Myelodysplastic Syndrome and Hemoglobin Improved by Intravenous Nutrient Therapy: A Case Report

Onkar Singh,[1,2] ND, **Mary-Leah Albano,**[1] MPH, ND, **Felicia Scaringi,**[2] BSc, and **Monique Aucoin,**[2,3] ND, MSc

ABSTRACT

Myelodysplastic syndromes (MDSs) are variations of bone marrow failure disorders that lead to insufficient production of healthy blood cells culminating in some combination of low red blood cells, low white cells, or both. This case report presents a case of increased hemoglobin levels following intravenous (IV) nutrient therapy. J.B. is a 74-year-old male who presented with a chief concern of MDS. He was experiencing extreme fatigue and exhaustion, episodes of shortness of breath and a decline in hemoglobin levels. He was being followed by a hematologist who monitored his complete blood count (CBC) at regular intervals, with primary focus on blood hemoglobin. His hemoglobin levels were significantly lower than the normal range, but never met the threshold for a blood transfusion (< 75 g/dL), his only treatment option. Beginning in November 2021, weekly to biweekly IV nutrient therapy treatments were initiated. In all, 39 IV treatments were given until August 2023. Intravenous nutrient formulas included Myer's Cocktail, high-dose vitamin C (25 g), Hydrating Myer's Cocktail and Hydrating Myer's Cocktail + glutathione. As IV treatments were administered, a trend was observed showing a consistent improvement of hemoglobin levels over time, with the greatest degree of improvement observed after the series of Hydrating Myer's Cocktails. The patient also reported decreased overall fatigue and reduced recovery time from activity. Delivering a series of IV infusions may have resulted in an improvement of hemoglobin levels in this patient. Further investigation is warranted to understand the potential effects IV nutrient therapy could have on MDS patients with a similar prognosis.

Key Words Naturopathic, intravenous infusions, bone marrow failure disorders, anemia, Myer's cocktail, high-dose vitamin C, glutathione

INTRODUCTION

Myelodysplastic syndromes (MDSs) are a group of rare bone marrow failure disorders characterized by poor bone marrow function.[1,2,3] Hematopoietic stem cells subject to clonal disorder lead to dysplasia, resulting in ineffective hematopoiesis within bone marrow.[2] Cellular susceptibility can be a result of genetic predisposition or secondary to environmental exposures such as benzene, alkylating agents in chemotherapy, radiation, heavy metals, or chemical toxicity from smoking or industrial exposure.[2] The course of disease is variable. However, its clinical manifestation will appear as low red blood cell count, white blood cell count, platelet count, or all three.[1,2]

The identification of morphologic dysplasia on a bone marrow examination is diagnostic of MDS, serving as a crucial criterion of the disease classification.[3] The World Health Organization (WHO) recognizes 6 pathological subtypes of MDS: MDS with single lineage dysplasia (MDS-SLD), MDS with ring sideroblasts (MDS-RS), MDS with multilineage dysplasia (MDS-MLD), MDS with excess blasts (MDS-EB), MDS with isolated del(5q), and MDS, unclassifiable (MDS-U).[4,5] Canada is still using the 2008 classification system, which includes both refractory anemia with ring sideroblasts (RARS) and refractory cytopenia with multilineage dysplasia and ring sideroblasts (RCMD-RS), 2 of their 7 types of MDS.[5] The WHO revised this list in 2016 by removing the terms refractory anemia and refractory cytopenia and categorizing the 2 sideroblasts together.[5] According to WHO, the diagnosis of MDS needs to be clearly defined and then classified.[5] Furthermore, the degree and not the lineage of cytopenia impacts the MDS prognosis.[5] The 6 subtypes are further classified as either high or low risk in the development of acute myeloid leukemia (AML).[6] Low-risk patients have a median survival of 3 to 10 years

Correspondence to: Mary-Leah Albano, Holistic Healing Arts, 274 King George Road, Unit 2, Brantford, ON N3R 5L6, Canada. **E-mail:** dralbano@ndoc.ca

