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Evaluation Of Anemia Management In CKD Patients: Effectiveness Of Erythropoiesis-Stimulating Agents (Esas)

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Abstract- Background:
Margarets NM jointly wrote this study with Panzer AD and Lai RC and Sanon M along with Michalopoulos E and Redmond AM and Moghadam R and Chambers JD. Variation in health plan coverage of ESAs for anaemia due to chronic kidney disease. Journal of Managed Care & Specialty Pharmacy. 2021 Sep;27(9):1221-9.
Objectives:
One goal of this study is to assess both the haemoglobin-level improvement and transfusion need reduction through the use of ESAs among CKD patients with anaemia.
Study design: A prospective study.
Place and duration of study: Jan 2021 to Jan 2023
Methods:
The Department Of Nephrology Mercy Teaching Hospital – Peshawar served as the study site to observe 120 CKD stage 3–5 patients with anaemia in this prospective observational study. The patients received standard ESA therapy as part of the study which extended over six months. Patient Hb levels and transfusion frequency as well as adverse events received recorded documentation during the study. The study utilized SPSS 24.0 for statistical analysis while treating $p<0.05$ as the threshold for significance.
Results: 100 patients participated in the study whereas males made up 58 percent of the group; the participants had an average age of 56.4 ± 11.3 years. Study participants began the study with an average Hb level at 8.9 ± 0.7 g/dL and achieved 11.1 ± 1.1 g/dL six months later ($p < 0.001$). Patient transfusion need reduced drastically from 32.5% to 6.7% according to statistical analysis ($p = 0.002$). Out of the 100 patients, hypertension affected 15.8% while headache occurred in 6.7%.
Conclusion:
ESAs properly manage CKD patient anaemia by boosting their haemoglobin levels and helping them move away from blood transfusions. Treatment results for patients develop best when healthcare providers monitor regularly and

tailor the medication dose according to individual needs and resolve any iron deficiencies.

Keywords:
Anaemia, CKD, ESA, Haemoglobin

Introduction:

The condition of anaemia presents as a common and vital medical problem that affects patients with advanced chronic kidney disease (CKD). The medical condition leads to both reduced Hb levels and diminished red blood cell volume because of kidney failure-induced erythropoietin deficiency alongside iron deficiency and inflammatory states and reduced red blood cell longevity [1]. Patients who progress toward end-stage renal disease (ESRD) see their anaemia prevalence rise so that it affects more than 90% of their population [2]. Anaemia affects patients with chronic kidney disease by causing numerous adverse events jointly with reduced life quality and cognitive decline as well as fatigue and exercise difficulty along with left ventricular hypertrophy and heart failure development and increased risk of death and hospital admissions [3]. Usual management of anaemia stands as a primary component in managing CKD since it offers symptom relief while delivering better prolonged clinical success. The bone marrow receives two types of artificial erythropoiesis-stimulating agents (ESAs) - epoetin alfa, darbepoetin alfa and continuous erythropoietin receptor activator (CERA - that stimulate erythroid progenitor cell proliferation [4]. The medical community has revolutionized CKD-related anaemia management through ESA utilization since their invention in the late 1980s which resulted in lowered transfusion requirements along with better patient functioning [5]. ESAs continue to be controversial in the medical field because their usage creates hypertension risks and generates vascular access thrombosis along with stroke and cardiovascular events particularly when patients achieve Hb levels above 13 g/dL [6]. The CHOIR and CREATE and TREAT trials revealed that intensive treatment of anaemia with ESAs fails to provide extra cardiovascular advantages while potentially raising the possibility of undesirable results [7]. The kidney disease: Improving Global Outcomes organization recommends 10–11.5 g/dL as the standard Hb target due to the need for balancing safety and effectiveness [8]. The responsiveness of ESA therapy to patients depends heavily on their iron status. The majority of patients with chronic kidney disease present functional or absolute iron deficiency which leads to suboptimal ESA treatment results [9]. Guidelines maintain that patients should receive proper doses of iron prior to ESA treatment to reach their best Hb levels using the least effective ESA dosage possible. This study examines the clinical efficiency of ESA therapy for CKD patients with anaemia through evaluations of haemoglobin response together with transfusion needs and adverse event manifestations. Hospital-based nephrology practitioners can benefit from this study by obtaining real-world evidence regarding ESA outcomes in chronic kidney disease patients.

