

Profile of Anemia and the Relationship between Hemoglobin Levels and Quality of Life in End-Stage Chronic Kidney Disease Patients undergoing Chronic Hemodialysis at Hasan Sadikin Hospital 2021-2022

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ARTICLE INFO	ABSTRACT
<p><i>Article history:</i> Received: March 16, 2024 Accepted: April 19, 2024 Published Online: April 24, 2024</p> <hr/> <p><i>Corresponding Author:</i> Fatimah Hasibuan, Internal Medicine Department, Hasan Sadikin Hospital, Padjadjaran University, fatimahschon@gmail.com</p>	<p>Background: Anemia is a common complication of Chronic Kidney Disease (CKD). The severity of anemia has implications for patients' quality of life.</p> <p>Objective: This study aims to determine the profile of Anemia and the relationship between Hemoglobin (Hb) levels and the quality of life of end-stage CKD patients undergoing chronic Hemodialysis.</p> <p>Methods: This study is analytical observational research with a cross-sectional design approach to explore the correlation between Hb levels and the quality of life of routine Hemodialysis patients at Hasan Sadikin Hospital, Bandung, throughout 2021-2022. Hb levels were continuous data. The quality of life of CKD patients was measured using the Indonesian version of the KDQOL questionnaire based on eight components. The obtained data were statistically analyzed using Spearman's Rank correlation.</p> <p>Results: This study had 150 subjects, 75 male (50.0%) and an average age of 45. The most common etiology of CKD was hypertensive nephrosclerosis (52.7%). The average Hb level was 9 g/dL. The highest quality of life score was 68, and the lowest was 41.28, with a median of 50.99. The correlation analysis results showed an r of -0.157 and p of 0.057, indicating a very weak negative correlation that is not statistically significant.</p> <p>Conclusion: The study's conclusion indicates no relationship between Hb levels and the quality of life of end-stage CKD patients undergoing chronic Hemodialysis.</p> <p>Keywords: anemia, hemodialysis, quality of life.</p>

Introduction

Chronic Kidney Disease (CKD) is one of the significant global health issues today. According to the United States Renal Data System, the prevalence of chronic kidney disease worldwide increases by 20-25% each year, estimating that 1 in 10 people worldwide has CKD.¹ The Indonesian Renal Registry (IRR) 2020 report noted a rise in the number of patients undergoing Hemodialysis, with 135,486 recorded in 2018, increasing to 185,901 in 2019, and declining to 130,931 in 2020. Hemoglobin (Hb) levels, as per the IRR 2020, showed a more

significant number of cases with Hb < 10 gr/dl at 110,074.81%, while Hb levels \geq 10 gr/dl accounted for 26,385.19%.²

CKD is characterized by kidney damage or decreased glomerular filtration rate (GFR) <60 ml/min/1.73m² for \geq three months. CKD results in a progressive and irreversible decline in kidney function, necessitating ongoing renal replacement therapy such as dialysis or kidney transplantation.³

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Anemia is a common complication of CKD, primarily caused by a relative decrease in erythropoietin production that is not commensurate with the degree of Anemia. Other contributing factors to Anemia in CKD include shortened red blood cell lifespan, iron deficiency, secondary hyperparathyroidism, and infection inflammation. There is currently no national epidemiological data regarding Anemia in CKD in Indonesia. At Dr. Cipto Mangunkusumo Hospital Jakarta, in 2010, Anemia was found in 100% of new patients undergoing Hemodialysis, with an average Hemoglobin of 7.7 gr/dl.⁴ Anemia leads to increased morbidity, mortality, and hospitalization rates. Additionally, it diminishes quality of life, reduces systemic hemodynamic capacity and cardiac function, increases the incidence of left ventricular hypertrophy, and impairs cognitive and sexual function. Several studies have demonstrated a strong association between Anemia and the progressive decline in kidney function.⁴

Assessment of quality of life plays a crucial role in the management of CKD patients receiving renal replacement therapy. Conducting a quality-of-life assessment before CKD patients undergo dialysis can assist doctors in selecting the appropriate type of dialysis, such as Hemodialysis or peritoneal dialysis, based on clinical indications and the patient's physical, psychological, and social conditions. The results of quality-of-life measurements can be used to evaluate the appropriateness of the therapy provided and the outcomes of healthcare efforts from the patient's perspective. Quality of life is subjective regarding the patient's feelings about their condition and the treatment they receive.⁵ This research investigates the anemia profile and the relationship between hemoglobin (Hb) levels and the quality of life of CKD patients undergoing chronic hemodialysis.