To cite: Singh O, Albano M-L, Scaringi F, Aucoin M. Myelodysplastic syndrome and hemoglobin improved by intravenous nutrient therapy: a case report. *CAND Journal.* 2024;31(2):3–9. https://doi.org/10.54434/candj.171

Received: 8 March 2024; **Accepted:** 17 May 2024; **Published:** 27 June 2024

due to low genetic variants and myeloblast percentage.[6] Those with a high risk have a median survival of 3 years due to high genetic variants, such as TP53.[6]

The most common genetic variant is caused by the deletion of the long arm on chromosome 5 (del(5q)), accounting for approximately 15% of primary MDS.[7] This deletion causes a deficiency in gene RPS14, a ribosomal protein involved in protein synthesis, resulting in impaired erythropoiesis.[8] Currently, no tumour suppressor genes have been identified on chromosome 5q. Patients with MDS del(5q) clinically present with severe refractory, macrocytic anemia, normative or high platelets, unaffected or low neutrophils and notably smaller megakaryocytes.[9] There are currently 2 identified chromosomal regions on 5q, 5q33 and 5q31, with 5q31 resulting in a poorer prognosis due to increased cytogenetic abnormalities.[9] Additionally, sequence-specific DNA and RNA binding protein, PURA, is homozygously deleted, common to AML.[9] Standard of care for del(5q) is lenalidomide, with a favourable prognosis and low risk of developing into AML.[7]

The incidence rate of MDS is approximately 4 to 5 cases per 100,000 people, with 20,541 new cases each year, approximately 30% of which develop into AML.[2,7] The risk of MDS increases by 5 to 10-fold after 60 years of age, resulting in the majority of diagnoses being made in those over the age of 65 and more commonly occurring in Caucasians and males.[7]

Initially, patients with MDS present with anemia, shortness of breath, anorexia, fatigue, dizziness, gingival bleeding, easy bruising, epistaxis, recurrent infections, and chest pain.[1-3] Lower-risk MDS patients are treated to reduce disease-related symptoms only, as there is no current treatment shown to increase overall survival.[6,8] MDS patients presenting with symptomatic anemia and/or thrombocytopenia and hemoglobin < 75 g/dL are treated with red blood cell transfusions. Transfusions have been shown to reduce fatigue and improve quality of life.[9] Any MDS patient presenting with a fever must be treated with antimicrobials, as infection is a leading cause of death in MDS.[6] Depending on the severity and presentation of MDS, a variety of treatment options are considered including erythropoiesis-stimulating agents, hypomethylating agents, immunomodulatory derivatives, and hematopoietic stem cell transplantation (HSCT) in the most severe cases.[6,10,11]

New research has shown the need to rule out potential nutritional deficiencies prior to diagnosing MDS. Early MDS can mimic copper deficiency, which presents with macrocytic anemia, neutropenia and hypercellular marrow with dyserythropoiesis.[12] There is also limited research on MDS and the effects of low baseline micronutrient status and oral micronutrient supplementation. Komroki et al. (2013) discuss how macrocytic anemia blood cells associated with MDS 5q deletion lack nutrients necessary to function normally.[13] Although a genetic variant, it is plausible that these cells and their associated symptoms could be managed and/or improved by providing blood-building nutrients. In a retrospective study, lower-risk MDS patients receiving erythropoietin (EPO) with oral sucrosomial iron supplementation reportedly had less side effects, fewer transfusions, and fewer outpatient medical visits compared with EPO alone.[14] Observational research has also revealed that baseline vitamin D levels are predictive of survival in MDS patients who are subject to receive azacitidine therapy. Higher vitamin D levels (> 32.8 nmol/L) resulted in fewer febrile neutropenia episodes and hospitalizations during therapy.[15] The current evidence suggests oral micronutrient supplementation could improve MDS outcomes, but the amount of research that has been done is limited.

