CASE REPORT

Hypoparathyroidism presenting as cognitive dysfunction

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puneetaggarwal4u@gmail.com**SUMMARY**

Metabolic dysfunction in hypoparathyroidism is an important cause of intracranial calcifications, which cause cognitive impairment depending on the calcified areas leading to difficulties in executing activities of daily living. We report a case of a 25-year-old man who presented with gradually decreasing organisational skills, memory problems and difficulty in carrying out daily activities. CT imaging of the brain showed extensive calcification in the basal ganglia and cerebral white matter. Comprehensive health-related quality of life and cognitive assessment revealed significant affliction in his activities of daily living along with impairment in recall memory, executive functions and verbal fluency. Owing to late diagnosis, chronicity of cognitive problems could not prevent him from discontinuing his college education.

BACKGROUND

Detecting cognitive dysfunction as early as possible can help in adapting disease modifying therapeutic strategies. As comprehensive cognitive testing is time-consuming and costly, it is not offered to every patient; therefore, a screening procedure able to determine which patients need full assessment by cognitive testing would be useful. This case report is the one of its kind highlighting the impact of late diagnosis of cognitive impairments, leading to difficulty in coping up with worldly demands.

CASE PRESENTATION

We report a 25-year-old man, who reported to us with mental confusion, forgetfulness, decreased attention span, impaired planning, decision making and also overall personality deterioration leading to lifestyle changes from the past 2 years. He was hyperirritable, anxious and complained of profound fatigue. The parents complained of his frequent mood swings, personality disturbances and falling academic performance. He had multiple episodes of carpopedal spasm in the past 3 years. He had no history of seizure. On examination his hair was dry and brittle. There were no dysmorphic features. Paraesthesia was present at perioral region and finger tips. Trousseau's test was positive. On eliciting knee and ankle jerks, there was plantar flexion on both feet with adduction of toes. No opacities in lens. No family history of similar problems.

INVESTIGATIONS

On investigations, serum calcium was low (5.1 mg/dl), serum inorganic phosphorus was high (12.2 mg/dl). To look for cause of hypocalcaemia other

investigations were performed which revealed normal serum magnesium, serum alkaline phosphatase, serum 25-OH-vitamin D and decreased parathyroid hormone (PTH) level (3.7 pg/ml, normal 15–85 pg/ml). Kidney function test and serum protein levels were normal. ECG showed flat T waves, long Q–T intervals.

Electroencephalography was normal and not altered by hyperventilation. CT scan of head (figure 1) revealed bilateral symmetrical calcifications distributed throughout the basal ganglia, thalamus and subcortical white matter.

Assessment of cognitive complaints

The patient was requested to complete a self-administered health-related QOL questionnaire (Neuro QOL Short Form), prior to the day of cognitive testing. This scale is a specific QOL scale adapted for neurological patients. The short form covers different aspects of QOL and 105 items are pooled in 13 subscales. Cognitive complaints were assessed by 16 questions divided into two subscales, that is, executive functions and general concerns. A global cognitive complaints score was calculated averaging the answers to the 16 questions and was expressed as a percentage. The highest possible score (100%) is equivalent to no cognitive complaint (answer 'never'/'none' for questions). We also used the following Neuro-QOL scale axis to assess self-perception of several other domains: anxiety, depression, emotional behaviour, fatigue, sleep, stigma, lower limb, well-being, satisfaction with social roles, upper limb and participation in social roles.

Neuropsychological assessment

Initial screening of cognitive complaints was performed with Montreal Cognitive assessment (MoCA), a brief 10 min cognitive screening battery, assessing different cognitive domains: attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations and orientation.

On the basis of screening test result, comprehensive evaluation was performed through tests to study more precisely inhibition, naming, non-verbal fluency and conceptualisation.

The comprehensive battery included:

1. A 12-word version of the Selective Reminding Test (SRT) which evaluates short-term verbal memory (Long Term Storage (SRT-LTS) and Consistent Long Term Retrieval scores (SRT-CLTR)) and long-term verbal memory [Delayed Recall score, (SRT-DR)].

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Figure 1 CT scan of head revealed bilateral symmetrical calcifications distributed throughout the basal ganglia, thalamus and subcortical white matter.

2. The Stroop Colour-Word test, which assess non-verbal cognitive flexibility.
3. The Word List Generation Test (WLG), assessing semantic verbal fluency.
4. Trail making test A&B measures psychomotor speed and flexibility.
5. Purdue Pegboard Test assessed manual dexterity where the object is to insert pegs into holes using one hand, then the other hand, and then both hands. Four separate scores are obtained with the Purdue Pegboard: (1) dominant hand; (2) non-dominant hand; (3) both hands and (4) assembly.

Statistical analysis

Cognitive impairment: Performance less than the fifth percentile of matched healthy individuals were calculated for all neuropsychological tests. For the tests with several scores (Selective Reminding Test (SRT), Purdue Peg Board and Trail Making Test (TMT)) the patient was considered as cognitively impaired for this test if one of the scores was impaired (meaning less than the fifth percentile of matched controls). The patient was diagnosed as cognitively impaired if they performed less than the fifth percentile of matched healthy individuals for age, sex and education level on at least two tests of the battery.

RESULTS

See Table 1.

Cognitive performances: Detailed cognitive scores of this patient are reported in table 2.

