

2020

Management of Iron-Deficiency Anemia on Inpatients and Appropriate Discharge and Follow-Up.

K. Patel

Northwell Health, kpatel36@northwell.edu

Z. Memon

R. Mazurkiewicz

Zucker School of Medicine at Hofstra/Northwell, rmazurkiew@northwell.edu

Follow this and additional works at: <https://academicworks.medicine.hofstra.edu/articles>



Part of the [Internal Medicine Commons](#)

Recommended Citation

Patel K, Memon Z, Mazurkiewicz R. Management of Iron-Deficiency Anemia on Inpatients and Appropriate Discharge and Follow-Up.. . 2020 Jan 01; 9(1-2):Article 6330 [p.]. Available from: <https://academicworks.medicine.hofstra.edu/articles/6330>. Free full text article.

This Article is brought to you for free and open access by Donald and Barbara Zucker School of Medicine Academic Works. It has been accepted for inclusion in Journal Articles by an authorized administrator of Donald and Barbara Zucker School of Medicine Academic Works. For more information, please contact academicworks@hofstra.edu.

Management of Iron-Deficiency Anemia on Inpatients and Appropriate Discharge and Follow-Up

Kishan Patel^{a, b}, Zain Memon^a, Rebecca Mazurkiewicz^a

Abstract

Background: The aims of the study were to identify appropriate supplementation of iron for inpatients and to identify factors involved in appropriate discharge documentation and follow-up.

Methods: This was a retrospective analysis of 103 patients at a community hospital in New York City.

Results: A total of 57 (57/103, 55.3%) patients were admitted due to symptomatic anemia. Twenty (20/103, 19.4%) of those with iron-deficiency anemia had either esophagogastroduodenoscopy or colonoscopy. Gastroenterologist or hematologist was consulted for 45/103 (43.7%). Inpatient iron supplementation was given for 62/103 (60.2%) of patients; and 43/103 (41.7%) had blood transfusion. Upon discharge, 50/103 (48.5%) had appropriate documentation of iron-deficiency anemia on discharge paperwork. Appropriate follow-up was done for 54/103 (52.4%). Iron supplementation was provided for 53/103 (51.5%) of patients. Having inpatient esophagogastroduodenoscopy or colonoscopy, blood transfusion, or symptomatic anemia had a statistical significance for likelihood of appropriate discharge documentation.

Conclusions: Iron-deficiency anemia can have high rates of mortality and morbidity in the population. Appropriate discharge of patients with iron-deficiency anemia and factors related to this are paramount for clinicians in order to have the best patient outcomes.

Keywords: Iron-deficiency anemia; Congestive heart failure; Chronic kidney disease; Iron supplementation; Inpatient

Introduction

Anemia is defined by hemoglobin levels under 13 g/dL in men, and under 12 g/dL in women [1]. Anemia affects roughly 25%

of the world population [2, 3], of which half is caused by iron deficiency, with 2% of American men and 5% of American women affected [2, 3]. Low iron store causes decreased levels of hemoglobin production by the bone marrow [2]. Iron is required for erythrocytes to produce heme for hemoglobin and for vital proteins in oxygen transportation [2-5]. Metabolically active cells, including myocytes, are highly dependent on this.

Previous literature has shown that in patients with untreated iron-deficiency anemia if severe enough, mortality is possible due to either poor tissue oxygenation, or cardiac arrhythmias from left ventricular hypertrophy. There is also high morbidity due to decreased exercise tolerance, increased fatigue, and worsened quality of life index [2, 6, 7].

Iron-deficiency anemia has been poorly diagnosed and treated in inpatients in the past with only 40-66% receiving adequate iron supplementation in tertiary care hospitals [8]. We hypothesized that patients whose admission to our institution revealed a new diagnosis of iron-deficiency anemia would not be reliably discharged on iron supplementation or have the diagnosis appropriately transmitted to their primary care physicians for further evaluation and treatment.

Materials and Methods

We performed a chart review of patients admitted to our academic community hospital in New York City who were discharged from the internal medicine service from January to June 2018, whose test results met criteria for iron-deficiency anemia during that hospital stay. Iron deficiency criterion for men was defined as hemoglobin under 13 g/dL, and women under 12 g/dL, with ferritin less than 30 ng/dL [1-3, 9] for any patient. Diagnostic criteria in patients with congestive heart failure were ferritin below 300 ng/dL and transferrin saturation (TSAT) under 20% [10-18]. Diagnostic criteria for those with chronic kidney disease were ferritin under 100 ng/dL, and TSAT under 20% [19-22]. Those with end stage renal disease had iron-deficiency anemia criteria of ferritin under 200 and TSAT under 20% [22]. The study excluded those with an allergy to iron.