Another method of delivering supplemental nutrients is via intravenous (IV) administration. Research on IV administration of micronutrients has mainly been focused on its potential benefits in combination with cancer treatments. A recent meta-analysis proposed that the mechanism of IV vitamin C in cancer patients is based on pro-oxidant function, triggering cytotoxicity in cancer cells via a hydrogen peroxide–dependent mechanism without causing harm to normal cells.[16] Intravenous delivery of nutrients aids in achieving high serum concentrations compared with the oral route, which is impaired by gastrointestinal (GI) motility (decreased peristalsis), damaged mucosal lining, dysbiosis or disruption of bacterial flora.[16] Intravenous delivery of nutrients bypasses the GI tract, thereby enhancing subsequent serum concentrations and thus optimizing absorption.[17] Currently, there are no clinical trials on the use of IV therapy for MDS patients. However, there was a recent case report on the use of IV therapy in an AML patient receiving blood transfusions.[18] This was a relapsed AML case with an initial diagnosis of AML in 2009 relapsing in 2014. Following completion of chemotherapy, the use of IV vitamin C was considered as an alternative to HSCT.[18] Infusion of 70 g of IV vitamin C monthly for 3 years increased the patient's hemoglobin from 107 g/dL to 124 g/dL.[18] There was also improvement in platelet counts from 25×10^9/L to 196×10^9/L and white blood cell counts increased from 0.29×10^9/L to 4.0×110^9/L.[18] Given the risk of progression from MDS to AML, this case report provides useful information about the potential role of IV nutrients in correcting hemoglobin levels in hematopoietic disorders. However, exploration of the impact of IV nutrients on MDS remains necessary.

The following case report presents the use of mineral- and vitamin-based IV therapy in the management of hemoglobin levels in a patient with MDS who was not eligible for blood transfusions.

CASE DESCRIPTION

Patient Information

Patient J.B. is a 74-year-old man who presented with a diagnosis of MDS. His primary symptoms included extreme fatigue and shortness of breath. A normally active and goal-oriented individual, J.B. noticed a decline in his overall energy levels since the diagnosis of MDS. He was having to take frequent breaks between tasks, which was unusual for him. At the time of presentation, he was not receiving any treatments, including supplemental iron for the anemia. It is worth noting that prior to the MDS diagnosis, his medical doctor (MD) had prescribed iron to remedy a chronically low hemoglobin value. When this did not help, his MD advised him to stop the iron and referred him to a hematologist for further investigation. J.B. was being monitored by a hematologist who was checking his complete blood count (CBC) values regularly, typically monthly. The potential treatment option from the hematologist was blood transfusions if his hemoglobin levels fell below

75 g/dL. Because his levels never fell this low, the transfusions were not initiated. See Figure 1 for his hemoglobin levels prior to initiating naturopathic treatment. J.B. wanted to do what he could to try to improve his hemoglobin numbers and presented for adjunctive naturopathic care. We received verbal and written consent to publish from the patient.

Psychosocial History

J.B. is happily married with three adult children. For over 30 years he had a career in advertising and marketing. As a retiree, J.B. likes to keep himself busy with various hobbies, including handyman work. He also works part-time at a car dealership as a trade driver.

Past Medical History and Medication

J.B. was diagnosed with hypertrophic cardiomyopathy in 2014. Initially, he was prescribed a low dose of metoprolol, which led to uncomfortable side effects. He was subsequently prescribed 5 mg of bisoprolol, which he takes once a day. In 2018, J.B. had a cardiac ablation and thereafter was prescribed the blood thinner rivaroxaban at a dosage of 20 mg per day. J.B. reported that the combination of metoprolol and rivaroxaban were keeping his cardiac concerns stable. J.B. has a 33-year history as a chronic smoker (1980–2013) at half a pack (ten) per day. J.B. did not report any other significant health history.

Clinical Findings

A physical exam was performed at baseline. The following observations were recorded: blood pressure (BP) 136/82 mmHg, heart rate (HR, bpm) 58, respiration rate (RR, brpm) 12, oxygenation saturation (SpO2, %) 98, temperature (forehead, degrees Celsius) 36.4. His weight was 197 lbs.

Prior to and after each IV treatment, vitals were reassessed. Vitals consistently fell within normal and acceptable levels and did not pose a concern as far as proceeding with the IVs. Prior to each IV treatment, pre-treatment status of the patient was assessed, including J.B. feeling well enough to receive the treatment and having had something to eat and drink within 3 hours of each IV.

