



## Full Length Article

# Association between psychological distress, subjective cognitive complaints and objective neuropsychological functioning in brain tumor patients



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## ABSTRACT

**Objectives:** Psychological distress and cognitive impairment are common complications in patients with brain tumors that are associated with poor quality of life and worse prognosis. This pilot study aimed to evaluate the associations between psychological distress, subjective cognitive complaints and baseline neuropsychological performance of brain tumor patients before neurosurgery.

**Patients and methods:** Sixty-two patients with various brain tumors referred for routine neuropsychological assessment 2–3 days before neurosurgery participated in the study. Short neuropsychological assessment battery was used to evaluate attention and executive functions, memory and verbal fluency. Presence of cognitive complaints was evaluated during neuropsychological interview using standardized symptoms checklist. Level of psychological distress was assessed using the Hospital Anxiety and Depression Scale.

**Results:** Various attention and executive function problems were reported by 13–58% patients; memory problems by 8–63%; language problems by 10–58% of patients. 36–57% of patients scored below 5th percentile on objective memory measures; 32–45% on attention measures and 11–27% on verbal fluency. However, correlation between objective neuropsychological findings and subjective cognitive complaints was weak, ranging from 0.0 to 0.3. 45% of patients met criteria for increased psychological distress. Psychological distress was associated with subjective cognitive complaints but failed to predict objective neuropsychological findings. Brain tumor histological diagnosis, side and location were not related to neuropsychological functioning.

**Conclusion:** Cognitive impairment and psychological distress are highly prevalent in BT patients before neurosurgery. Although depression and distress may adversely impact quality of life and prognosis of BT patients, our current findings do not confirm that distress has strong negative impact on objective preoperative cognitive functioning. However, it is related to worse subjective evaluation of one's cognitive abilities. Therefore, objective neuropsychological assessment of cognitive functions is highly recommended despite concern.

## 1. Introduction

Cognitive deficits are common complications of brain tumors (BT) affecting from 50% to 90% of patients [1–5]. Cognitive impairment is a major cause of disability of BT patients and is frequently identified by patients and their caregivers as the greatest source of burden [5]. Cognitive impairment is often already present at the time of BT diagnosis [2,6,7], and is an independent predictor of shorter survival and worse health status [8–11]. Cognitive decline is a reliable indicator of BT progression, even before the tumor progression becomes evident on brain imaging studies [10,12]. Therefore, assessment of neuropsychological functioning before BT treatment initiation and at subsequent treatment phases can be used as an indicator of disease severity and progression. Preoperative neuropsychological evaluation of BT patients

is also clinically important as it helps to plan subsequent rehabilitation, return to work and social adjustment.

In clinical practice decisions about necessity and objectives of neuropsychological assessment are often based on subjective complaints of a patient. However, research demonstrates significant discrepancies between subjective complaints and objective cognitive functioning in various patient samples [13–15]. Underreporting and overreporting of cognitive difficulties were also documented in BT patients [16–18]. These results call for rethinking of current cognitive functioning assessment strategies of BT patients throughout the course of their illness and advising neurocognitive assessment to all BT patients despite of presence or absence of subjective complaints.

BTs can compromise normal brain functioning and subsequently cause cognitive impairment via various disease and BT treatment

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related mechanisms. BTs can infiltrate and/or displace brain tissue, increase intracranial pressure, cause seizures, and disrupt structural and functional brain connectivity [19,4]. Furthermore, surgical tumor removal, radiotherapy, chemotherapy, and corticosteroids can also adversely affect cognitive functioning [20,4,21].

Psychological state of a patient, especially depression and distress can also contribute towards impaired objective cognitive performance as well as subjective evaluation of one's abilities [17,20,22]. Mental disorders affect up to one third of BT patients and more than 50% of patients suffer from elevated mental symptoms [23–26]. Relationship between subjective cognitive complaints and psychological distress is well documented [27,13,15,28], but less is known about the impact of psychological distress on objective neuropsychological performance of BT patients. Bunevicius et al. reported significant relationship between emotional well-being, measured with SF-36 quality of life scale, and cognitive functioning, assessed using MMSE (Mini Mental State Examination) in a sample of 200 patients with BTs [8]. In a study of 81 BT patient with and without epilepsy, depression was associated with decreased MoCA (The Montreal Cognitive Assessment) scores [29]. However Goebel et al. [20] demonstrated negative effects of extreme levels of distress on cognitive functioning of BT patients, but no effect of moderate levels of distress. As psychological distress might be considered as a potentially modifiable risk factor for cognitive decline, it might become an important target for treatment interventions to improve cognitive functioning and quality of life of BT patients. The goal of this study was to evaluate concordance between subjective and objective evaluation of preoperative cognitive functioning in a sample of BT patients and to investigate association of psychological distress with patient's baseline cognitive performance and subjective cognitive complaints before surgery.