Patients' charts were reviewed for inpatient supplementation of iron, discharge supplementation on paperwork, and documentation of iron-deficiency anemia. Patients' charts were also assessed to see rates of hematology and gastroenterology consults. Rates of blood transfusions, esophagogastroduodenoscopy (EGD), or colonoscopies performed were analyzed. This also reviewed if need for EGD or colonoscopy,

Manuscript submitted April 1, 2020, accepted April 13, 2020

^aDepartment of Internal Medicine, Lenox Hill Hospital, New York, NY, USA

^bCorresponding Author: Kishan Patel, Department of Internal Medicine, Lenox Hill Hospital, 100 East 77th Street, New York, NY 10075, USA.
Email: KPatel36@northwell.edu

doi: <https://doi.org/10.14740/jh626>

Table 1. Demographics (N = 103)

Variables	N (%) or result
Gender, N (%)	
Male	28 (27%)
Female	75 (72.8%)
Race, N (%)	
Caucasian	41 (39.8%)
African American	39 (37.9%)
Latino	9 (8.7%)
Asian	6 (5.8%)
Other	8 (7.8%)
Age (average, years)	
Male	68.0
Female	60.6

blood transfusions, or reason for admission was symptomatic anemia if there was a statistical relationship with discharge documentation. We used Chi-squared, relative risk (RR), and odds ratio (OR) to analyze this.

All personal information for patients was de-identified. This paper conforms to the Declaration of Helsinki. Institutional Review Board approval was obtained by Feinstein Institute for Medical Research.

Results

A total of 103 patients were examined, with females 75 (72.8%) and males 28 (27.2%) (Table 1). Demographic breakdown showed that Caucasians 41 (39.8%), African American 39 (37.8%); six patients (5.8%) were Asian, nine (8.7%) Latino, and eight (7.8%) were other (Table 1). The average age was 62.6 years for all patients, with females 60.6 years old and males 68.0 years old.

Of 103 patients discharged, 57/103 (55.3%) were admitted due to symptomatic anemia including: gastrointestinal or genitourinary bleeding, syncope, lightheadedness, or weakness. Colonoscopy or EGD during hospitalization was done on 20/103 (19.4%) of the patients. Either gastroenterologist

or hematologist was consulted for 45/103 (43.7%) of the patients. Inpatient iron supplementation was done with 62/103 (60.2%) of the patients. Oral ferrous sulfate supplementations were given in 21/103 (20.4%) of these patients (Table 2). Intravenous iron sucrose was given to 33/103 (32%) of the patients (Table 2). Intravenous sodium ferric gluconate was given to 8/103 (7.8%) of the patients (Table 2). Forty-three (43/103, 41.7%) had blood transfusion inpatient, and 34/43 (79%) of those with blood transfusion had inpatient iron supplementation.

Upon discharge, 50/103 (48.5%) had the term iron-deficiency anemia documented (Table 2). Appropriate follow-up with primary care, gastroenterology, obstetrician and gynecologist, or hematologist was done for 54/103 (52.4%) of the patients (Table 2). Oral iron was supplemented to 53/103 (51.5%) of the patients (Table 2).

Of those with EGD or colonoscopy, 18/20 (90%) had appropriate discharge documentation of iron-deficiency anemia. Of those without the procedure, 32/83 (38.6%) had appropriate discharge documentation. P value was < 0.001 (RR was 2.3 and OR was 14.3, Table 3). These findings showed that having an EGD or colonoscopy had a positive relationship with likelihood of appropriate mention of iron-deficiency anemia on discharge paperwork.

Of those with symptomatic anemia, 38/57 (66.7%) had appropriate discharge documentation. Of those without symptomatic anemia, 12/46 (26.1%) had appropriate discharge documentation. P value was < 0.001 (RR 2.56 and OR 5.67, Table 3).

Of those patients with blood transfusions during their hospital course, 29/43 (67.4%) had appropriate discharge documentation (Table 3). Of those without blood transfusion, 21/60 (35%) had appropriate discharge documentation. P value was 0.0012 (RR 1.93 and OR was 2.07, Table 3).

