www.jcimcr.org

JCIMCR OPEN ACCESS Journal of Clinical Images and Medical Case Reports

ISSN 2766-7820

Case Report

Open Access, Volume 5

A case report of anemia associated with short bowel syndrome corrected by EPO during nutrition therapy

Bing Lin[1]; Yu Wang[2]; Jinfeng Zheng[2]; Cuifeng Zhu[1]*

[1]Department of Clinical Nutrition, Shenzhen Hospital, Southern Medical University, Shenzhen, China.

[2]Department of Nutrition, Jinling Hospital, Nanjing University School of Medicine, Nanjing, China.

***Corresponding Author: Cuifeng Zhu**

Department of Clinical Nutrition, Shenzhen Hospital, Southern Medical University, Shenzhen, China.

Email: 1794371266@qq.com

Received: Jan 26, 2024

Accepted: Feb 14, 2024

Published: Feb 21, 2024

Archived: www.jcimcr.org

DOI: www.doi.org/10.52768/2766-7820/2872

Abstract

Many study showed long-term parenteral treatment often couple with iron-deficiency anemia. This case was a short bowel syndrome (SBS) patient with remaining 15 centimeters intestine and intact ileocecal valve. After small bowel resection, nutrition support was consist of continuous parenteral nutrition, and a crescent dose of enteral nutrition. The hemoglobin continues to decline after ten months, which was first considered to be nutrition related anemia. But his ferritin and transferrin saturation were high, which do not support iron deficiency anemia. Serum vitamin B6, Folic acid and zinc were normal too. Then we tried recombinant human erythropoietin indications (rHu EPO) and oral iron supplementation to correct anemia, which resulted in significant improvement of hemoglobin.

Keywords: Short Bowel Syndrome (SBS); Parenteral nutrition; Enteral nutrition; Anemia; Erythropoietin; Iron.

Introduction

Short Bowel Syndrome (SBS) often due to mesenteric vascular embolism, intestinal volvulus, severe abdominal injury, malignant tumor and other diseases. After the removal of a large portion of the small intestine, the remained intestine cannot maintain sufficient nutrients to meet the body's nutritional needs, which resulting in disturbance of water and electrolyte metabolism, and malnutrition. Nutritional therapy is the important treatment for SBS, including parenteral nutrition and enteral nutrition. Although parenteral nutrition technology has made great development, the long-term application in SBS is still frequent, such as anemia, liver damage, electrolyte imbalance, etc [1]. SBS related anemia is more common with iron deficiency anemia, but the patient in this case had sufficient iron and other hematopoietic raw materials. Meanwhile the evidence of other reasons of anemia was insufficient. The EPO was attracting more and more attention in nutritional anemia and perioperative anemia. Based on the existing evidence, we report a new SBS patient whose anemia corrected significantly by the application of EPO that has not been reported before. It provides reference for the anemia treatment of EPO in SBS patients.

Case presentation

The 48-year-old male patient was admitted to the hospital on October 30, 2020-due to "10 months after small bowel resection and more than 3 months after jejunum and colostomy reduction". Due to mesenteric thrombosis and small intestine necrosis, the patient underwent wide resection of small intestine, jejunostomy and descending colostomy in January 2020, and received total parenteral nutrition support by indwelling infusion port from then. On July 6, jejunum ileum anastomosis operation was made, and the ileocecal valve retained intact. The rest small intestine was about 15 cm, including most duodenum. In August, enteral nutrition was gradually pumped into few warm water, rice soup transition and the short peptide enteral nutrition agent 1000 ml by the nasogastric tube. The dominant stool was yellow water samples for 3 to 5 times/day. Oral tolerance is not well. Diarrhea was significantly aggravated

when eating noodles, rice porridge and other foods, while diarrhea was serious when eating meat, milk and other high-protein foods. The patient's weight was 60 kg 10 months ago, while the current weight was 55 kg. The nutrition status was moderate, and there was no appearance of anemia. After long admission, liver transaminase and total bilirubin were higher, while blood magnesium was low. Other common examinations showed no special findings. This patient was diagnosed as "short bowel syndrome and liver function impairment", and continued to receive integrated intravenous nutrition add enteral nutrition support.