Diagnostic Assessment

Diagnosis of MDS was made by the hematologist via a bone marrow biopsy. It was discovered that J.B. has a genetic form of MDS called an isolated deletion 5q. This has a low risk of progressing to AML.

Therapeutic Intervention

Our therapeutic intervention involved delivering intravenous nutrients with an intended outcome of increasing hemoglobin levels. Our rationale for providing IV nutrient therapy was that providing key blood-building nutrients in therapeutic doses directly into the bloodstream may help the body produce red blood cells in the bone marrow. The treatment plan included IV therapy Myer's Cocktails weekly to every other week guided by bloodwork results. It was discussed that IV therapy formulas could be adjusted depending on bloodwork and hemoglobin numbers. J.B. was in regular communication with his hematologist about his naturopathic visits and the IV treatments he was

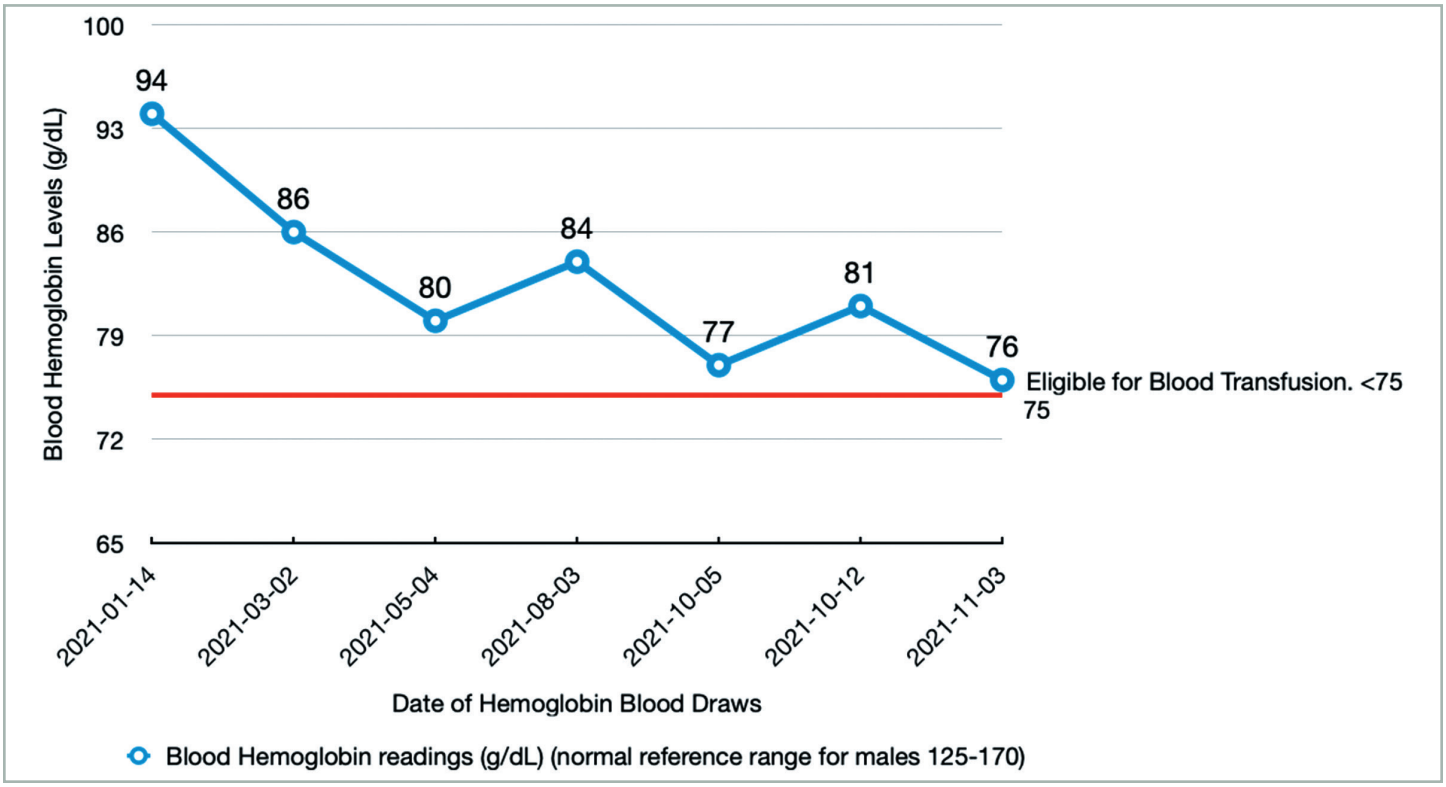

FIGURE 1 Hemoglobin Levels Prior to Initiating Naturopathic Treatment

receiving. The hematologist was aware of the improving hemoglobin levels over time and the patient informed us that, at one of his follow-up appointments with the hematologist, he advised him to "keep doing what you are doing."

Four types of IV infusions were administered (see Table 1 for composition). The first 6 IV treatments consisted of a synergistic combination of vitamins and minerals (Myer's Cocktail). The next set of 4 IV treatments consisted of high-dose vitamin C. The third set of 13 IV treatments consisted of a hydrating Myer's infusion (Hydrating Myer's Cocktail), which included an increased amount of vitamin C and 250 mL of sterile water versus 130 mL saline in the original Myer's cocktail. The final 16 IV treatments consisted of the Hydrating Myer's formula followed by 1000 mg of glutathione (Hydrating Myer's Cocktail + glutathione). IV drip rates were consistently in the medium flow rate range of 3–5 mL/minute. The total volume of the IV bags ranged from 151 mL (Myer's Cocktail) to 547 mL (Hydrating Myer's + glutathione) and took from 30.2 minutes to 182.3 minutes to drip, respectively.

Timeline

J.B. was diagnosed with MDS in May of 2021. His hematologist assessed his hemoglobin monthly with a plan to administer a blood transfusion if his hemoglobin levels reached below 75 g/dL. His hemoglobin levels never reached this threshold; thus, he did not receive treatment from the hematologist. IV nutrient infusions were initiated on November 28, 2021. During this time, bloodwork continued to be ordered and monitored by his hematologist on a monthly basis. See Figure 2 for the timeline of events.

