CASE REPORTS

Complications of dietary deficiency of Vitamin B₁₂ in young Caucasians

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Summary

The occurrence of dietary deficiency of Vitamin B₁₂ is reported in two young caucasian adults. In one case megaloblastic anaemia occurred and in the other optic atrophy. The importance of the dietary history, the significance of folic acid intake and the inter-relationship of Vitamin B₁₂ and cyanide detoxication are discussed.

Introduction

Dietary deficiency of Vitamin B₁₂ is a well recognized causative factor in the nutritional macrocytic anaemia seen in the Indian sub-continent (Chatterjea, 1958). A significant proportion of the Indian population may be classed as vegetarian, and in this group a lowering of the serum Vitamin B₁₂ level has been clearly shown (Banerjee and Chatterjea, 1960).

It is the purpose of this paper to report the occurrence of complications of dietary B₁₂ deficiency in two young Anglo-Saxon vegetarians, one of whom presented with optic atrophy. In a previous investigation of British vegan patients, Smith (1962) has emphasized the paucity of symptoms in these patients, although two of the twelve patients he studied showed evidence of sub-acute combined degeneration. Other reports of complications of dietary B₁₂ deficiency in caucasians include a patient with mild megaloblastic anaemia (Bourne and Oleesky, 1960) and a further patient with sub-acute combined degeneration of the cord (Misra and Fallowfield, 1971). We have been unable to find any previous reports of optic atrophy complicating veganism.

Case reports

First case

M.B., a male aged 19 years, a clerical worker, was first seen at Crumpsall Hospital in 1969 complaining of tiredness. A blood count revealed a haemoglobin concentration of 11.0 g/100 ml. Anisocytosis, poikilocytosis, polychromasia and ovalocytes were

noted in the blood film. A repeat haemoglobin, some weeks later, was 15.1 g/100 ml and no further haematological investigations were performed.

In January 1971 he was admitted to hospital with a pyrexial illness. He was complaining of headache, anorexia, lassitude, photophobia and neck stiffness.

Physical examination revealed injected fauces and marked cervical lymphadenopathy; his liver was palpable 2 cm below the costal margin. There was no splenomegaly and the remainder of the examination was unremarkable.

Investigations showed a haemoglobin of 12.5 g/100 ml with an MCV of 112 μ^3 , and MCHC of 34.3%. The blood film showed anisocytosis and polychromasia. The white cell count was 4900/mm³ with 11% abnormal mononuclear cells, and the platelet count was 50,000/mm³. The Paul-Bunnet test was weakly positive. Liver function tests showed slight elevation of the serum bilirubin at 1.6 mg/100 ml, and of the SGOT at 70 μ /ml and SGPT at 50 μ /ml. The bone marrow showed transitional megaloblastic change with Howell-Jolly bodies and giant metamyelocytes present, iron stores being normal. The serum B₁₂ level was markedly low at 15 pg/100 ml (normal 150-900) and the serum folate was at the lower limit of normal range at 3.4 ng/100 ml (normal 3-8). The Schilling test of Vitamin B₁₂ absorption was normal both with and without intrinsic factor (18% and 16% respectively). The serum iron, and iron-binding capacity, histamine test meal, xylose absorption and barium meal and follow-through were all normal. An electroencephalogram showed excess slow wave activity for the patient's age.

The presenting illness was diagnosed as glandular fever. His symptoms subsided spontaneously without therapy.

It was not until a dietary history was taken that the cause for his megaloblastic anaemia and markedly low serum B₁₂ level became apparent. It appeared that he had never liked meat and eaten very little since childhood.

His regular diet was as follows. Breakfast: Tomatoes or beans on toast. Lunch: Similar to breakfast or tomato soup, bread and butter. Apple as dessert.

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If at work he would have tomato sandwiches. Dinner: Chips, beans, tomatoes, bread and butter. Tinned fruit, condensed milk with ice cream.

He volunteered that he would occasionally eat bacon and if he felt run down would actually eat liver or meat. He only rarely ate fish.

The patient would not agree to stay in hospital. He did, however, agree to improve his diet and eat meat and within 2 months his haemoglobin had risen to 15.1 g/100 ml, but with a persistent macrocytosis. It was only after performance of the Schilling Test using a 1000 µg flushing dose of Vitamin B₁₂ that his indices returned to normal.

Twelve months later, his blood count showed evidence of macrocytosis, his serum B₁₂ had fallen again to 75 pg/100 ml and the patient admitted that he had slipped back into his old dietary habits. He has subsequently declined further follow-up.

Second case

C.H., a female shop assistant aged 19 years, was found to have defective vision in the left eye during a school medical examination in 1969 at the age of 15. She was referred to the Manchester Royal Eye Hospital (Dr S. B. Smith) where she was found to have advanced optic atrophy in the left eye with a large central scotoma, right eye vision being normal. Some months later, however, vision in the right eye deteriorated, appearances in the right fundus suggested 'papillitis' and corticosteroid therapy was initiated. Vision in the eye rapidly recovered and the fundus returned to normal.

Since then she has had four further episodes of visual deterioration responding on each occasion to steroid therapy, but on no subsequent occasion were any inflammatory changes noticed in the right disc. She was admitted to Crumpsall Hospital for investigations in 1970.