Nutritional therapy and anemia: After admission, enteral nutrition was given 1000 mL 960 kcal combined with parenteral nutrition 1764 ml 1450 kcal. Blood routine examination, liver and kidney function and electrolytes were detected weekly, and the amount of electrolytes in parenteral nutrition formula was adjusted according to the results. Due to few gastrointestinal reaction, the amount of enteral nutrition was added to 1400 ml/day, with 1620 kcal, and reduce parenteral nutrition to 1397 ml 1197 kcal, as shown in Table 2.

Table 1: Parenteral nutrition formula A.

Supplements	Dose	Supplements	Dose
20% Medium-long chain fat emulsion	200 ml	Sodium glycerophosphate injection (10 ml:2.16 g)	10 ml
20% SMOF	100 ml	Calcium gluconate injection (10 ml:1 g)	10 ml
8.5% Compound amino acid (18AA-2)	750 ml	Magnesium sulfate injection (10 ml:2.5 g)	4 ml
50% glucose injection	300 ml	15% Potassium chloride injection	35 ml
10% glucose injection	250 ml	10% Sodium chloride injection	40 ml
Multivitamins for injection (12)	5 ml	Vitamin B6 injection	200 mg
Multiple trace elements (Addamel)	10 ml		
-Iron	20 umol/ 1.1 mg		
summation			
liquid volume	1714 ml	energy	1450 kcal
amino acids	64 g	glucose	175 g
Fat	60 g	energy /nitrogen rate	117:1
From Oct 31 to Nov 10		days	11

Clinical treatment principally was symptomatic treatment, including 1) liver protection:monoammonium cysteine glycyrrheate sodium chloride injection 200 ml quaque die (QD), ursodeoxycholic acid tablet 250 mg ter in die (TID) oral + deoxytide sodium injection 150 mg QD Intravenously Guttae (IVGTT) + polyene phosphatidylcholine injection 465 mg QD IVGTT, antidiarrheal (loperamide hydrochloride capsule 4 mg QID for oral administration), 2) Inhibition of gastric acid (eprazole sodium for injection, 10 mg QD IVGTT). Weekly blood routine examination showed decreased hemoglobin (HGB) levels of 127 g/L (Nov 1), 118 g/L (Nov 5), 103 g/L (Nov 14), and 89 g/L (Nov 20). The anaemic reason was explored, with fecal occult blood (-), urine occult blood (-). Serum triglycerides was 2.4 mmol/ L,

Table 2: Parenteral nutrition formula B.

Supplements	Dose	Supplements	Dose
20% Medium -long chain fat emulsion	250 ml	Sodium glycerophosphate injection(10 ml; 2.16 g)	15 ml
8.5% Compound amino acid (18AA-2)	650 ml	Calcium gluconate injection (10 ml: 1 g)	10 ml
50% glucose injection	250 ml	Magnesium sulfate injection (10 ml:2.5 g)	4 ml
10% glucose injection	150 ml	15% Potassium chloride injection	20 ml
Multivitamins for injection (12)	5 ml	10% Sodium chloride injection	30 ml
Multiple trace elements (Addamel)	10 ml	Vitamin B6 injection	200 mg
-Iron	20 umol/ 1.1 mg		
summation			
liquid volume	1397 ml	energy	1197 kcal
amino acids	55 g	glucose	140 g
Fat	50 g	energy /nitrogen rate	111:1
From Nov 11 to Nov-20, Nov 24 to Dec 6		days	23

Table 3: Examination of nutrients associated with anemia (11-21 to 11-23).

Items	Result	Unit	Reference
Folic acid	13.09	ng/ml	3.89-26.8
Vitamin B12	1036	pg/ml	197-771
Serum iron	28.41	umol/l	5.83-34.5
Total iron binding capacity	38.51	umol/l	45.0-75.0
Transferrin saturation	73.77	%	33.0-55.0
transferrin	1.82	g/l	2.0-3.6
Serum ferritin	5157	ng/ml	30-400

reticulocyte proportion, leucocyte, platelet, albumin, total protein, liver transaminase, bilirubin, blood creatinine and other indicators were no significant change. The hematology department was invited for consultation, which was considered as nutritional anemia likely. It was suggested to further specialized examination such as bone marrow smear, but it was refused by the patient. Empirical treatment was continued.

