the pain syndrome: group 1–83 patients of 41.8±9.6 years of age on average with mild reflex-tonic pain syndrome; group 2–46 patients in the age range of 33.6–56 years with moderate radicular pain syndrome; group 3–19 patients of 48.0±10.9 years of age with severe degree of the pain syndrome.

To make an objective assessment of the function of the specific and non-specific afferent systems on various levels of cerebral structures, the somatosensory stimulated potentials (SSP) of the somatosensory afferent-efferent pathway were detected.

NeuroSoft electromiograph, Russia, was used to record SSP. Somatosensory stimulated potentials were recorded through usual 5 mm disc electrodes placed on the head of the subject. When stimulating the right median nerve, SSP were recorded at Erb’s point (above brachial plexus), C7, in cervical part (above the seventh vertebra), Fz in frontal part, C3 and C4 (right and left projection areas of the somatosensory cerebral cortex). The corresponding tracks revealed component N9 – brachial plexus response, N11–N13 – spinal cord cervical segments, N20–P25 – cortex projection area of a hand (according to the Encephalographic Abduction International System U – 20%) while recording SSP under the stimulation of left and right tibial nerve.

The statistical analysis was conducted using 2007 Microsoft Excel, AnalystSoft and StatPlus program versions on IBM-compliant Pentium PC.

The main statistical parameters were calculated using parametric and nonparametric descriptive statistical methods. The comparison of the average results between the samples was made via independent sample Student t-test with the defined difference reliability level.