Methods:

This prospective observational study took place at the Department Of Nephrology Mercy Teaching Hospital – Peshawar throughout January 2023 to December 2023. The study included 120 adult CKD stage 3–5 patients with documented anaemia (Hb <11 g/dL). The patients received ESA therapy through epoetin alfa or darbepoetin alfa treatments according to institutional standards. A check of iron status occurred along with necessary treatment adjustments before starting ESA. A six-month tracking period was implemented which included regular haemoglobin measurements done by monthly visits. The physicians regulated ESA therapy through Hb measurements. The study checked for patient adverse effects along with transfusion requirements and their compliance with ESA treatment. Healthcare providers accessed a structured database to record essential baseline demographic and clinical data elements that included patient age along with gender information and kidney disease staging and comorbidities status and laboratory test outcomes of Hb along with serum ferritin and TSAT amounts.

Inclusion Criteria:

The study participants consisted of patients who met these criteria: they were above 18 years old, had stage 3–5 CKD along with low haemoglobin levels under 11 g/dL and qualified for ESA treatment and kept their scheduled follow-

up appointments without being on dialysis at baseline.

Exclusion Criteria:

The study excluded patients with active infections and malignancy as well as recent transfusions (within 4 weeks) and non-renal causes of anaemia or those who received investigational drugs to minimize sample heterogeneity and bias.

Data Collection:

The study collected clinic and laboratory data at the beginning then continued to follow patients through regular visits monthly during six months. The physicians tracked Hb levels together with iron status as well as ESA dose modifications and the number of transfusions and adverse effects. Standard protocols ensured data consistency. The attending nephrologist reviewed both treatment conformity and therapeutic outcomes.

Statistical Analysis:

Analysis of data took place through the SPSS version 24.0 software. Continued variables are provided as mean ± standard deviation while categorical variables are shown through frequencies and percentages. The evaluation of pre-treatment and post-treatment haemoglobin values employed paired t-tests. The Chi-square statistical test evaluated relationships between different variable categories. The study considered p-values under 0.05 as statistically significant.

Results:

100 patients with CKD-related anaemia with a male participant percentage at 70 (58.3%) and females at 50 (41.7%). The subjects averaged 56.4 years with age variation of ± 11.3 years. Among all patients with CKD stage distribution the numbers were 45% at stage 4 and 35% at stage 5 and 20% at stage 3. The initial mean measurement of haemoglobin in patients stood at 8.9 ± 0.7 g/dL. Significant Hb mean levels reached 11.1 ± 1.1 g/dL after six months of ESA treatment ($p < 0.001$). The patient population required fewer blood transfusions following six months of ESA therapy with the baseline percentage of 32.5 decreasing to 6.7 ($p = 0.002$). Doctors treated 28% of their patients who had iron deficiency through intravenous iron infusion to address this deficiency. The treatment led to hypertension occurrence in 15.8% of patients and headache appearance in 6.7% whereas vascular access thrombosis developed in 2.5% of patients. About forty percent of the patients receiving ESA therapy needed dosage modifications because their Hb level responses were either insufficient or excessive. A group of diabetic patients demonstrated slower Hb response compared to non-diabetics according to a statistical test ($p = 0.04$). The administered ESA therapy provided effective treatment while remaining well accepted by recipients. The success of haemoglobin treatment depended on the patient's level of iron deficit along with their ability to follow medical instructions thus highlighting the need for full anaemia care in CKD patients.

