

Original Research Article

Drug utilization study and safety profile of iron isomaltoside 1000 in treatment of iron deficiency anemia in cancer patients: a retrospective study

Davinder Paul¹, Manish Mahajan², Suyash Bharat², Richa Tripathi^{2*}

¹Department of Medical Oncology, Fortis Hospital, Ludhiana, Punjab, India

²Department of Medical Affairs, Zydus Biologics, Zydus Lifesciences Ltd, Ahmedabad, Gujarat, India

Received: 20 April 2025

Revised: 05 May 2025

Accepted: 06 May 2025

*Correspondence:

Richa Tripathi,
E-mail: oncologist.india22@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Anemia is prevalent among cancer patients, affecting 39.3% to 63.4%, depending on the diagnostic threshold used. Cancer treatments often exacerbate anemia, significantly impacting patients' quality of life. In 2019, Feruno (Iron Isomaltoside 1000) was introduced in India for rapid intravenous infusion, offering controlled and gradual iron release, thereby reducing toxicity risks. Studies have confirmed its safety, effectiveness, and tolerability across various patient populations.

Methods: This single-centre, retrospective drug utilization study evaluated Iron Isomaltoside 1000 (Feruno) in 98 cancer patients with iron deficiency anemia.

Results: The mean age of patients was 56 years, with breast, ovarian, and colon cancers being the most common. The average iron requirement was 1,396.9 mg, and the most frequently administered dosage was 1,000 mg. The treatment was effective and well-tolerated, with minimal adverse reactions.

Conclusions: Iron Isomaltoside demonstrated a good safety profile. The iron requirement in cancer patients is usually above 1 gram, and the most frequently prescribed dose was 1,000 mg. To improve patient compliance and leverage the benefit of a higher dose (20 mg/kg body weight) administered in a single infusion, most patients can be treated effectively with a total dose infusion.

Keywords: Anemia, Oncology patients, Red blood cell transfusions, Iron therapy, Feruno, Iron Isomaltoside 1000, Iron deficiency anemia

INTRODUCTION

Anemia is a common occurrence in oncology patients, affecting 39.3% of them as reported by the European Cancer Anemia Survey. Other studies indicate that the prevalence can go up to 63.4% at the time of diagnosis, varying based on the selected threshold. Cancer patients frequently experience anemia; half of them develop anemia during chemotherapy and/or radiation therapy, and one-third already had it before diagnosis. Mild to moderate anemia develops in up to 75% of patients with cancer who are undergoing treatment with chemotherapy and/or

radiation therapy.¹ Hemoglobin concentration (Hb) <120 g/l in women and <130 g/l in men is considered anemia, according to the World Health Organization (WHO).² Blood loss, hemolysis, and decreased erythropoiesis are the three main mechanisms that lead to anemia.³ Gastrointestinal tumors and the replacement of bone marrow by cancer cells directly cause blood loss. Indirect effects of inflammation include hepcidin-mediated iron sequestration, bone marrow suppression, and cachexia related to malignancy. Fatigue deteriorated physical function, and a lower standard of living are linked to anemia.⁴ Red blood cell transfusions and the injection of

erythropoiesis-stimulating agents (ESAs), with or without iron therapy, are being used as therapies for anemia caused by chemotherapy and cancer.

Transfusions can have major side effects, poor absorption and intolerance restrict the use of oral iron supplementation, and ESAs are expensive and raise safety issues. In 2019, a high-dose IV iron formulation designed for quick infusion was introduced in India under the brand name Feruno (Iron isomaltoside 1000; Pharmacosmos A/S, Holbaek, Denmark). It is made up of carbohydrate moiety and iron that is firmly attached to a matrix structure. This allows iron to be released to iron-binding proteins gradually and in a controlled manner which reduces the chances of toxicity preventing any possible toxicity from the release of labile iron. Iron Isomaltoside is safe, effective, and tolerable in a variety of patient types compared to prior published studies.¹

Objectives

The primary objective of the current research was to determine the amount of iron needed and the dose administered. The secondary objective was to assess the safety of iron Isomaltoside in cancer patients with iron deficiency anemia.

METHODS

Study design

This was a single-center, retrospective, drug utilization study designed to assess the use of Iron Isomaltoside 1000 (Feruno) in cancer patients diagnosed with iron deficiency anemia (IDA).

Study setting and duration

The study was conducted at Fortris Hospital, Ludhiana, Punjab over a period of eight months, from February 2023 to September 2023.

Study population

The study included a total of 98 cancer patients with a confirmed diagnosis of iron deficiency anemia who were prescribed Iron Isomaltoside 1000 during the study period. Patients whose anemia was caused by factors other than iron deficiency were excluded from the analysis.