Follow-Up and Outcomes

Figure 3 presents the hemoglobin values and IV treatments administered. During the time when the first IV formula was administered, hemoglobin levels changed slightly from 76 g/dL to 85 g/dL, prompting consideration of an alternative IV nutrient formula. Hemoglobin levels after the 4 vitamin C IV infusions were unchanged; they stayed at 85 g/dL. After returning to the Myer's formula with more hydration, hemoglobin levels rose to 101 g/dL, the highest they had been since J.B. was diagnosed with MDS. With the addition of glutathione, hemoglobin levels were maintained in the mid to upper nineties range. We focused mainly on hemoglobin levels because this was the hematologist's main focus as the key parameter used to determine whether a blood transfusion was needed or not. However, it is worth noting that J.B.'s platelets and white blood cells were stable throughout the treatment process.

TABLE 1 Composition of the IV Nutrient Treatments Provided

Intravenous Treatment Types	Myer's Cocktail	High-Dose Vitamin C (25 mg)	Hydrating Myer's Cocktail	Hydrating Myer's Cocktail + Glutathione
Total number of treatments	6	4	13	16
0.9% Normal saline	130 mL	N/A	N/A	N/A
Sterile water	N/A	250 mL	250 mL	250 mL
Vitamin C (ascorbic acid from cassava root) 500 mg/mL	12–20 mL (6–10 g)	50 mL (25 g)	25–35 mL (12.5–15.5 g)	30 mL (15 g)
Vitamin B Complex 100 (vitamins B1, B2, B3, B5, B6)	2 mL	N/A	2 mL	2 mL
Vitamin B5 (dexpanthenol) 250 mg/mL	2 mL (500 mg)	N/A	2 mL (500 mg)	2 mL (500 mg)
Vitamin B6 (pyridoxine) 100 mg/mL	2mL (200 mg)	N/A	2 mL (200 mg)	2 mL (200 mg)
Vitamin B12 (methylcobalamin) 1000 mcg/mL	1 mL (1000 mcg)	N/A	1 mL (1000 mcg)	1 mL (1000 mcg)
Calcium chloride 100 mg/mL	1 mL (100 mg)	2 mL (200 mg)	1 mL (100 mg)	1 mL (100 mg)
Magnesium chloride 200 mg/mL	1 mL (200 mg)	2 mL (400 mg)	2 mL (400 mg)	2 mL (400 mg)
Potassium chloride 2 mEq (mmol)/mL	N/A	2 mL (4 mEq/mL)	N/A	N/A
Selenium 200 mcg/mL	0–1 mL (0–200 mcg)	N/A	0–1 mL (0–200 mcg)	0–1 mL (0–200 mcg)
Zinc chloride 10 mg/mL	0–1 mL (0–10 mg)	N/A	0–1 mL (0–10 mg)	0–1 mL (0–10 mg)
Glutathione 200 mg/mL in 250 mL saline	N/A	N/A	N/A	5 mL (1000 mg)
Total Osmolarity (mOsm)	821.46–950.69	1006.47	560.35–738.00	638.00–894.00

