Cognitive function in patients of multiple neurocysticercosis: study from Kashmir

Dr. Mohd. Arsalan Bhat[1], Dr. Azhar Wani[2], Dr. Imtiyaz Ali[3*]

[1,2]Department of Neurology, Sher-i-Kashmir Institute of Medical Sciences, Soura, Jammu & Kashmir

[3]Department of General Medicine, Government Medical College, Srinagar, Jammu & Kashmir

***Corresponding Author:** Dr. Imtiyaz Ali, Department of General Medicine, Government Medical College, Srinagar, Jammu & Kashmir E-mail: drimtiyazali078@gmail.com

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ABSTRACT

Background & objectives: Neurocysticercosis (NCC) is recognized as a significant contributor to the occurrence of seizures in many places worldwide, notably in India. The purpose of this study is to assess the cognitive function of individuals diagnosed with multiple neurocysticercosis (NCC). **Methods:** This study examined a sample of 50 patients diagnosed with multiple neurocysticercosis (NCC). Diagnosis was based on the clinical presentation of symptoms and imaging characteristics. The participants were seeking treatment at the Department of Neurology in a tertiary care hospital between January 2021 and January 2022. **Results:** Patients with more than 10 lesions displayed a higher prevalence of cognitive impairment (52%). Overall Mini-Mental State Examination (MMSE) score in patients with 5-10 lesions was 24.96 ± 2.19. The presence of elevated NPI scores was observed in conjunction with an increased incidence of brain lesions. Total Narcissistic Personality Inventory (NPI) score in patients with more than 10 lesions was 18.27 ± 9.12, compared to individuals with 5-10 lesions (11.11 ± 5.31). **Conclusions:** Cognitive Impairment and Dementia, being the first and only presenting symptom is an unusual presentation in Neurocysticercosis. The cognitive areas most commonly impacted by the condition were complex attention, executive processes, memory, and language and visuospatial skills.

Key words: cognitive function, neurocysticercosis, lesion, granuloma

INTRODUCTION

Neurocysticercosis (NCC) is a prevalent parasite infection that affects the central nervous system on a global scale. Neurocysticercosis, a prevalent helminthic infection of the central nervous system (CNS), is widely recognized as a significant etiological factor contributing to the development of acquired epilepsy on a global scale. It is believed that around 50 million individuals around the globe are affected by neurocysticercosis (NCC) infection.[1] The exact prevalence of NCC on a global scale remains uncertain; nevertheless, a study indicates that between 1.7 and 3.0 million people have developed epilepsy as a consequence of NCC, which significantly contributes to the overall burden of disease.[2]

The study determined that the incidence of neurocysticercosis (NCC) as a contributing factor to the occurrence of active epilepsy in India was estimated at a rate of one case per 1000 individuals.[3]

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The prevalent manifestation of the disease in India was the solitary cysticercus granuloma (SCG), initially discovered in 1989, observed in a substantial proportion of individuals diagnosed with neurocysticercosis (NCC), reaching up to 60 percent of cases.[4] In the cohort of Indian patients with seizures, it has been shown that 26% of improved computed tomographic (CT) scans reveal the presence of a solitary, diminutive (< 1 cm) lesion. The clinical presentations of neurocysticercosis (NCC) exhibit a wide range of characteristics, which are contingent upon the location, quantity, dimensions, and developmental stage of the lesions, as well as the immunological response of the infected individual.[5]

Seizures are frequently observed as the primary clinical manifestation, however a significant number of patients exhibit focal deficits, headache, elevated intracranial tension (ICT) resulting from cerebrospinal fluid (CSF) flow obstruction, stroke, neuropsychiatric symptoms, ophthalmologic abnormalities, and endocrinological indications.

The occurrence of cognitive impairment and dementia as the initial and sole manifestation is an atypical presentation in non-communicable diseases. Nevertheless, a significant proportion of individuals diagnosed with neurocysticercosis experience cognitive deficits, affecting approximately 66% of patients.[6] The objective of this study was to assess the cognitive function of individuals diagnosed with multiple neurocysticercosis (NCC) in comparison to a control group.