Discussion

Our study found that only 52.4% of those discharge had appropriate follow-up with care providers or oral iron supplementation, and only 48% had appropriate documentation of iron-deficiency anemia on discharge paperwork. Having a blood transfusion, EGD or colonoscopy, or symptomatic anemia had a higher likelihood of better discharge documentation.

Table 2. Inpatient Iron Supplementation and Discharge

Inpatient iron supplementation and discharge	N (%)
Any form of iron supplementation inpatient	62 (60.2%)
Oral ferrous sulfate inpatient	21 (20.4%)
Intravenous iron sucrose inpatient	33 (32%)
Intravenous sodium ferric gluconate inpatient	8 (7.8%)
Oral iron supplementation on discharge	53/103 (51.5%)
Appropriate follow-up with primary care physician, hematologist, gastroenterologist, or obstetric gynecologist on discharge paperwork or discharged on oral iron supplementation	54 (52.4%)
Proper documentation of iron-deficiency anemia on discharge paperwork	50 (48%)

Table 3. Appropriate Documentation of Iron-Deficiency Anemia and Having EGD/Colonoscopy, Blood transfusion, and Symptomatic Anemia

Variables	N (%)	P value (Chi-square)	Relative risk (95% CI)	Odds ratio
Procedure and appropriate discharge documentation		< 0.001 (17.1)	2.3 (1.7 - 3.2)	14.3
Yes	18/20 (90%)			
No	32/83 (38.6%)			
Blood transfusion and appropriate discharge documentation		0.0012 (10.6)	1.93 (1.3 - 2.9)	2.07
Yes	29/43 (67.4%)			
No	21/60 (35%)			
Diagnostic criteria and appropriate discharge documentation		< 0.001 (16.8)	2.56 (1.5 - 4.3)	5.67
Yes	38/57 (66.7%)			
No	12/46 (26.1%)			

EGD: esophagogastroduodenoscopy; 95% CI: 95% confidence interval.

Iron-deficiency anemia is a highly prevalent condition in the USA. It can put patients at increased risk of death due to decreased oxygen transportation, cause cardiac arrhythmias, and decrease quality of life [1, 2, 6]. Iron-deficiency anemia has been poorly diagnosed and treated in inpatients in the past, with only 60-66% receiving adequate iron supplementation [8]. Only 60.2% of those who were admitted to the hospital with diagnostic criteria of iron-deficiency anemia were supplemented, consistent with prior studies. Our study shows that outpatient management of iron-deficiency anemia after discharge is inadequate, and this can place patients at increased risk for morbidity and mortality.

The limitations of this study include being a retrospective chart review of documentation. Iron-deficiency anemia is also tricky in patients with chronic diseases. Iron supplementation has been shown to help reduce mortality in those with blood loss [2-7]. Iron deficiency due to congestive heart failure and chronic kidney disease confers increased fatigue and decreased exercise capacity [10-22]. Oral or intravenous supplementation depending on inflammatory markers helps patients have a better quality of life. Future studies are needed in interventions to help increase iron supplementation from clinicians.

Acknowledgments

We would like to thank the Department of Internal Medicine at Lenox Hill Hospital for their support.

Financial Disclosure

None to declare.

Conflict of Interest

None to declare.

Informed Consent

Our research was retrospective in nature. Waiver for informed consent was obtained from the Institutional Review Board at the Feinstein Institute for Medical Research.

Author Contributions

Kishan Patel helped in creating the first draft of the paper and appropriate chart review. Zain Memon helped in literature search, chart review, and data analysis. Rebecca Mazurkiewicz helped with final edits of the paper.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

References

1. World Health Organization. Iron deficiency anaemia assessment, prevention, and control a guide for programme managers. 2001.
2. Johnson-Wimbley TD, Graham DY. Diagnosis and management of iron deficiency anemia in the 21st century. *Therap Adv Gastroenterol.* 2011;4(3):177-184.
3. Miller JL. Iron deficiency anemia: a common and curable disease. *Cold Spring Harb Perspect Med.* 2013;3(7):a011866.
4. Macdougall LG, Judisch JM, Mistry SB. Red cell metabolism in iron deficiency anemia. II. The relationship between red cell survival and alterations in red cell metabolism. *J Pediatr.* 1970;76(5):660-675.
5. Kroot JJ, Kemna EH, Bansal SS, Busbridge M, Campos-trini N, Girelli D, Hider RC, et al. Results of the first international round robin for the quantification of urinary

