International Journal of Research in Medical Sciences
Khatrawi EM et al. Int J Res Med Sci. 2022 Nov;10(11):2671-2673
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20222634

Case Report

Type 1 hypersensitivity from vitamin B12 injection: a case report

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Received: 26 September 2022
Accepted: 07 October 2022

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ABSTRACT

Vitamin B12 is essential for the development of healthy nerves and red blood cells. Vitamin B12 deficiency is becoming widespread and most commonly affects the elderly, pregnant women, vegetarians, and patients with renal or intestinal diseases. Either parenteral vitamin B12 treatment or high-dose oral vitamin B12 treatment is an effective therapy regardless of etiology. Parenteral therapy using the intramuscular route is considered the most familiar treatment for vitamin B12 deficiency. Anaphylactic reaction after intramuscular injection is an uncommon and potentially serious side effect. In this study, we are documenting a case of anaphylactic reaction in a 50-year-old man after her second dose of intramuscular injection of cyanocobalamin. The purpose of this case report is to highlight the need to understand the rare life-threatening side effect of intramuscular cyanocobalamin. Health care providers should be vigilant while administering the intramuscular injection of cyanocobalamin to vitamin B12 deficient patients.

Keywords: Anaphylaxis, Type 1 hypersensitivity, Vitamin B12, Cyanocobalamin, Allergy

INTRODUCTION

Cobalamin also referred to as vitamin B12, is a water-soluble vitamin essential for metabolism. One of the eight B vitamins is this important complex. Animals need it because they use it as a cofactor in the creation of deoxyribonucleic acid (DNA) and in the metabolism of fatty acids and amino acids.[1] It has a crucial role in the production of myelin, which supports the neurological system, and in the maturity of red blood cells in the bone marrow, which supports the circulatory system. Cobalamin is not required by plants, and enzymes that are not reliant on it are used to carry out processes. The most chemically complicated vitamin is vitamin B12, which is also the only vitamin that must be obtained from meals or supplements produced from animals for humans.[2] Only a few types of bacteria can produce vitamin B12. The majority of individuals in industrialized countries obtain adequate B12 from eating meat or other foods derived from animals. Meat, shellfish, liver, fish, chicken, eggs, and dairy foods are foods that contain vitamin B12. Foods made of grains may be fortified with this vitamin. Vitamin B12 deficiency can be treated and prevented with supplements and drugs.[3] They are ingested, but they can also be administered intramuscularly to correct deficiencies. The loss of the stomach intrinsic factor (IF), which must be coupled to a food supply of B12 for absorption to take place, is the main cause of cobalamin insufficiency in developed nations. The loss of stomach acid with age (achlorhydria), which releases the protein-bound vitamin, is a secondary key factor. People who use proton-pump inhibitors, H2 blockers, or even other antacids or are on long-term antacid medication are at higher risk. Vegetarian and vegan diets might not contain enough B12 until a dietary supplement is taken. A lack of vitamin B12 can result in limb neuropathy or a megaloblastic anemia blood condition called pernicious anemia, which can make patients feel exhausted and weak and cause them to feel lightheaded, breathless, lose appetite, experience abnormal sensations, change how they move, have severe joint pain, have weak muscles, have memory issues, be less conscious, have brain fog, and many other clinical signs. The deficit in babies may result in neurological problems if untreated.[4] The level of folate

in a person may have an impact on the progression of pathological alterations and the symptoms of vitamin B12 insufficiency.