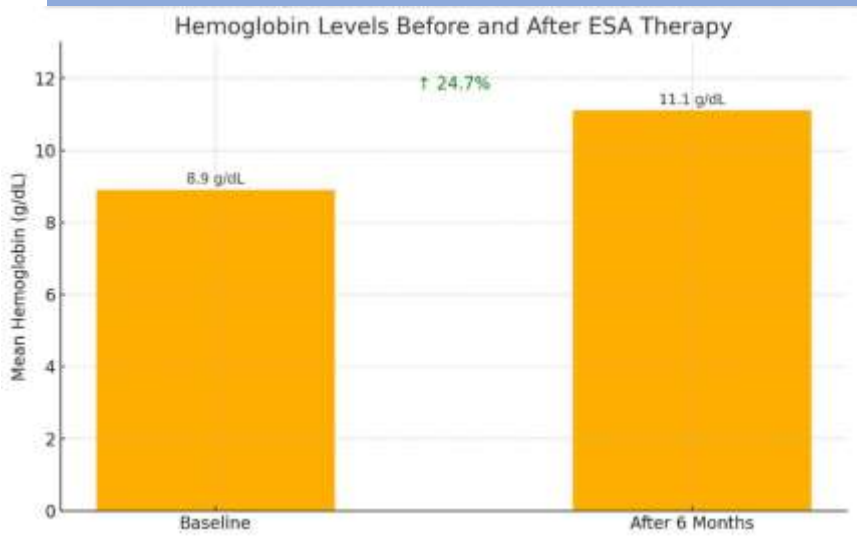

Table 1: Baseline Characteristics

Characteristic	Value
Number of patients	120
Male (%)	58.3%
Female (%)	41.7%
Mean age (years)	56.4 ± 11.3
CKD Stage 3 (%)	20%
CKD Stage 4 (%)	45%
CKD Stage 5 (%)	35%

Table 2: Haemoglobin Levels

Timepoint	Mean Haemoglobin (g/dL)	Standard Deviation	p-value
Baseline	8.9	0.7	< 0.001
After 6 Months	11.1	1.1	< 0.001

Table 3: Adverse Events and Transfusions

Parameter	Frequency (%)
Transfusion Required (Baseline)	32.5%
Transfusion Required (6 Months)	6.7%
Hypertension	15.8%
Headache	6.7%
Thrombosis	2.5%

Discussion:

This study shows that erythropoiesis-stimulating agents (ESAs) work effectively to treat chronic kidney disease (CKD) anaemia through their ability to enhance mean haemoglobin (Hb) levels and decrease transfusion needs during

a six-month period. The study findings match previous clinical trial and observational data showing that ESA therapy improves both blood outcomes and reduces transfusion needs among patients with chronic kidney disease [10]. Clinical trial results in CHOIR and CREATE show similar Hb changes when non-dialysis patients received ESAs since the treated group moved from 8.9 ± 0.7 g/dL to 11.1 ± 1.1 g/dL [11]. Yet both trials demonstrated how Hb levels exceeding 13 g/dL created cardiovascular risks because of the risk of overtreatment. The participants received ESA treatment to maintain their Hb levels within 10–11.5 g/dL according to the kidney disease: Improving Global Outcomes (KDIGO) guidelines [12]. Receiving ESA treatment helps prevent transfusions which enhances patient suitability for kidney transplantation by reducing sensitization risk due to blood transfusions. The study results demonstrating ESA-based transfusion avoidance from 32.5% to 6.7% match the findings reported by Locatelli et al. [13]. The administration of ESA compounds leads to better health-related quality of life scores because correcting anaemia reduces the physical limitations faced by patients however this study lacked HRQoL evaluation. Studies and clinical practice show the same adverse effects appear in our population such as hypertension together with headache alongside thrombosis occurrence [14]. Vasoconstriction of red cell mass elevation leads to blood pressure elevations which is a common side effect reported in literature [15,16]. According to the TREAT trial professionals must adjust medication doses properly when treating diabetic patients whose hearts already manage multiple cardiovascular conditions [17]. Patient responses to haematological changes moved at a slower rate for diabetic subjects because their bodies experience chronic inflammation along with iron sequestration and reduced ESA responsiveness. Our findings revealed that iron deficiency affected 28% of participants since it was a significant factor which altered ESA effectiveness [18]. The treatment with intravenous iron resulted in better outcomes which affirmed previous evidence showing that appropriate iron reserves are necessary for effective ESA function [19]. The effectiveness of ESA therapy depends on the addition of regular ferritin and transferrin saturation tracking. The study validates ESA therapy as fundamental treatment for anaemia management in CKD patients but emphasizes that individualized doses combined with optimized iron treatment and continual complication surveillance remain crucial. The therapeutic landscape of anaemia management will likely advance through future clinical assessments of hypoxia-inducible factor (HIF) stabilizers since they enter medical practice [20].