Sample size calculation

The sample size was determined using the Raosoft online sample size calculator. A margin of error of 8.55%, a confidence level of 91%, and a response distribution of 50% were applied. For a population size exceeding 20,000, the minimum required sample size was calculated to be 98 patients.

Data collection

Demographic data such as age, weight, and type of cancer were recorded for all patients. Hemoglobin levels at the time of diagnosis were documented based on the American Society of Hematology (ASH) guidelines. The iron requirement for each patient was estimated using a Simplified Table. Data on the actual dose of Iron Isomaltoside (Feruno) administered was also captured.

Treatment regimen

Iron Isomaltoside 1000 was administered as an intravenous infusion. The typical dose was 20 mg/kg body weight, with a maximum single dose of up to 1000 mg given over 30–60 minutes. The actual dose administered to each patient was determined based on their calculated iron need, using the simplified table derived from the modified Ganzoni formula.⁵

Outcome measures

The primary outcome of the study was to evaluate the iron requirement of patients using the simplified table and compare it with the actual Iron Isomaltoside dose received. The secondary outcome was to assess the safety profile of Iron Isomaltoside by documenting any reported adverse events during treatment.

RESULTS

Between February 2023 to September 2023, the retrospective study enrolled 98 patients undergoing treatment for a solid tumor. Of these, 98 patients were deemed assessable for meeting the criteria and consequently included in the analyses. The mean age of patients with anemia due to solid tumor malignancies is 56 years with an average weight of 65 years and hemoglobin of 8.93 mg/dl (Table 1).

Table 1: Patient demographic details.

Patient demographics	Mean±SD
Age (years)	56.64±13.40
Weight (kg)	65.48±12.39
Hemoglobin (mg/dl)	8.93±1.71

Breast, ovarian, colon, gastrointestinal, and kidney cancer represent 23%, 14%, 14%, 12%, 11% of anemia cases respectively (Table 2). The mean iron deficiency in cancer patients was calculated to be 1396.9±401.41 mg, with the most common intravenous iron therapy dosage being 1000 mg (Table 3).

Anemia is characterized by low hemoglobin levels, with thresholds set at <14 g/dl for men and <12 g/dl for women. It's categorized into several grades: mild (10 g/dl—normal), moderate (8–10 g/dl), severe (6.5–8 g/dl), and

life-threatening (<6.5 g/dl or in unstable patients) (Figure 1).¹⁶

Table 2: Incidence of anaemia in different cancer types.

Cancer type	Percentage (n=98)
Bone cancer	2.04
Breast cancer	23.47
Cervical cancer	1.02
Colon cancer	14.29
Endometrial cancer	2.04
Gallbladder	3.06
Gastrointestinal cancer	12.24
Head and neck cancer	7.14
Hematological cancer	7.14
Kidney cancer	11.22
Lung cancer	2.04
Ovarian cancer	14.28

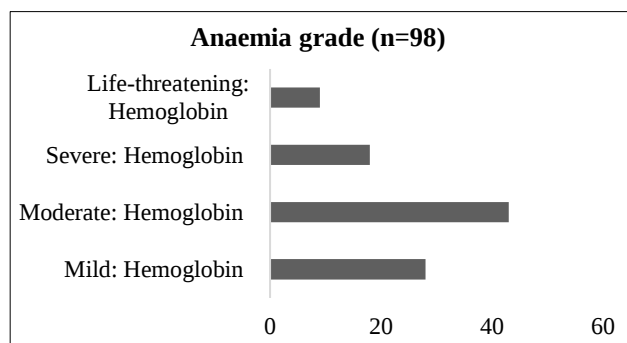


Figure 1: Different grades of iron deficiency anaemia in cancer patients.

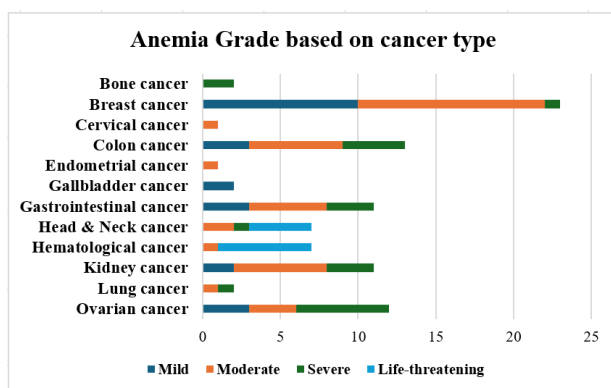


Figure 2: Different grades of iron deficiency anaemia based on different cancer types in patients.

Safe use of iron Isomaltoside

In routine practice, during the administration of Iron Isomaltoside, patients received IV iron as per the protocol and the prescribing information of Feruno. Patients were monitored during and for 30 minutes after the infusion for any adverse reactions.