B12 is available in the synthetic form cyanocobalamin. AdoB12 and MeB12 are produced during bacterial fermentation, and when potassium cyanide is added to the environment of sodium nitrite, heat, and potassium cyanide, they are transformed into cyanocobalamin. Cyanocobalamin is transformed into the physiologically active vitamins AdoB12 and MeB12 after consumption. Methylcobalamin in the cytosol and adenosylcobalamin in the mitochondria are the two functional forms of vitamin B12. Due to cyanide's ability to protect the molecule against degradation, cyanocobalamin is the most prevalent form of vitamin B12 utilized in nutritional supplements and food fortification.[5] Additionally, methylcobalamin is available as a nutritional supplement. To treat vitamin B12 insufficiency, hydroxycobalamin injections can be given intramuscularly. For the treatment of cyanide poisoning, it can also be administered intravenously.[6] Cyanide displaces the hydroxyl group, forming non-toxic cyanocobalamin which is excreted. This case report details an anaphylactic reaction that a 50-year-old-male experienced following her second injectable dosage of cyanocobalamin to correct his Vitamin B12 insufficiency.[7]

CASE REPORT

A 50-year-old man arrived at the outpatient setting complaining of fatigue, lethargy, malaise, and mild breathlessness that had been bothering him for the last 1.5 years. He had no accompanying symptoms, such as a fever, rash hematuria, chest pain, asthma, aberrant sensory perception, paresthesia, or trouble adjusting to the temperature of the environment. He did not previously have any infections. His prior surgical and medical histories were not noteworthy. He didn't have any known food or medicine allergies. A thorough medical history revealed that the individual was a staunch vegetarian who did not consume any fortified foods or multivitamins. Upon examination, his vital signs were as follows: afebrile temperature; blood pressure of 140/90 mmHg; respiratory rate of 20 breaths per minute; and heart rate of 110 beats per minute. Scleral pallor was discovered during the general evaluation. His neurological evaluation and systemic examination were also unremarkable.

Hemoglobin was 9 mg/dl (normal range for men is 12–16 mg/dl), reticulocyte count was 0.8% (normal range is 0.5–1.5%), red blood cells were 2.40 million/cumm (normal range is 3.50–5.50 million/cumm), white blood cells were 7600/cumm (normal range is 4000–11,000/cumm), platelets were 350,100/cumm (normal range is 150,000–450,000/cumm), and MCV=110 fl/red cell (normal: 80-96 fl/red cell). A peripheral blood film showed hypersegmented neutrophils on macrocytes. His plasma folate levels were 10 ng/ml and his serum vitamin B12 levels were 138 pg/ml (normal range: 200-600 pg/ml). Plasma levels of methylmalonic acid and homocysteine were increased, according to additional tests. Megaloblastic anemia owing to deficiency in vitamin B12 was identified as the condition. Antibodies to the serum intrinsic factor tested negative. The patient received info pertaining his condition as well as advice on the benefits of taking nutritional supplements and eating fortified foods. The patient was given an intramuscular injection of 1 mg of cyanocobalamin on the day of the appointment since he was symptomatic, and he handled it well. He was supposed to receive a weekly injection of 1 mg of cyanocobalamin intramuscularly for seven weeks in a row. The patient experienced generalized urticaria, dermatitis, reddening of eyes, abdominal cramps, vomiting, tongue puffiness, vertigo and trouble breathing during his second week of therapy with 1 mg of cyanocobalamin intramuscularly. The patient was brought right away to the hospital's emergency room. The individual was in severe distress upon being examined physically. His vital signs were as follows: afebrile temperature; 60/40 mm Hg blood pressure; RR was 36 breaths/minute; and tachycardia (130 beats/minute). His blood pressure was continuously falling, and we had to administer 20 minutes of continuous cardiopulmonary resuscitation to him along with the therapeutic treatment discussed below.

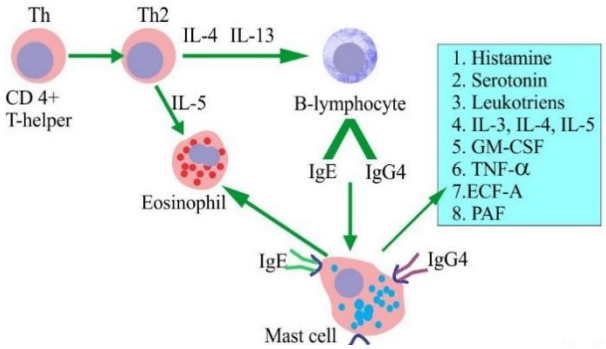

Figure 1: Role of T cells in type 1 hypersensitivity.