N/A = not applicable.

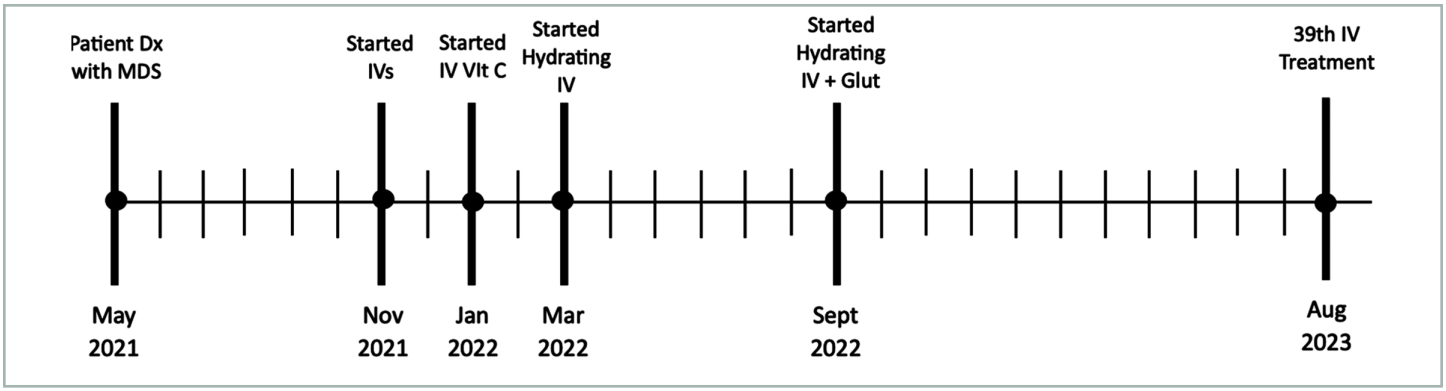

FIGURE 2 Timeline of Events. Dx = diagnosed; MDS = myelodysplastic syndrome; IV = intravenous; Vit C = vitamin C; Glut = glutathione.

