Characterizing the Burden of Anemia in End-Stage Renal Disease Patients

Scott Sibbel, PhD, MPH;[1] Adam G. Walker, PhD;[1] Trudy B. Pendergraft, MSPH;[2] Sean Zhao, MD, PhD;[2] Louise Sargent Heuer, MS, RPh;[2] Shaum Kabadi PhD, MPH;[2] Steven M. Brunelli, MD, MSCE[1]

[1]DaVita Clinical Research, Minneapolis, MN, USA; [2]AstraZeneca, Wilmington, DE, USA

Introduction

- Despite being recognized as common, the precise prevalence of anemia among ESRD patients in the US is unknown, in part because there is no consensus definition.
  - The World Health Organization defines anemia as Hb <12 g/dL for adult women and <13 g/dL for adult men.[1] However, this is a population level metric not specific to ESRD patients.
  - Treatment with ESAs is the most common therapy for low Hb in ESRD patients and is one indication that a patient is considered anemic.[2]
  - Per FDA labeling, ESA treatment is initiated at Hb concentrations <10 g/dL to prevent the need for red blood cell transfusion.[3]

Objectives

- To estimate the cross-sectional prevalence of anemia in a contemporary population of ESRD patients under varying definitions
- To characterize ESRD patients treated with ESAs versus those not treated with ESAs

Methods

Data Source and Population

- Data were derived from the electronic health records of an LDO.
- Patients included in this study were ≥18 years old, not receiving Veterans Administration benefits, and were dialyzing with the LDO.

Design and Analysis

Cross-Sectional Analysis

- Among patients dialyzing at the LDO as of January 2015, we assessed:
  - Period prevalence estimates of anemia using various definitions
  - Demographics and characteristics for patients on ESA therapy versus those not on ESA therapy
  - Distributions of Hb, ferritin, and TSAT for patients on ESA therapy and not on ESA therapy

Longitudinal Analysis

- Longitudinal analysis of ESA dose and Hb concentration was performed for patients initiating ESA therapy from 01 October – 31 December 2014

List of Abbreviations

AVF, arteriovenous fistula; AVG, arteriovenous graft; CVC, central venous catheter; ESA, erythropoiesis-stimulating agent; ESRD, end-stage renal disease; FDA, Food and Drug Administration; Hb, hemoglobin; HD, hemodialysis, ICHD, in-center hemodialysis; IV, intravenous; LDO, large dialysis organization; m, months; p25, 25th; percentile; p75, 75th percentile; PD, peritoneal dialysis; PTH, parathyroid hormone; SD, standard deviation; TSAT, transferrin saturation; U, units.

Results

Cross-Sectional Results

- Anemia prevalence was dependent upon defining criteria and modality (Figure 1).
  - In the overall population, prevalence was 21.9% when defined as Hb <10 g/dL, 84.7% when defined as treated with ESA, and 85.2% when defined as Hb <10 g/dL or ESA treatment.
  - Prevalence estimates for PD patients were lower than those for ICHD patients and dialysis patients overall.
  - Because defining anemia by ESA treatment captures 99.4% of the patients under the combined definition of ESA treatment or Hb <10 g/dL and can be applied to more analytic scenarios, the subsequent analyses compared patients treated with ESA versus those not treated with ESA.
- Characteristics of patients treated versus not treated with ESA are presented in Table 1.
  - Relative to ESA-treated patients, those not treated with ESA were more likely to be male, white, on PD, have lower prevalence of diabetes and congestive heart failure, and have higher mean Hb and lower ferritin.
- Hb concentrations were higher and ferritin concentrations were lower in patients not treated with ESA relative to those who were. There were no apparent differences in distributions of TSAT (Figure 2).

Longitudinal Results

- Longitudinal analyses of ESA dose and Hb concentrations are shown in Table 2.
  - Median ESA dose rose slightly from 4992 U/treatment at initiation to 5500 U/treatment in months +1 and +2 before declining to 4000 U/treatment by month +5.
  - Hb concentrations increased from 9.3 g/dL at initiation to peak at 11.0 g/dL in month +2 before stabilizing at approximately 10.8 g/dL for the remainder of follow-up.