Table 1 Self-reports cognitive and quality of life issues

Domain	T score
Anxiety	(51.4±1.8)
Depression	(47.9±1.7)
Emotional behaviour	(46.7±2.4)
Fatigue	(45.6±1.7)
Sleep	(62.8±3.4)
Stigma	(54.6±2.0)
Applied cognition-executive functions	(34.2±2.3)
Applied cognition-general concerns	(25.8±2.2)
Lower limb	(34.5±2.1)
Well-being	(37.0±1.4)
Satisfaction with social roles	(41.7±1.3)
Upper limb	(25.3±2.0)
Participation in social roles	(38.5±1.4)

T score of 60 is considered to be the reference point.

TREATMENT

The patient was put on calcium and vitamin D supplementation along with cognitive behaviour therapy. Cognitive rehabilitation comprises five sessions per week for a total duration of 8 weeks after which the patient will again undergo neuropsychological assessment.

OUTCOME AND FOLLOW-UP

The results of various tests are consistent with the findings that the patient is suffering from significant cognitive impairments affecting his daily activities owing to idiopathic hypoparathyroidism. Areas showing marked impairment are memory recall, executive functions, mental flexibility, visuospatial skills and motor coordination.

DISCUSSION

Our patient had significant quality of life and cognitive complaints. Considering the cognitive axis of the Neuro-QOL questionnaire, the patient complained of moderate cognitive problems. It is important to note that the patient himself filled in the Neuro-QOL questionnaire and that no question was asked to relatives. Cognitive impairments have been shown earlier by few authors in case of intracranial calcification. In our patient, his diagnosis of hypoparathyroidism was performed considerably late owing to late presentation. Hence the disease has progressed to cerebral calcifications level. The main functions altered were attention, working memory, inhibition, short-term and delayed verbal memory and visuomotor coordination. Our results are in accordance with previous studies performed on patients of intracerebral calcification owing to hypoparathyroidism. In a study conducted by Kowdley *et al.*,¹ neuropsychological testing revealed cognitive impairment in 65% of individuals with hypoparathyroid, and the presence of significant differences between the hypoparathyroid and control groups. Mejdoubi² reported a case of a 24-year-old woman who showed confusion, movement disorders and asthenia related to severe hypocalcaemia and low parathyroid hormone concentration.

Answers to cognitive questions on the Neuro-QOL questionnaire were also correlated with questions concerning emotional distress owing to the disease, emotional well-being and role limitation owing to emotional disturbances. This suggests that mood alteration and emotional distress strongly influence answers to cognitive questions. NeuroQOL³ was able to explain the quality of life of our patient quite explicitly.

In this study, we also calculated whether any of the cognitive tests could serve as a predictive test. MoCA turned out to be sensitive test to predict affected domains, which were clearly highlighted postdetailed examination with other neuropsychological tests like selective reminding test,⁴ Stroop colour-word

Table 2 A summary of scoring less than the fifth centile of matched healthy individuals

Tests	MoCA	Stroop test	TMT A/B	SRT*	WLG	Peg board†
Pt. scores	21	2.1	80 s/1 min 20 s	61.6	21.9	129
Cut-off scores	26/above	1.34±0.29	29 s/75 s	—	26.8±5.8	—

*SRT: SRT-LTS+SRT-CLTR+SRT-DR.

†Dominant hand+non dominant hand+both hands+assembly.

WLG, Word List Generation Test; SRT, Selective Reminding Test; MoCA, Montreal Cognitive assessment.

test,⁵ word list generation test,⁶ trail-making test A&B⁷ and Purdue Pegboard Test.⁸ MoCA⁹ screening test is very easy to perform and lasts 10–15 min. It is generally well-accepted by patients, so it could be used in daily practice by practicing neurologists as part of their clinical assessment. This brief 10 min cognitive screening battery assesses different cognitive domains—attention and concentration, executive functions, memory, language, visuocognitive skills, conceptual thinking, calculations and orientation.

Cognitive impairment highly correlates to calcified areas. The most common site is globus pallidus.¹⁰ Very few studies have highlighted the prevalence of cognitive impairments in chronic hypoparathyroidism. As calcification in the basal ganglion causes various extrapyramidal motor disturbances, calcification in the cerebral cortex, especially in the frontal lobe, may give rise to decreased intelligence and other cognitive functions owing to dysfunction in corticobasal connections and their interhemispheric relations. Resulting in subcortical dementia secondary to mineral deposits.¹¹

This case report gives rise to an important clinical question—whether cognitive impairments precedes or proceed intracranial calcifications in hypoparathyroidism? To confirm the clinical interest longitudinal studies are warranted with cognitive evaluations of patients with potential risk of developing intracranial calcifications owing to hypoparathyroidism.

Learning points

- ▶ Patients with hypoparathyroid are susceptible to vast array of cognitive dysfunctions leading to psychiatric symptoms.
- ▶ A thorough neuropsychological assessment should follow the screening of cognitive functions to pin point the affected domains.
- ▶ A multidisciplinary intensive rehabilitation programme can be initiated to save the losing potentials of the brain and improve the overall quality of life.
- ▶ Further research into cognitive impairments in IHP would help in understanding the reorganisation capacity of the brain through cognitive training.

Contributors GK and PA undertook the medical diagnosis and management part of the patient. DK undertook cognitive evaluation and looking after the cognitive rehabilitation of the patient. TK is overall supervisor for this case.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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