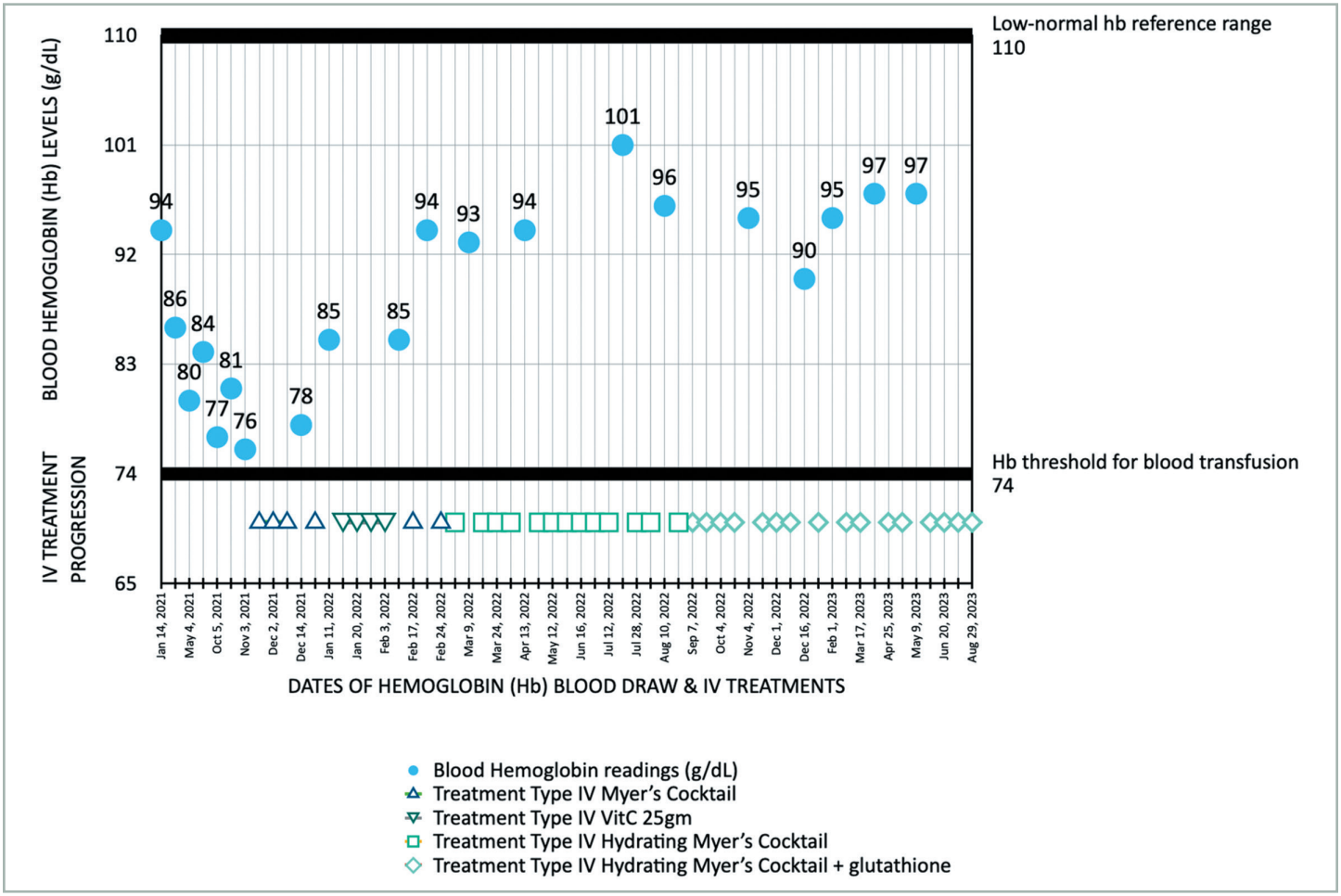

FIGURE 3 Summary of Hemoglobin Levels Pre- and Post-IV Nutrient Treatments. IV = intravenous; hb = hemoglobin.

During this time, the patient reported improved energy, fewer episodes of shortness of breath, and fewer naps during the day. We also observed that he had less pallor and was more vital during his appointments. He was more talkative and jovial and was not always napping during a treatment. J.B. attended all recommended IV treatments. IV treatments were well tolerated, and no adverse or unanticipated events were observed.

DISCUSSION

This case report documents a case of improved hemoglobin levels in a patient (J.B.) diagnosed with MDS following IV nutrient therapy. A total of 39 IV treatments were administered to J.B., which included 4 different types of infusions. Over the course of these treatments, there was an observed improvement in hemoglobin

levels. The greatest degree of improvement was seen with the series of Hydrating Myer's infusions.