Table 1. Patient Demographics and Characteristics by ESA Use

		On ESA [a] N =135,011	Not On ESA N = 24,366
Age, years	mean ± SD	61.6 ± 15.0	59.1 ± 14.4
Sex,	n (%)		
Male		71,599 (53.0)	16,927 (69.5)
Female		63,412 (47.0)	7439 (30.5)
Race,	n (%)		
White		48,181 (35.7)	10,652 (43.7)
Black		49,812 (36.9)	7866 (32.3)
Hispanic		25,156 (18.6)	4049 (16.6)
Asian		6006 (4.5)	693 (2.8)
Other/unknown		5856 (4.3)	1106 (4.5)
Access type,	n (%)		
AVF		79,665 (59.0)	13,468 (55.3)
AVG		23,233 (17.2)	2991 (12.3)
CVC/other		20,588 (15.3)	2461 (10.1)
PD		11,525 (8.5)	5446 (22.4)
Modality,	n (%)		
Standard ICHD		120,338 (89.1)	17,951 (73.7)
Home HD		2155 (1.6)	583 (2.4)
Nocturnal HD		993 (0.7)	386 (1.6)
PD		11,525 (8.5)	5446 (22.4)
Vintage, m	median [p25, p75]	35 [15, 68]	36 [15, 75]
Diabetes mellitus,	n (%)	91,448 (67.7)	15,169 (62.3)
Congestive heart failure,	n (%)	19,455 (14.4)	2977 (12.2)
Coronary artery disease,	n (%)	13,956 (10.3)	2660 (10.9)
Cerebrovascular disease,	n (%)	1701 (1.3)	254 (1.0)
Serum albumin, g/dL	mean ± SD	3.8 ± 0.4	3.9 ± 0.4
Serum calcium, mg/dl	mean ± SD	8.9 ± 0.7	9.0 ± 0.7
Phosphorus, mg/dL	mean ± SD	5.4 ± 1.6	5.3 ± 1.6
PTH, pg/mL	median [p25, p75]	401 [249, 626]	399 [249, 626]
Kt/V	mean ± SD	1.58 ± 0.32	1.54 ± 0.32
Hemoglobin, g/dL	mean ± SD	10.5 ± 1.1	12.2 ± 1.4
TSAT, %	mean ± SD	30.6 ± 14.5	30.9 ± 13.1
Ferritin, ng/mL	median [p25, p75]	724 [466, 977]	512 [251, 819]
IV iron use,	n (%)	93,470 (69.2)	11,856 (48.7)

[a] ESA use defined as having at least 1 dose of ESA during the during the month of January 2015.