Among the 98 patients, three experienced treatment-related mild injection site adverse events. Two patients developed a mild rash at the injection site, and one patient had a mild rash (site not specified). These adverse events were non-serious and did not require treatment discontinuation or dose modification. No causality assessment was performed for these events. All three patients who experienced adverse events had metastatic breast cancer.

Table 3: Mean iron need (iron deficient) of cancer patients and most common IIM dose given to the patients.

Iron need	Dose (mg)
Iron deficient (mean±SD)	1396.9±401.41
Iron dosage (mode)	1000

DISCUSSION

The incidence of anemia in cancer patients varies widely, with studies reporting a prevalence ranging from 30% to 90% during the course of the disease.⁶⁻⁸ The prevalence of anemia is influenced by factors such as cancer type, disease stage, and the definition of anemia used. For example, the reported prevalence of anemia was 37.7% in patients with gynaecologic cancers and 26.7% in those with colorectal cancer.⁷

Anemia in cancer patients can occur as a direct effect of the neoplasm, through immune system sensitization, or because of cancer treatments such as surgery, radiotherapy, or chemotherapy. The incidence of moderate-to-severe anemia (hemoglobin <10 g/dl) remains high in patients with solid tumors receiving chemotherapy, with a higher risk observed in those with distant metastasis.⁸

A study from Northeast India reported that approximately 40–50% of patients had cancer-related anemia (CRA) at the time of diagnosis, and this prevalence increased by around 40% following chemotherapy. The specific incidence of anemia varies depending on tumor type, disease stage, and patient age.⁹

Another study conducted at a cancer research centre in India found that 12.5% of patients with anemia had absolute iron deficiency (AID), while 75% had functional iron deficiency (FID).¹⁰ At least 50% of cancer patients in India with anemia require iron supplementation, with intravenous (IV) iron being the preferred mode of therapy.¹¹

Grades of anaemia in different cancers

Anemia in cancer patients can be a debilitating condition that negatively affects their overall quality of life and worsens their prognosis. The prevalence of anemia in cancer patients is remarkably high and is influenced by the stage of the disease.^{12,13}

The primary causes of anemia in these patients are twofold: the cancer itself and the therapies used for its management. The incidence of moderate-to-severe anemia (hemoglobin <10 g/dl) remains considerably high in patients with solid tumors receiving chemotherapy, with a greater risk observed in those with distant metastases.

The incidence of grade 3 or 4 anemia is approximately 12% in patients with stage IV disease, ranging from 3.7% in those with stage IV colorectal cancer to 21.2% in those with stage IV ovarian cancer (Figure 2).⁸

Iron deficit in cancer patients and iron dosage

A study analyzed data from 1,085 patients across five smaller clinical studies and 3,556 patients from two larger studies, calculating the average iron deficit using a modified Ganzoni formula. The results showed that the average iron deficit was approximately 1,531 mg in the smaller studies and 1,392 mg in the larger studies. Our data on average iron deficit in iron deficiency anaemia (IDA) in 98 cancer patients, suggesting 1396.9 mg mean iron need or deficit concur with global data.¹⁴

The above study also suggested that a total cumulative dose of 1,000 mg of IV iron may be insufficient for iron repletion in a majority of patients with IDA, and a dose closer to 1,500 mg may more accurately reflect actual iron needs.¹⁴

Researchers also conducted an economic analysis comparing two iron therapies Iron Isomaltoside 1000 (IIM) and ferric carboxymaltose (FCM) in patients with IDA in Denmark. The study found that, on average, 1.2 infusions were required to correct the mean iron deficit with IIM, compared to 1.6 infusions with FCM. Furthermore, only 25.0% of patients treated with IIM required multiple infusions, compared to 64.3% of those treated with FCM. These findings suggest that IIM may require fewer infusions per treatment course and is associated with a lower likelihood of multiple infusion needs compared to FCM.¹⁵

Limitations

The limitation of this study was that this study was a retrospective study conducted at a single center, which may limit the generalizability of the findings. The results may not be representative of the broader population of cancer patients with anemia due to variability in patient demographics, clinical practices, and healthcare infrastructure across different regions and institutions. The follow-up period was limited to observations made during and 30 minutes' post-infusion. Longer-term safety and efficacy outcomes, such as sustained hemoglobin levels, recurrence of anemia, and longer-term adverse effects, were not assessed. Conducted in India, the study's findings may be influenced by regional factors such as nutritional status, genetic predispositions, and local clinical practices, which might not apply to other regions or populations.