On examination, the abnormalities were confined to the eyes. The fundi showed the appearances of bilateral optic atrophy much more marked on the left side. In this eye visual acuity was worse than 6/60, the patient being just able to distinguish hand movements. Right eye visual acuity was 6/12.

Investigations showed that a complete blood count and sternal marrow examination were normal. There were no abnormalities of liver function and the urea and electrolytes were normal. X-rays of the chest and skull with coned views of the pituitary fossa revealed no abnormalities. Examination of the CSF was entirely normal including Lange, WR and CSF IgG level. The EEG, however, showed an excess of slow wave activity for the patient's age. Serum B₁₂ levels taken on five separate occasions from March 1970 to October 1971 ranged from 50 to 120 pg/ml with a mean of 80 pg/ml. The serum folate was slightly higher than normal at 10 ng/ml. The Schilling test of

Vitamin B₁₂ absorption was normal both with and without intrinsic factor (23% and 22% respectively).

In May 1970, after the observation of consistently low serum B₁₂ levels, the patient was given a 7-day course of hydroxocobalamin injections in conjunction with the steroid therapy.

After a further exacerbation she was readmitted in November 1971. Serum B₁₂ was again low (56 pg/ml). A careful dietary history on this occasion revealed the explanation for this finding. She had eaten no meat at all for the previous 10 years, nor eggs, poultry or fish. Before this, as a young child, she had rarely eaten any meat, initially because she disliked the taste, and subsequently because she believed that the slaughter of animals to provide food was inhumane. She had drunk no milk for 10 years, although she did eat cheese and liberal amounts of vegetables. In addition she had smoked up to 20 cigarettes a day for 2 years prior to the onset of her visual deterioration.

The visual acuity in her right eye has improved slowly with hydroxocobalamin and steroid therapy. The latter drugs have now been stopped and monthly maintenance B₁₂ therapy continued, since when there have been no further episodes of visual deterioration. She has stopped smoking. Vision in the right eye is now normal but that in the left eye seems irrecoverable. During the period from 1968 to 1973 she has had no other neurological symptoms.

Discussion

The chief dietary sources of Vitamin B₁₂ are: liver, meat, fish, eggs, butter, milk and cheese (De Gruchy, 1970). Thus in view of the dietary habits of these two young people it is not surprising that they should develop Vitamin B₁₂ deficiency. In Case 1, the diet was not only inadequate in animal food sources but also in green vegetables, an important source of folic acid. In Case 2 the diet was very close to that of a true vegan, and thus with a very low animal food intake but a high intake of vegetables the finding of low B₁₂ but high folate levels would be expected.

Confirmation that in both cases the B₁₂ deficiency was not due to failure of absorption was obtained by the normal Schilling tests without intrinsic factor. In neither case was there any family history of pernicious anaemia, and in Case 1 the finding of normal free acid production was further evidence against the possibility that the megaloblastic anaemia was Addisonian in type. The marked improvement in the anaemia which occurred in response to a diet containing meat was an additional pointer to the dietary origin of the vitamin deficiency.

Retrobulbar neuritis with optic atrophy does occur albeit rarely as a complication of pernicious anaemia (De Gruchy, 1970) and it would seem reasonable to

expect it to complicate Vitamin B₁₂ deficiency due to dietary causes. Other causes of optic atrophy such as Leber's disease and dominantly inherited optic atrophy are unlikely without a positive family history. Idiopathic demyelination with coincidental vitamin deficiency seems unlikely in view of the normal CSF constituents and the absence of other neurological symptoms or signs in a 5 year follow-up period. The occurrence of optic atrophy in a young Caucasian vegan must be extremely unusual if not unique. The interesting question arises as to whether smoking could have played a part in its causation, in a manner analogous to the optic atrophy in Addison's anaemia (Freeman and Heaton, 1961). The mechanism probably involves cyanide toxicity-hydroxocobalamin being required for its detoxification (Boxer and Rickards, 1952), and thus low B₁₂ levels predispose to cyanide neurotoxicity.

It is interesting that in the first case there was a megaloblastic anaemia without neurological complications whereas the converse clinical features occurred in the second case. A possible explanation lies in the folate intake. In Case 1 the intake and serum level of folate were borderline low. On the other hand the high folate intake in the second case may have protected against the development of anaemia but may well have played a role in initiating the neurological complications.

Studies on immigrant Indians living in this country have shown that megaloblastic anaemia and early neurological complications of dietary B₁₂ deficiency are not uncommon occurrences in Hindu vegetarians (Stewart, Roberts and Hoffbrand, 1970; Britt, Harper and Spray, 1971). The present cases serve to maintain our awareness that dietary deficiency of Vitamin B₁₂ may occur in our own young Caucasian population, as well as among Asian immigrants. Case 2 emphasizes how important it is to take a dietary history on finding a low serum B₁₂ level.

Although there was nothing particularly characteristic in the personalities or occupations of our two young patients that might have indicated their likelihood to adopt a vegetarian diet, there has been a

recent report of increasing numbers of ex-drug addicts adopting such diets (Dwyer and Mayer, 1971). It therefore seems probable that further similar cases will be recognized in young Caucasian people, the society 'drop-outs' possibly being a particularly vulnerable group.

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