Tests showed iron overload, folic acid and vitamin B12 were not low. We contacted the operation hospital for detailed treatment. This patient received 3000 U/d human erythropoietic injection and iron sucrose injection 100 mg/d after intestinal reduction 3 months ago, which last for 10 days. There was no other treatment of EPO, intravenous iron and no history of blood transfusion since then. Parenteral nutrition was suspended for three days to eliminate parenteral nutrition-related hemolysis. Hemoglobin was 88 g/l after that (Nov 24). However, parenteral nutrition was restarted because of exacerbation of weakness and hypoglycemia. The hemoglobin was then reduced to 78 g/ L in Nov 30. 300 ml erythrocytes were transfused on Dec 1, and also 3000U recombinant human erythropoietin injection CHO cells (rHu-EPO, produced by Kywa Hakko Kirin Co., Ltd)

Table 4: Changes of hemoglobin and RBC.

Date	Nov 1, 2020	Nov 5, 2020	Nov 14, 2020	Nov 20, 2020	Nov 24, 2020	Nov 30, 2020	Dec 2, 2020	Dec 7, 2020
HGB (g/L)	127	118	103	89	88	78	89	97
RBC(*10^{12}/L)	4.0	3.76	3.27	2.86	2.7	2.38	2.81	2.97

were given by three times per week. Oral iron supplementation of 30mg/d was given as appropriate, after which hemoglobin continued to rise to 97 g/L (Dec 7). The erythrocyte count and hemoglobin changed synchronously, as shown in Table 4. On Dec 7, the patient was transferred to another hospital for EPO 3000U TIW, and daily venous multiple trace elements with iron 1.1 mg/d. By the time of blood routine review on January 4, 2021, Hemoglobin had returned to normal 154 g/L. EPO was then stopped, during which no transfusion occurred.

Discussion

There is a spontaneous adaptation process of SBS which lasts 1-2 years after resection. It is characterized by adaptive changes of the remaining small bowel (structural adaptation) in order to increase the absorptive surface while the time of intestinal transit typically decreases to maximize the time available for absorption (functional adaptation) [2]. Some experts believe that when the complete colon is retained, the residual small intestine needs to be more than 70-90 cm, or 1 cm/kg, SBS patient can completely get rid of parenteral nutrition. In this case, the residual small intestine of the patient was only about 15 cm, and compensatory effect may compensate for partial nutrient digestion and absorption capacity, whose parenteral nutrition is necessary for long-time. Anemia is the one of most common complications usually caused by deficiencies of some nutrients such as iron, folic acid, vitamin B12, zinc, and copper. Many studies showed the incidence of iron deficiency anemia is about 1/3 of patients receiving long-term TPN (longer than 2 months). Over half of patients with parenteral nutrition had iron deficiency anemia over 5 years [2]. In a recent analytical investigation of 53040 American SBS patients from 2005 to 2014, there were 29.7% of patients received at least one unit of packed Red Blood Cell (RBC) transfusion during their hospitalization [3]. The use of PN can be associated with a variety of complications including bacterial infections, intravenous catheter complications, low bone calcium uptake, blood clots and some mineral deficiency [4,5].

Erythropoietin (EPO) is a human endogenous highly glycosylated protein, which is generated by the renal cortex and interstitial cells around renal tubules interstitial cells (produced by cells around the central vein of the liver in embryo, but rarely after birth). EPO binds to the EPO receptor indicated by bone marrow erythroid progenitor cells, activates the downstream signal transduction pathway to promote the amplification and differentiation of bone marrow erythroid colony-forming units, inhibits apoptosis and increase the number of red blood cells [6]. EPO-EPOR complexes which are then degraded in lysosomes, as a mechanism of negative feedback to reduce EPO level to avoid overproduction of erythrocytes when a patient recovers from acute blood loss [7].