Urticaria of the hands, palms, soles, and inner thighs were discovered upon examination of the body. Chest auscultation revealed bilateral widespread wheezes. Abdominal distension was discovered during an examination. He had an intramuscular epinephrine shot and an intravenous hydrocortisone infusion right away. Antihistamines were also provided to him for symptomatic relief. Once the patient had stabilized, he was to remain under monitoring for a period of two weeks. He was given a large oral dosage of vitamin B12, 2 mg/dl each day. He responded favorably to the oral vitamin B12 and experienced no negative side effects. His hemoglobin and hematocrit increased within a few months of consuming oral vitamin B12, and the patient ceased exhibiting symptoms.

DISCUSSION

Numerous factors may contribute to adverse responses following a B12 injection. An instance of hypersensitivity to benzyl alcohol used as a preservative that caused urticaria following injection was documented by

Lagerholm et al.[9] Bedford observed that carry-out contaminants created during the production of vitamin B12 behave as allergens and cause hypersensitivity.[8] Hovding asserted that sensitization was caused by the cobalamin molecules or polypeptides attached to the cobalamin acting as a full-fledged allergen on its own and inducing an allergic reaction.[12] The allergic reaction might range from mild urticaria and itching to anaphylactoid reactions, which can occasionally result in the patient's death. Cyanocobalamin, hydroxocobalamin, methylcobalamin, and adenosylcobalamin are the four different forms of cobalamin.[11] There have been reports of allergic reactions being brought on by both the parenteral and oral preparations, although the former is more common than the latter in cases of hypersensitivity.[10]

Cobalamin comes in two highly refined injectable forms: cyanocobalamin and hydroxocobalamin. After receiving the vitamin B12 sensitization dose, the anaphylactic reaction can happen in minutes, hours, days, months, or more frequently, years later.[13] In the above scenario, the individual tolerated his first injectable dose of cyanocobalamin. However, he became sensitized to it, which is the first step in the pathogenesis of anaphylactic or type 1 hypersensitivity reaction. A week later, the patient received his second dose of cyanocobalamin intramuscularly and developed type I hypersensitivity or anaphylactic reaction. The patient responded nicely to the switch to oral vitamin B12 and had no negative side effects. His condition improved, and following a few months of therapy using oral vitamin B12, his hemoglobin level returned to normal at 14.4. The absence of carryover contaminants or any additives in oral formulations of vitamin B12 can be used to explain why individuals tolerate them more readily.

In their regular clinical duties, doctors face challenging scenarios involving drug allergies and treatments. Skin testing or particular IgE assays should be used to confirm IgE-mediated allergic responses in patients who have any negative side effects after medication therapy. When there are no viable substitute medications, desensitization should then be carried out in these circumstances. Nowadays, desensitization is applied successfully with a variety of chemotherapeutic medications, and also medications such as antibiotics, aspirin, and numerous other drugs.

CONCLUSION

Anaphylactic reactions following intramuscular injection of cyanocobalamin have so far only rarely been documented. This case study aims to demonstrate the significance of comprehending the infrequent but potentially fatal side effects of injectable cyanocobalamin. When giving vitamin B12 deficient people an intramuscular injection of cyanocobalamin, medical professionals need to exercise caution as even though it's rare, but if the hypersensitivity occurs it could potentially be life threatening and can result in the death of the person within a few minutes if not acted upon promptly.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Khatrawi EM, Prajjwal P, Ranjan R. Type 1 hypersensitivity from vitamin B12 injection: a case report. Int J Res Med Sci 2022;10:2671-3.