Conclusion:

ESA therapy produces better haemoglobin results alongside lower transfusion frequency for CKD patients. ASA therapy requires proper iron supplementations combined with regular patient assessments for maximizing treatment effectiveness. ESAs preserve their role as essential therapy for anaemia management to achieve clinical stability coupled with diminished complication risks of chronic anaemia in renal failure treatments.

Limitations:

Several limitations affected this study due to its single-center approach combined with minimal study participants and brief observational period. Generalization of study findings is restricted by the absence of randomization methods because dialysis patients were not included in the study. Insights about patient-focused results were hindered by the absence of assessments for quality of life and biomarkers connected to ESA responsiveness.

Future Findings:

Multi-site randomized trials need to complete future study which will investigate ESA safety durations while assessing their impact on cardiovascular health. HIF stabilizers along with inflammation-modulating therapies show promise to enhance the responsiveness of ESA medication in patients. The addition of patient-reported outcomes together with biomarkers will improve specific treatment plans for managing anaemia throughout CKD care.

Abbreviations

1. **CKD** – chronic kidney disease
2. **CERA** – Continuous Erythropoietin Receptor Activator

3. **CHOIR** – Correction of Haemoglobin and Outcomes in Renal Insufficiency
4. **CREATE** – Cardiovascular Risk Reduction by Early Anaemia Treatment with Epoetin Beta
5. **ESAs** – Erythropoiesis-Stimulating Agents
6. **ESRD** – End-Stage Renal Disease
7. **GFR** – Glomerular Filtration Rate
8. **Hb** – Haemoglobin
9. **HIF** – Hypoxia-Inducible Factor
10. **HRQoL** – Health-Related Quality of Life
11. **KDIGO** – kidney disease: Improving Global Outcomes
12. **SPSS** – Statistical Package for the Social Sciences
13. **TSAT** – Transferrin Saturation
14. **TREAT** – Trial to Reduce Cardiovascular Events with Aranesp Therapy

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Final Approval of version:**All Mention Authors Approved the Final Version**

Reference

1. Wish JB. Treatment of anaemia in kidney disease: beyond erythropoietin. Kidney International Reports. 2021 Oct 1;6(10):2540-53.
2. Chung EY, Palmer SC, Saglimbene VM, Craig JC, Tonelli M, Strippoli GF. Erythropoiesis-stimulating agents for anaemia in adults with chronic kidney disease: a network meta-analysis. Cochrane database of systematic reviews. 2023(2).
3. Weir MR. Managing anaemia across the stages of kidney disease in those hyporesponsive to erythropoiesis-stimulating agents. American Journal of Nephrology. 2021 Jul 19;52(6):450-66.
4. Nishiwaki H, Abe Y, Suzuki T, Hasegawa T, Levack WM, Noma H, Ota E. Erythropoiesis-stimulating agents for preventing acute kidney injury. Cochrane Database of Systematic Reviews. 2024(9).
5. Karaganov T. Treatment of Anaemia Associated with Chronic Kidney Disease: Plea for Considering Physiological Erythropoiesis. International Journal of Molecular Sciences. 2024 Jul 3;25(13):7322.
6. Karimi Z, Shahrani HR, Mohammadian-Hashwani A. Erythropoiesis-stimulating agents and cardiovascular mortality: A systematic review and meta-analysis of 17 studies and 372,156 haemodialysis patients. International Journal of Cardiology Cardiovascular Risk and Prevention. 2023 Dec 1; 19:200220.
7. Karimi Z, Raeis Shahrani H, Mohammadian-Hashwani A. Investigating the relationship between erythropoiesis-stimulating agents and mortality in haemodialysis patients: A systematic review and meta-analysis. PLoS one. 2023 Nov 9;18(11): e0293980.
8. Kidane old A, Woldu B, Enawgaw B. Role of Erythropoiesis Stimulating Agents in the Treatment of Anaemia: a Literature Review. Clinical Laboratory. 2021 Jul 1(4).
9. Yamamoto H, Noboru K, Matsuda Y, Hayashi Y, Hamasaki T, Aizawa T. Solid-state for renal anaemia in no dialysis patients previously treated with erythropoiesis-stimulating agents: a randomized, open-label, phase 3 study. American Journal of Nephrology. 2021 Sep 16;52(10-11):884-93