CONCLUSION

The study highlights the significant prevalence of anemia among cancer patients, particularly those undergoing chemotherapy and radiation therapy. Iron Isomaltoside 1000 (Feruno) appears to be a safe treatment for iron deficiency anemia in cancer patient population. The mean iron needed in the studied patients was 1396.9 mg, with the most common dosage administered being 1000 mg, hence, to improve compliance of patients and the benefit of higher dose (20 mg/kg bodyweight) being given in one infusion, most patients can receive total dose infusion in one setting.

ACKNOWLEDGEMENTS

Authors would like to thank Digicare Health Solutions Private Limited (DHSPL) team for their support and assistance during the publication of this study.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Birgegård G, Henry D, Glaspy J, Chopra R, Thomsen LL, Auerbach M. A Randomized Noninferiority Trial of Intravenous Iron Isomaltoside versus Oral Iron Sulfate in Patients with Nonmyeloid Malignancies and Anemia Receiving Chemotherapy: The PROFOUND Trial. *Pharmacotherapy*. 2016;36(4):402-14.
2. McLean E, Cogswell M, Egli I, Wojdyla D, de Benoist B. Worldwide prevalence of anaemia, WHO Vitamin and Mineral Nutrition Information System, 1993-2005. *Public Health Nutr*. 2009;12(4):444-54.
3. Gilreath JA, Rodgers GM. How I treat cancer-associated anemia. *Blood*. 2020;136(7):801-13.
4. Cella D, Kallich J, McDermott A, Xu X. The longitudinal relationship of hemoglobin, fatigue and quality of life in anemic cancer patients: results from five randomized clinical trials. *Ann Oncol*. 2004;15(6):979-86.
5. Koch TA, Myers J, Goodnough LT. Intravenous Iron Therapy in Patients with Iron Deficiency Anemia: Dosing Considerations. *Anemia*. 2015;2015:763576.
6. Knight K, Wade S, Balducci L. Prevalence and outcomes of anemia in cancer: a systematic review of the literature. *Am J Med*. 2004;116(7A):11S-26S.
7. Kifle E, Hussein M, Alemu J, Tigeneh W. Prevalence of Anemia and Associated Factors among Newly Diagnosed Patients with Solid Malignancy at Tikur Anbessa Specialized Hospital, Radiotherapy Center, Addis Ababa, Ethiopia. *Adv Hematol*. 2019;2019:8279789.
8. Xu H, Xu L, Page JH, Cannavale K, Sattayapiwat O, Rodriguez R, et al. Incidence of anemia in patients

- diagnosed with solid tumors receiving chemotherapy, 2010-2013. *Clin Epidemiol.* 2016;8:61-71.
9. Majumdar S, Shet AS. Cancer-related anemia in Northeast India: Many questions and few answers. *Cancer Res Statistics Treatment.* 2021;4(1):163-4.
 10. Sundriyal D, Nayak PP, Arya L, Walia M, Saha R. Evaluation of Iron Status in Patients of Solid Organ Malignancies: Study from a Cancer Research Centre. *Indian J Surg Oncol.* 2020;11(1):56-9.
 11. Parikh PM, Aggarwal S, Biswas G, Gulia S, Agarwala V, Basade M, et al. Practical Clinical Consensus Guidelines for the Management of Cancer Associated Anemia in Low- and Middle-Income Countries. *South Asian J Cancer.* 2023;12(2):93-9.
 12. Bohlius J, Weingart O, Trelle S, Engert A. Cancer-related anemia and recombinant human erythropoietin--an updated overview. *Nat Clin Pract Oncol.* 2006;3(3):152-64.
 13. Madeddu C, Gramignano G, Astara G, Demontis R, Sanna E, Atzeni V, et al. Pathogenesis and Treatment Options of Cancer Related Anemia: Perspective for a Targeted Mechanism-Based Approach. *Front Physiol.* 2018;9:1294.
 14. Koch TA, Myers J, Goodnough LT. Intravenous Iron Therapy in Patients with Iron Deficiency Anemia: Dosing Considerations. *Anemia.* 2015;2015:763576.
 15. Pollock RF, Muduma G. An Economic Evaluation of Iron Isomaltoside 1000 Versus Ferric Carboxymaltose in Patients with Inflammatory Bowel Disease and Iron Deficiency Anemia in Denmark. *Adv Ther.* 2018;35(12):2128-37.
 16. Dicato M, Plawny L, Diederich M. Anemia in cancer. *Ann Oncol.* 2010;21(7):167-72.

Cite this article as: Paul D, Mahajan M, Bharat S, Tripathi R. Drug utilization study and safety profile of iron isomaltoside 1000 in treatment of iron deficiency anemia in cancer patients: a retrospective study. *Int J Res Med Sci* 2025;13:2409-13.