Figure 1. Prevalence of Anemia in ESRD Patients Under Varying Definitions

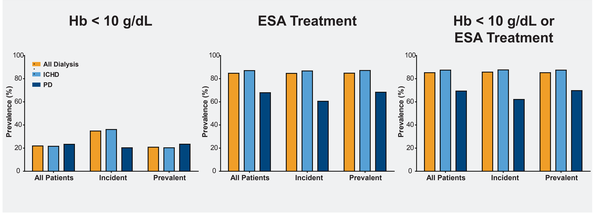

Figure 2. Distributions of Hemoglobin, Ferritin, and TSAT by ESA Use

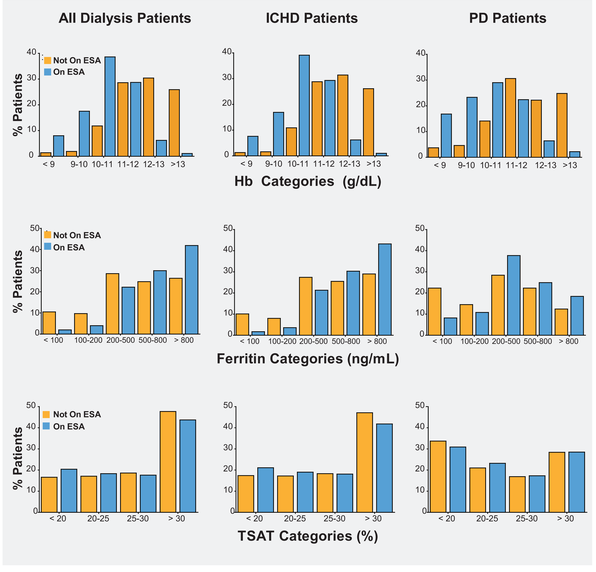

Table 2. Longitudinal Relationship between ESA Dose and Hemoglobin Concentration in Dialysis Patients Initiating ESA Treatment, 01 October 2014 – 31 December 2014

		ESA initiation	Month +1	Month +2	Month +3	Month +4	Month +5
Number of patients		7195	6791	6468	6215	6007	5855
ESA dose, U/treatment	mean ± SD	6124 ± 3551	6409 ± 3746	6533 ± 6019	6334 ± 4617	5627 ± 4081	5195 ± 4840
	median	4992	5500	5500	5312	4500	4054
	[p25, p75]	[3808, 7700]	[4062, 8715]	[3758, 9054]	[3300, 9333]	[2658, 8077]	[2200, 7500]
Hb, g/dL	mean ± SD	9.3 ± 1.1	10.5 ± 1.3	11.0 ± 1.3	11.0 ± 1.2	10.9 ± 1.2	10.7 ± 1.1
Hb categories, g/dL	n (%)						
<9		2476 (35.2)	726 (11.1)	429 (6.9)	366 (6.1)	356 (6.1)	379 (6.7)
9-9.9		2515 (35.8)	1281 (19.7)	785 (12.6)	648 (10.8)	775 (13.3)	882 (15.5)
10-10.9		1499 (21.3)	1976 (30.3)	1604 (25.7)	1656 (27.6)	1785 (30.6)	1927 (33.9)
11-11.9		447 (6.4)	1669 (25.6)	2123 (34.1)	2084 (34.7)	1984 (34.0)	1779 (31.3)
12-12.9		79 (1.1)	697 (10.7)	1019 (16.4)	1033 (17.2)	786 (13.5)	602 (10.6)
≥13		13 (0.2)	170 (2.6)	273 (4.4)	223 (3.7)	145 (2.5)	113 (2.0)

Conclusions

- The prevalence of anemia in patients on dialysis in January 2015 was 84.7% when defined by ESA treatment and 85.2% when defined by Hb <10 g/dL or ESA treatment.
  - Anemia defined as ESA treatment captures 99.4% of patients under the combined definition of ESA treatment or Hb <10 g/dL and can be applied to more analytic scenarios.
  - Because guidelines specify that ESA treatment should be initiated at Hb <10 g/dL, anemia prevalence under the definition of Hb <10 g/dL is low. Thus, Hb <10 g/dL is not a meaningful definition of anemia in the ESRD population.
- Relative to non-treated patients, those treated with ESA have:
  - Greater prevalence of diabetes and congestive heart failure
  - Lower Hb concentrations
  - Higher serum ferritin concentrations
- On average Hb levels were 9.3 g/dL at ESA initiation and rose by 1.7 g/dL, reaching 11.0 g/dL by month 3. After month 3, Hb levels were comparatively stable, while ESA doses declined starting in month 4.

References

1. World Health Organization (2011). Vitamin and Mineral Nutrition Information System.http://www.who.int/vmnis/indicators/haemoglobin.pdf
2. Locatelli, F. & Del Vecchio, L. (2011). The Oncologist; 16(suppl 3): 19-25.
3. Epogen (epoetin alfa) package insert (2011). Amgen, Inc.

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Correspondence: scott.sibbel@davita.com

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