MATERIALS AND METHODS

This observational study was conducted on 50 participants with multiple NCC diagnosed using clinical presentation of symptoms and imaging characteristics seeking treatment at the Department of Neurology, Sher-i-Kashmir Institute of Medical Sciences, Soura, Jammu & Kashmir from January 2021 to January 2022.

Exclusion criteria

1. Patients with other medical, neurological and psychiatric disorders likely to impact cognitive task performance.
2. Current use of any psychotropic or neurological medication except antiepileptic drugs
3. Clinical signs of antiepileptic drug (AED) toxicity
4. History of head trauma with loss of consciousness
5. History of any current substance other than tobacco dependence.
6. Mental Retardation

The study recruited patients who meet the specified inclusion and exclusion criteria and have provided written informed permission. A comprehensive evaluation, encompassing a thorough history, physical examination, and neurological assessment, was conducted on all participants. The proforma included the collection of information pertaining to NCC, such as the age at which it manifests, the length of time it persists, the frequency of seizures, the specific antiepileptic medications used, and any identifiable circumstances that may trigger the condition.

The scales employed for cognitive testing in this study included the Mini-mental state examination (MMSE)[7], the Montreal Cognitive testing (MOCA)[8], and the Neuropsychiatric Inventory Questionnaire (NPI-Q).[9] A subset of neuroimaging records, comprising at least 25% of the total, from participants diagnosed with NCC was randomly selected for evaluation. This evaluation was

conducted by a radiologist who had received appropriate training and was unaware of the participants' diagnoses. The same rating technique was employed during this evaluation. The Crohnbach alpha was utilized to enhance the measurement of inter-rater reliability by comparing the two ratings.

The categorical variables were reported using both numerical counts and percentages (%), while the continuous variables were reported using the mean ± standard deviation (SD) and median. The comparison of quantitative variables between the two groups was conducted using an Independent t-test, while the comparison of qualitative variables was performed using either a Chi-Square test or a Fisher Exact test. A p-value less than 0.05 was deemed to be statistically significant. The data was inputted into a spreadsheet using the MS EXCEL software, and subsequent analysis was conducted with the Statistical Package for Social Sciences (SPSS) version 21.0.

RESULTS

Age group was 21-30 years in majority of patients. Mean ± SD of age in cases was 29.32 ± 15.94. Majority of patients were males (70%). (Table 1)

Table 1: Socio-demography of study participants

characteristics	Number (Percentage)
Age (years)	
18-20 years	10 (20%)
21-30 years	18 (36%)
31-40 years	8(16%)
41-50 years	10 (20%)
51-60 years	04 (8%)
Mean ± SD	29.32 ± 15.94
Gender	
Female	15 (30%)
Male	35 (70%)

Mean ± SD of total MMSE score was 24.12 ± 1.9, Mean ± SD of total MOCA score was 21.54 ± 5.1 and Mean ± SD of total NPI score was 14.51 ± 7.25. (Table 2)

Table 2: MMSE score, MOCA score, NPI score of study participants

Scores	Mean ±SD
MMSE score	24.12 ± 1.9
MOCA score	21.54 ± 5.1
NPI score	14.51 ± 7.25

DISCUSSION

The primary objective of the present investigation was to evaluate the cognitive attributes of adult individuals (between the ages of 18 and 60) who have been diagnosed with multiple neurocysticercosis (NCC). Each patient demonstrated a minimum of five cystic lesions containing a scolex, and fulfilled the stringent criteria required for a conclusive diagnosis of neurocysticercosis

(NCC). The treatment protocol for all patients included the administration of both steroid and albendazole medicines. The study participants were administered antiepileptic drugs as part of their treatment regimen. The cases are thereafter categorized into two distinct groups, predicated on the burden of CT/MRI lesions. One group encompasses patients with a range of 5-10 lesions, while the other group comprises cases with an excess of 10 lesions.

