Case report

A unique pattern of memory deficits in reversible dementia induced by B12 deficiency

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Introduction

Although there is a large body of literature on B12 deficiency-induced dementia, relatively little is known about its neuropsychological characteristics[1,2]. We report a middle-aged male vegan with dementia showing unique pattern of learning and memory deficit on detailed assessment due to B12 deficiency. He completely recovered with parenteral vitamin B12 therapy.

Case report

A 45-year-old, right-handed, male working in a printing press was admitted with altered behavior and confusion. He complained of a tremor in hands and obsession about cleanliness and neatness. At the time of admission, he had stopped going to work. He had been a strict vegan for over 25 years due to an aversion to animal foods.

On examination he was slightly pale, pigmented and had a fine tremor on outstretched hands. He was not making eye contacts. The rest of the general medical examination, cardiovascular and respiratory system were normal. He scored 19/30 in the Mini-Mental State Examination. Motor and sensory examination of the limbs as well as the reflexes were normal.

Pre-treatment investigations showed, Hb: 10 g/dL, MCV: 129.9fL (80-100), WBC: 7600 /mm^3 with normal differential count, platelet count: 140,000 /mm^3, reticulocyte count: 0.4%, blood picture: oval macrocytes and hypersegmented neutrophils, ESR: 25 mm st hr, Na^+:135 mmol/L, K^+: 4.6 mmol/L, Ca^{++}: 1.19 mmol/L (1.12-1.32), Magnesium: 2.5/dL (1.7-2.7), FBS: 88 mg/dl, serum vitamin B12 level was 235 pg/mL (223-925), VDRL: non-reactive, antibody to HIV 1 and 2: negative.

MRI and CT scans of the brain, EEG, and cerebrospinal fluid analyses were normal, as were renal and liver functions tests.

Assessment of memory

His memory was assessed with Lankan Verbal Learning Test (LVLT) and Modified Enhanced Cued Recall Test (MECRT). LVLT is a list learning test in which the patient was required to recall a list of 12 words drawn from 3 categories (spices, clothing items, and furniture) over 3 learning trials. Following a 20-minute filled delay, memory for the words was tested by means of free recall and recognition memory methods. MECRT comprises 4 cards, each showing 4 line-drawings of common items[3]. The test is administered by showing one card at a time, instructing the patient to name each item in response to a semantic cue (e.g. "One of these is a vegetable. What is its name?"). Once the patient had named the 4 items on a card, the examiner removed it and asked him to recall them. The patient was asked to recall all the items soon after the administration of the 4 cards (immediate recall) and then following a 20-minute delay (delayed recall). Thus, in the latter test the examiner provided more support for learning than in the former. While patients with Alzheimer's disease do not benefit from such support[4], those with memory problems due to attentional issues are known to benefit from it. Accordingly, the two memory tests allowed assessing memory as a function of the level of learning support.

Results of the memory tests

Based on norms established for Sri Lankan older persons, the patient's raw scores were converted to T scores, which have a mean of 50 and standard deviation of 10. As shown in Table 1, the patient performed in markedly impaired range at baseline on the LVLT which provided low-level support. However, performance on this test significantly improved and maintained after B12 supplementation.

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Table 1. Memory as a function of low and high-levels of cognitive support

Cognitive tests	*Baseline*	*2-month*	*7-month*	*12-month*
Low-level support				
LVLT				
Free recall total (3 trials) (T score)	30	63	53	59
Delayed free recall (T score)	<20	54	69	61
Recognition memory (T score)	<20	61	61	61
High-level support				
MECRT				
Immediate free recall (T score)	42	51	70	70
Semantic cue (raw score)	7/9	9/9	3/3	3/3
Delayed free recall (T score)	44	48	57	62
Semantic cue (raw score)	6/8	9/9	5/5	4/4

In sharp contrast, the patient did not show learning deficits at baseline on the MECRT which provided high-level memory support. On this test, he recalled the items on the free recall trial when semantic cues were given, showing that he had encoded all the items.

He was treated with Cyanocobalamin 1000µg/ intramuscularly daily for five days followed by monthly injections. Follow-up neuropsychological assessments were performed at 2, 7, and 12 months after the initiation of treatment. Serum B12 level at 12 month follow up was within the normal range (510.7 pg/ml). Having fully recovered the patient has returned to work at the time of writing and continue to take regular B12 injections and when not available oral B12 supplements.

Discussion

Our patient had clinical and haematological features characteristic of B12 deficiency with borderline low B12 levels. Ideally in such cases the raised levels of Methyl malonic acid (MMA) and homocysteine should be demonstrated. However we could not do these levels as patient could not afford. Together with clinical features, dramatic improvement with intramuscular B12 is strongly supportive of the diagnosis of B12 deficiency. He had neurological features known to be associated with Vitamin B12 deficiency like, tremor and an obsessive compulsive disorder. He showed a distinct pattern of memory abnormality due to Vitamin B12 deficiency. While the patient had great difficulty in learning an aurally-presented list of 12 items, he learned with relative ease a list of 16 items when they were presented through multiple modalities (e.g. visual and aural). This pattern of results stands in stark contrast to that seen in Alzheimer's disease with failure to encode new information despite receiving memory support[5]. It appears that attentional deficits and confusion cause disruption in learning in patients with B12 induced dementia. This finding is consistent with the observation that patients with B12 deficiency show a pattern of neuropsychological deficits similar to that seen in frontotemporal dementia[1].

References

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