10. Elamin ZM, Badi S, Yousef BA. Assessment of Erythropoiesis-Stimulating Agents for Anaemia Treatment among Chronic Kidney Disease Patients: A Descriptive, Retrospective Study. Matrix Science Medica. 2021 Jan 1;5(1):21-4.
11. Miura T, Sato T, Yano T, Takakura A, Miki T, Those N, Nishizawa K. Role of erythropoiesis-stimulating agents in cardiovascular protection in CKD patients: reappraisal of their impact and mechanisms. Cardiovascular Drugs and Therapy. 2023 Dec;37(6):1175-92.
12. Daimon S. Reconsideration of the anaemia management strategy for chronic kidney disease and dialysis patients. Renal Replacement Therapy. 2025 Mar 1;11(1):16.
13. Gauthier-Loiselle M, Michalopoulos SN, Cloutier M, Serra E, Bungay R, Szabo E, Guérin A. Costs associated with the administration of erythropoiesis-stimulating agents for the treatment of anaemia in patients with non-dialysis-dependent chronic kidney disease: a US societal perspective. Journal of Managed Care & Specialty Pharmacy. 2021 Dec;27(12):1703-13.
14. Minutolo R, Garofalo C, Chiodini P, Aucella F, Del Vecchio L, Locatelli F, Scaglione F, De Nicola L. Types of erythropoiesis-stimulating agents and risk of end-stage kidney disease and death in patients with non-dialysis chronic kidney disease. Nephrology Dialysis Transplantation. 2021 Feb 1;36(2):267-74.
15. Doggerel SA. Are there advantages of aerostat over erythropoiesis-stimulating agents (ESAs) in treating anaemia associated with chronic kidney disease (CKD)?. Expert Opinion on Pharmacotherapy. 2022 May 3;23(7):769-73.
16. Wang J, Zhang L, Zhao MH. Comparative Effectiveness of Roxadustat vs. Erythropoiesis-Stimulating Agents (ESAs) on Anaemia and Kidney Outcomes among Patients with CKD: A Retrospective Cohort Study: FR-PO1161. Journal of the American Society of Nephrology. 2024 Oct 1;35(10S):10-681.
17. Soliman AE, Magdy S, Ayoub HS, Ebeid AH. Short versus long-acting erythropoiesis-stimulating agents for anaemia management in Egyptian haemodialysis patients. Qatar Medical Journal. 2024;2024(1):16.
18. Hodson EM, Strippoli GF. Long-or short-acting erythropoiesis-stimulating agents: take no shortcuts in their evaluation. Nephrology Dialysis Transplantation. 2021 Feb 1;36(2):205-7.
19. Karimi Z, Shahrani HR, Mohammadian-Hashwani A. The effect of erythropoiesis-stimulating agents on systolic and diastolic blood pressure in haemodialysis patients: A systematic review and meta-analysis of clinical trials. Medicina Clinica. 2024 Mar 2.
20. Margarets NM, Panzer AD, Lai RC, Sanon M, Michalopoulos E, Redmond AM, Moghadam R, Chambers JD. Variation in health plan coverage of ESAs for anaemia due to chronic kidney disease. Journal of Managed Care & Specialty Pharmacy. 2021 Sep;27(9):1221-9.