## 2. Material and methods

### 2.1. Procedure

This study aimed to perform neuropsychological assessment to unselected sample of BT patients, thus consecutive adult patients admitted for elective BT surgery at the Neurosurgery Department of Hospital of Lithuanian University of Health Sciences, Kaunas, Lithuania, from January 2015 to September 2015 were potential candidates to participate in the study. Information about neuropsychological functioning and psychological distress was gathered prospectively. Clinical data, including BT histological diagnosis and location, was obtained from medical records retrospectively. Neuropsychological assessment was performed from 2 to 3 days before BT surgery by a medical psychologist. Written informed consent was obtained from all study patients before neuropsychological assessment.

### 2.2. Sample

During study period 107 patients were admitted to Neurosurgery Department of Hospital of Lithuanian University of Health Sciences for elective surgery. One patient (1%) refused to participate in the study, 2 patients (2%) agreed to participate but were not able to complete study tasks due to severe language impairment. In three cases (3%) diagnosis of brain tumor was not confirmed after comprehensive clinical investigation. 2 (2%) patients were excluded from further analysis due to insufficient data pertaining to tumor localization and clinical disease characteristics in their medical records. 36 (33.6%) patients were lost due to various clinical and organizational reasons, including shorter than three days' preoperative stay and difficulties scheduling psychological assessment in such a short preoperative period, severe clinical condition, or significant auditory and motor impairment. The final study sample included 62 patients – 25 (40.3%) males and 37 (59.7%) females, mean age 58.3, SD 13.4 years, age range from 23 to 83 years. Majority of patients were diagnosed with supratentorial tumors. The

**Table 1**  
Clinical characteristics of the study sample.

Characteristics	Mean (SD), Number (%)
Tumor diagnosis	
Glioma	20 (32.3%)
Meningioma	31 (50.0%)
Other	11 (17.7%)
Side of the tumor	
Left	25 (40.3%)
Rights	31 (53.4%)
Middle/bifrontal	6 (9.7%)
Tumor location	
Supratentorial	48 (77.4%)
Infratentorial	14 (22.6%)

most common histological diagnosis was meningioma, followed by glioma and other tumors, including acoustic schwannomas, metastatic tumors and other tumors. Right-sided tumors were more prevalent than left-side tumors. Clinical characteristics of the sample are presented in Table 1.

As no Lithuanian normative data is available for neuropsychological tests used in this study and verbal tests are culture specific, data of 89 community dwelling adults, 40 (44.9%) males and 49 (55.1%) females without reported neurological disorders were included into analysis as a control sample. Sample of healthy adults was collected using non-probability stratifying sampling according to age and education and excluding participants reporting current neurological disorders and treatment. Four age groups (18–30, 31–50, 51–65, 66 and older) balanced on percentage of respondents with university education ( $\chi^2(3) = 0.63, p = 0.89$ ) were formed. Based on this sample, age and education stratified means and standard deviations for scores of neuropsychological tests were calculated and later used for transformation of primary BT patient test scores to percentiles. Distribution of clinical and control samples according to demographic characteristic is displayed in Table 2.

### 2.3. Neuropsychological assessment

Three neuropsychological tests assessing attention and executive functions, memory and verbal fluency were used in this study.

*Trail Making Test (TMT, Parts A and B)* is a classical neuropsychological test for assessment of visual attention, psychomotor speed, mental flexibility and executive functioning [30,31]. The task requires a patient to connect a sequence of 25 targets (numbers 1, 2, 3 etc. in Part A, and alternate between numbers and letters 1, A, 2, B etc. in Part B) on a sheet of paper.

*Key Auditory Verbal Learning Test (RAVLT, [32]; stimulus list based*

**Table 2**  
Distributions of demographic characteristics in clinical and control samples.

Demographic characteristics		Healthy controls	BT patients
		N (%)	
Gender	Male	40 (44.9%)	25 (40.3%)
	Female	49 (55.1%)	37 (59.7%)
Age\education groups			
18–30	Without university degree	13 (14.6%)	2 (3.2%)
	With university degree	12 (13.5%)	0 (0.0%)
31–50	Without university degree	15 (16.9%)	7 (11.3%)
	With university degree	9 (10.1%)	7 (11.3%)
51–65	Without university degree	15 (16.9%)	24 (38.7%)
	With university degree	10 (11.2%)	5 (8.1%)
66 and older	Without university degree	9 (10.1%)	14 (22.6%)
	With university degree	6 (6.7%)	3 (4.8%)
Total		89 (100%)	62 (100%)

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