As the increased evidence, recombinant human erythropoietin indications (rHu EPO) has been more and more widely recommended in clinical practice, including renal insufficiency anemia, perioperative anemia, malignant tumor chemotherapy related anemia, bone marrow exhaustion disease, as well as other exploratory applications and non-hematogenic activity, such as infants anemia, acquired immunodeficiency syndrome related anemia, rheumatism, and antiapoptotic activity, etc [8-10]. In the treatment of nutritional anemia, some experts suggest that rHu EPO can be used to promote erythropoiesis, but there is no guidance or consensus. This patient was treated with rHu EPO for 10 consecutive days among perioperative period 3 months ago, and the response was satisfactory, with hemoglobin increasing continually and no blood transfusion. According to the treatment principles of nutritional anemia, rHu EPO was given after signing the informed consent letter. The actual effect was conspicuously effective by continuously elevated RBC and hemoglobin. No blood transfusion was given after use of rHu EPO, which means the rHu EPO effectively reduced the frequency of use of blood products.

Conclusion

Anemia is one common complication of SBS, which is attributed possibly by nutritional factors. As no evidence of organic disease, rHu EPO may be a valuable treatment for SBS patients complicated with anemia.

Disclosure of interest: The authors declare that they have no competing interest.

References

1. Elena Cernat, Tania Ahmad, Susan Hill, Jutta Köglmeier. Anaemia in Children Receiving Home Parenteral Nutrition: A Common Problem? J Pediatr Gastroenterol Nutr. 2022, 74(5): 122-e126. PMID: 35213859.
2. Massironi S, Cavalcoli F, Rausa E, Invernizzi P, Braga M, Vecchi M. Understanding short bowel syndrome: Current status and future perspectives. Digestive and liver disease: official journal of the Italian Society of Gastroenterology and the Italian Association for the Study of the Liver. 2020; 52(3): 253-61. PMID: 31892505.
3. Siddiqui MT, Al-Yaman W, Singh A, Kirby DF. Short-Bowel Syndrome: Epidemiology, Hospitalization Trends, In-Hospital Mortality, and Healthcare Utilization. JPEN Journal of parenteral and enteral nutrition. 2021; 45(7): 1441-55. PMID: 33233017.
4. Hwa YL, Rashtak S, Kelly DG, Murray JA. Iron Deficiency in Long-Term Parenteral Nutrition Therapy. JPEN Journal of parenteral and enteral nutrition. 2016; 40(6): 869-76. PMID: 25972429.
5. Nabeel Moon, Mahmoud Aryan, Donevan Westerveld, Sunina Nathoo, Sarah Glover, Amir Y Kamel. Clinical Manifestations of Copper Deficiency: A Case Report and Review of the Literature.
6. Pasricha SR, Tye-Din J, Muckenthaler MU, Swinkels DW. Iron deficiency. Lancet (London, England). 2021;397(10270):233-48. PMID: 33285139. Nutr Clin Pract. 2021; 36(5): 1080-1085. PMID: 33037701.
7. Shih HM, Wu CJ, Lin SL. Physiology and pathophysiology of renal erythropoietin-producing cells. Journal of the Formosan Medical Association = Taiwan yi zhi. 2018; 117(11): 955-63. PMID: 29655605.
8. Hanna RM, Streja E, Kalantar-Zadeh K. Burden of Anemia in Chronic Kidney Disease: Beyond Erythropoietin. Advances in therapy. 2021; 38(1): 52-75. PMID: 33123967.

9. Aschalew Kidanewold, Berhanu Woldu, Bamlaku Enawgaw. Role of Erythropoiesis Stimulating Agents in the Treatment of Anemia: a Literature Review. Clin Lab. 2021; 67(4): PMID: 33865269.

10. Franco Musio. Revisiting the treatment of anemia in the setting of chronic kidney disease, hematologic malignancies, and cancer: perspectives with opinion and commentary. Expert Rev Hematol. 2020; 13(11): 1175-1188. PMID: 33028115.