Introduction

Poland is one of the European countries with a high risk of developing cancer of the central nervous system (CNS). In 2010, the number of cases of cancer was 2,730, including 1,380 males and 1,350 females. Behavioral changes are often associated in patients with brain tumors, which may be connected to depression as a secondary symptom and/or the location of the neoplastic lesion. Taking into account current scientific reports, the main goal of the study was to investigate whether people with tumors of the CNS have deficits in recognizing biological movement. It was investigated whether these deficits are related to cognitive functions, especially executive functions. A research hypothesis was made that the type and size of the brain tumor and edema affect cognition and the recognition of biological movement. It has been hypothesized that gender has an influence on the recognition of biological movement.

Purpose of the study

The main aim of the study was to assess whether patients with CNS neoplasms have deficits in the recognition of biological movement and whether they are related to executive and visual-spatial functions.

Method

The study was conducted at the Department of Neurosurgery in 2019–2021. The study was approved by the Bioethical Committee of the Institute of Psychiatry and Neurology in Warsaw (consent number: 1/2019). A total of 120 people aged 24 to 85 participated in the study. The subjects were matched in terms of gender ($p = 1{,}000$), they were divided into two groups: the control group ($n = 60$) and the research group ($n = 60$). There were statistically significant differences in terms of education ($p = 0.392$), age ($p = 0.000$) and the number of years of education ($p = 0{,}003$).The following neuropsychological tools were used for the study: Addenbrooke'sCoginitive Examination (ACE-III), Rey-Osterrieth's Composite Figure (FZR), Color Connection Test (CTT), Ruff's Fluency Test (RFFT), Digits Intelligence Scale (WAIS-R) subscale Wprost and Wspak, as well as a program for studying biological movement recognition. The study also used data from medical records – the result of a histopatho-logical examination and images from neuroimaging tests. The size of the brain tumor was calculated using the AW Server program, the size of the edema was calculated using the three-point Steinhoff scale. The differences were assessed at the assumed significance level of $p < 0.05$.

Results

This study showed deficits in the recognition of biological movement in patients with CNS neoplasms ($p = 0,000$). The median for the research group in terms of biological movement recognition was 11, and for the control group 15. Moreover, it was shown that they are related to executive functions. In the majority of cases related to the correlation of the result from the neuropsychological examination and the recognition of biological movement, the presence of the average strength of the correlation was demonstrated (the range of the correlation coefficient: 0,4-0,7). The size of the brain tumor and the brain edema affect some cognition, but not the recognition of biological movement. It was shown that gender did not influence the recognition of biological movement ($p = 0,105$). Age ($p = 0,00$) and education ($p <0.01$) turned out to have an effect on the recognition of biological movement only in the research group (weak correlation strength). The higher the age, the lower the value in recognizing biological movement. The higher the education, the higher the value in recognizing biological movement. In the control group, this influence was not observed (age: $p = 0.941$, education: $p = 0,878$). Hemispherical location ($p = 0,941$ and 0,336), location in the area of the brain lobes, histopathological diagnosis ($p = 0,613$), and tumor grade ($p = 0,265$) do not seem to be related to the recognition of biological movement.

Conclusions

The study showed that patients with CNS neoplasms have deficits in the recognition of biological movement. Moreover, a relationship has been demonstrated between the recognition of biological movement and cognitive functions. A relationship has been shown between the size of the brain tumor and the size of edema and cognitive deficits.

Keywords: recognition of biological movement, cancer, central nervous system, cognitive functions, executive functions