- and plasma hepcidin assays: need for standardization. *Haematologica*. 2009;94(12):1748-1752.
6. Ems T, Huecker MR. Biochemistry, iron absorption. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2019. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK448204/>.
 7. Abbaspour N, Hurrell R, Kelishadi R. Review on iron and its importance for human health. *J Res Med Sci*. 2014;19(2):164-174.
 8. Fazal MW, Andrews JM, Thomas J, Saffouri E. Inpatient iron deficiency detection and management: how do general physicians and gastroenterologists perform in a tertiary care hospital? *Intern Med J*. 2017;47(8):928-932.
 9. Cook JD. Diagnosis and management of iron-deficiency anaemia. *Best Pract Res Clin Haematol*. 2005;18(2):319-332.
 10. Wong CC, Ng AC, Kritharides L, Sindone AP. Iron Deficiency in Heart Failure: Looking Beyond Anaemia. *Heart Lung Circ*. 2016;25(3):209-216.
 11. Koch TA, Myers J, Goodnough LT. Intravenous iron therapy in patients with iron deficiency anemia: dosing considerations. *Anemia*. 2015;2015:763576.
 12. Ponikowski P, van Veldhuisen DJ, Comin-Colet J, Ertl G, Komajda M, Mareev V, McDonagh T, et al. Beneficial effects of long-term intravenous iron therapy with ferric carboxymaltose in patients with symptomatic heart failure and iron deficiency. *Eur Heart J*. 2015;36(11):657-668.
 13. van Veldhuisen DJ, Ponikowski P, van der Meer P, Metra M, Bohm M, Doletsky A, Voors AA, et al. Effect of ferric carboxymaltose on exercise capacity in patients with chronic heart failure and iron deficiency. *Circulation*. 2017;136(15):1374-1383.
 14. Usmanov RI, Zueva EB, Silverberg DS, Shaked M. Intravenous iron without erythropoietin for the treatment of iron deficiency anemia in patients with moderate to severe congestive heart failure and chronic kidney insufficiency. *J Nephrol*. 2008;21(2):236-242.
 15. Toblli JE, Lombrana A, Duarte P, Di Gennaro F. Intravenous iron reduces NT-pro-brain natriuretic peptide in anemic patients with chronic heart failure and renal insufficiency. *J Am Coll Cardiol*. 2007;50(17):1657-1665.
 16. Okonko DO, Grzeslo A, Witkowski T, Mandal AK, Slater RM, Roughton M, Foldes G, et al. Effect of intravenous iron sucrose on exercise tolerance in anemic and nonanemic patients with symptomatic chronic heart failure and iron deficiency FERRIC-HF: a randomized, controlled, observer-blinded trial. *J Am Coll Cardiol*. 2008;51(2):103-112.
 17. Anker SD, Comin Colet J, Filippatos G, Willenheimer R, Dickstein K, Drexler H, Luscher TF, et al. Ferric carboxymaltose in patients with heart failure and iron deficiency. *N Engl J Med*. 2009;361(25):2436-2448.
 18. Lewis GD, Malhotra R, Hernandez AF, McNulty SE, Smith A, Felker GM, Tang WHW, et al. Effect of oral iron repletion on exercise capacity in patients with heart failure with reduced ejection fraction and iron deficiency: the IRONOUT HF randomized clinical trial. *JAMA*. 2017;317(19):1958-1966.
 19. Babitt JL, Lin HY. Mechanisms of anemia in CKD. *J Am Soc Nephrol*. 2012;23(10):1631-1634.
 20. Babitt JL, Lin HY. Molecular mechanisms of hepcidin regulation: implications for the anemia of CKD. *Am J Kidney Dis*. 2010;55(4):726-741.
 21. Besarab A, Ayyoub F. Anemia in renal disease. In: Schrier RW (Ed.) *Diseases of the kidney and urinary tract*. Philadelphia, Lippincott Williams and Wilkins, 2007; p. 2406-2430.
 22. Mast AE, Blinder MA, Gronowski AM, Chumley C, Scott MG. Clinical utility of the soluble transferrin receptor and comparison with serum ferritin in several populations. *Clin Chem*. 1998;44(1):45-51.