IV treatment was initiated with a Myer's Cocktail of vitamins and minerals. We based our formula (selection of nutrients and amounts) on the clinical work of Dr. Alan Gaby, MD.[18] It is noteworthy that he had administered thousands of Myer's infusions for various chronic health concerns. Although Dr. Gaby did not report any case of using the Myer's infusion for MDS, our premise was that providing a high concentration of blood-building nutrients, including B vitamins, vitamin C, and zinc, could provide the building blocks needed for the bone marrow to produce more blood cells and increase hemoglobin.[19-21] It is important to note that although folic acid is an important nutrient for the bone marrow, it is not included in our Myer's infusion as it tends to form a precipitate when mixed with other nutrients.[22] Vitamin C helps to improve red blood cell and hemoglobin by helping to mobilize stored iron. This in turn increases overall iron absorption.[23] B vitamins are important for the process of erythropoiesis.[24] Magnesium is an important mineral as it is a major co-factor for glutathione peroxidase, which is an important catalyst for hemoglobin synthesis.[25] Calcium is a critical signalling nutrient involved in various regulatory mechanisms with respect to blood cell formation. Red blood cells are dependent on calcium during differentiation from precursor cells.[26] Zinc and selenium are both important micronutrients that act as catalysts for the process of erythropoiesis.[27,28]

Treatment was switched to high-dose (25 grams) IV vitamin C for two main reasons: firstly, a small change was observed in hemoglobin levels after the Myer's infusions, and secondly, high dose (> 18 g) IV vitamin C has been shown to have cytotoxic effects on abnormal cells. The rationale was that, if MDS is a leukemia precursor, the high-dose vitamin C treatment could be more effective than the Myer's infusions in improving red blood cell indices and therefore patient quality of life. However, the series of high-dose IV vitamin C treatments did not render any change in the patient's hemoglobin levels.

The decision for the third formula (Hydrating Myer's) was twofold: we did not see any change in hemoglobin after the series of high-dose vitamin C infusions, and it was hypothesized that a more hydrating formula could help optimize circulation of nutrients through the bloodstream and into the cells. The third formula was more hydrating than the first Myer's Cocktail in that it provided 250 mL of sterile water instead of 130 mL of saline, reducing the osmolarity down to 500–750 from 800–900s. This was still a hypertonic solution, but more hydrating compared with the first Myer's Cocktail provided. Finally, the decision to add glutathione to the hydrating Myer's was based on its action as a potent anti-antioxidant. This was relevant as J.B. had a long history of being a smoker and this could have affected bone marrow cells through chronic exposure to chemical toxicity through oxidative damage. While there was no further improvement of hemoglobin levels with the addition of glutathione, it is possible that other health parameters may have been impacted; however, this is unknown.

It is important to highlight some strengths and limitations of this case report. One strength is that IV nutrient therapy was the only treatment being provided to the patient. Thus, changes in clinical outcomes were likely related to this treatment. He was not eligible to receive medical treatment at the time, and no other naturopathic treatments were provided concurrently. Additionally, hemoglobin levels were being tested frequently, resulting in comprehensive data collection.

One limitation of this report is that it retrospectively documents the clinical outcomes of a single patient. A single case study does not allow for establishing any cause–effect relationship, and the results may not be generalizable to other patients with MDS. Another limitation is that each type of IV was given for a different number of treatments. It is possible that any one possible IV, given enough times, would have created a positive outcome on hemoglobin levels.

To our knowledge, this is the first report of the impact of IV nutrients on hemoglobin levels in a patient with MDS. One previous case report on the use of IV vitamin C in a patient with AML reported an increase in hemoglobin levels; these findings were consistent with the current report. No other case reports or studies were identified. To understand whether there is a positive clinical outcome on hemoglobin levels in MDS patients with IV nutrient therapy, more research is needed. This could be in the form of observational or interventional studies.

Delivering a series of IV infusions may have resulted in an improvement in hemoglobin levels in this patient with MDS. Further investigation is warranted to understand the impact IV nutrient therapy could have on MDS patients with a similar prognosis.

AUTHOR AFFILIATIONS

[1]Holistic Healing Arts, ON, Canada; [2]Canadian College of Naturopathic Medicine, ON, Canada; [3]University of Guelph, ON, Canada.

ACKNOWLEDGEMENTS

Not applicable.

CONFLICTS OF INTEREST DISCLOSURE

We have read and understood the *CAND Journal*'s policy on conflicts of interest and declare that we have none.

FUNDING

This research did not receive any funding.

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