Cognitive testing is also performed in cases where there is a lesion burden, with the aim of facilitating comparison. Individuals who have been diagnosed with many cases of neurocysticercosis (NCC) display significant cognitive decline. To explore the various factors contributing to cognitive decline in NCC, we purposefully excluded individuals exhibiting indications of delirium, advanced age, recent seizures, intoxication from antiepileptic drugs (AEDs), infectious or autoimmune disorders, and persistent depressive symptoms from our assessment.

Andrade et al.[10] did a cross-sectional controlled analysis wherein they discovered the presence of dementia in 5 out of 40 adult patients diagnosed with neurocysticercosis. This finding indicates a prevalence rate of 12.5%. The occurrence was attributed by the authors to a synergistic interplay between lesions caused by cysticercus and inflammation present in the immediate area.

The research discovered that individuals who were diagnosed with neurocysticercosis (NCC) demonstrated significant impairments in executive functioning, verbal and nonverbal memory, constructive praxis, and verbal fluency when compared to a control group consisting of healthy individuals ($p < 0.05$). No significant correlation was found between cognitive scores and the quantity, location, or characteristics of non-contrast-enhancing lesions detected on magnetic resonance imaging (MRI). Various tests are employed to evaluate cognitive function, such as the employment of the Mini Mental State Examination, tasks involving digit-span forward and digit-span backward, the clock drawing test, and the trail generation test.

The majority of research examining minimal cognitive impairment have utilized a diverse sample set comprising children throughout a broad age spectrum. For instance, Sotelo et al.[11] conducted a study that encompassed participants ranging from 5 to 76 years of age. The variable of age holds substantial importance and exhibits autonomy in its ability to forecast cognitive decline. Prior studies have predominantly concentrated on younger cohorts, leading to comparatively lower prevalence of cognitive impairment in contrast to our present investigation.

In the present study, both the patient group and the control group underwent neuropsychological assessment using the neuropsychiatric inventory (NPI) in order to facilitate comparison. According to the NPI score, it was revealed that patients demonstrated a prevalence of 73.58% for mild impairment and 26.42% for moderate impairment. On the other hand, the control group exhibited only modest impairment in 33.96% of the instances.

Forlenza et al.[12] conducted a study which demonstrated that 65.8% of the cases examined exhibited psychiatric disorders. The investigators utilized the Schedule for Affective Disorders and Schizophrenia-Lifetime Version (SADS-L) as an instrument for administering neuropsychological evaluations.

In the domain of mental illnesses, it was noted that a prevalence rate of 52.6% was

detected for depressive disorders among patients, whilst psychosis was identified in 14.2% of the cases. Loo and Braude (2013) conducted a study in which a cohort of 23 persons was studied. The findings of the study indicated that 56% of the adult population displayed mental symptoms during the initial evaluation.[13]

Both of the aforementioned research demonstrated similarities to our investigation in relation to demographic factors and psychiatric symptoms. Sotelo et al. (1985) conducted a study on neurocysticercosis and documented the occurrence of psychotic episodes in 4.7% of the 753 cases.[11]

The study encompassed patients ranging in age from 5 to 76 years. A detailed analysis was undertaken by Scharf, which encompassed 238 cases of adult patients who had been diagnosed with neurocysticercosis at various stages of their condition.[14] The results of this investigation indicated that psychosis was detected in around 3% of the cases.

Verma et al.[15] conducted a study employing a sample size consisting of 35 cases and 35 controls. The baseline demographic data demonstrated comparable features in both groups. The findings of the behavioral evaluation revealed that both cohorts exhibited T-scores falling within the normal range, namely below 60. The research discovered that treatment-naïve youngsters who had just been diagnosed with neurocysticercosis (NCC) displayed a behavioral profile that closely resembled that of their same-age peers.

CONCLUSION

Cognitive Impairment and Dementia, being the first and only presenting symptom is an unusual presentation in Neurocysticercosis. The most frequently affected cognitive domains were complex attention, executive functions, memory, and language and visuospatial skills.

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AUTHORS' CONTRIBUTION

All the authors have contributed equally.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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