Methods

Design and participants

The research design is an analytical observational design with a cross-sectional approach. This study was conducted at the

Hemodialysis Installation of Hasan Sadikin Hospital in Bandung for a period of 1 year, from May 2021 to May 2022. The population of this study consists of CKD patients undergoing chronic Hemodialysis. The sample of this study comprises CKD patients with Anemia undergoing chronic Hemodialysis who meet the inclusion and exclusion criteria.

Data Collection

Inclusion criteria are CKD patients undergoing chronic hemodialysis as outpatients, aged >18 years, able to read and write, understand Bahasa Indonesia, willing to participate in the study, and signing the informed consent form voluntarily. Exclusion criteria in the study are patients with impaired consciousness such as somnolence, sopor, and coma, patients with oral communication disorders, and CKD patients undergoing chronic Hemodialysis as inpatients. The study variables consist of independent variables, namely Hb, and dependent variables, namely quality of life. The sampling in this study involves selecting all CKD patient subjects undergoing regular Hemodialysis in the Hemodialysis Installation of Hasan Sadikin Hospital in Bandung based on inclusion criteria. Research data were obtained by reviewing patients' medical records and completing questionnaires. General characteristic data such as gender and etiology of chronic kidney disease are presented on a categorical scale, while age data are presented on a numerical scale. The measured anemia profile data includes hemoglobin levels, transferrin saturation, serum iron, and TIBC (Total Iron Binding Capacity), categorized on a numerical scale. Quality of life data is measured using the Thirty-Six-item Kidney Disease Quality of Life (KDQOL-36) questionnaire, assessed based on eight components, and presented in numerical scale. The presentation of categorical scale data is in frequency with percentage. Numerical scale data are presented with mean and standard deviation if normally distributed, presented with median and minimum-maximum values if not normally distributed. Ethical approval for this study has been obtained from the ethics committee of Hasan Sadikin Hospital in Bandung.

Operational Definitions

Patients are considered anemic based on the measurement of Hb with a threshold of Hb<14 g/dL for males and Hb<12 g/dL for females.⁴ Hemoglobin is a protein compound in red blood cells composed of globin chains and heme iron structures. Hb is a meta-protein of red blood cells that delivers oxygen throughout the body.⁶ Quality of life is an individual's perception of their role in life according to cultural systems and values in their region. It relates to interests, life goals, aspirations, and standards to be achieved.⁷

Statistical analysis

The univariable analysis aims to describe the general characteristics and Anemia profile of CKD patients undergoing chronic Hemodialysis at Hasan Sadikin Hospital. Using Spearman's Rank correlation test, the bivariable analysis assesses the relationship between Hb and quality of life.

Results

This research was conducted at the Hemodialysis Installation of Hasan Sadikin Hospital in Bandung over one year, from May 2021 to May 2022. The study initially involved 172 respondents, but only 150 met the inclusion criteria.

Table 1. Characteristics Data of CKD Patients who have undergone Hemodialysis at RSHS Period 2021-2022.

Variable	Total
Age	
Mean±SD	44.78±14.46
Median (Min-Max)	45 (18-82)
Gender	
Male, n (%)	75(50)
Female, n (%)	75(50)
CKD Etiology	
Hypertensive	79(52.7)
Nephrosclerosis, n (%)	

Glomerulonephritis, n (%)	40(26.7%)
PNC, n (%)	7(4.7)
Diabetic Kidney Disease, n (%)	20(13.3)
Polycystic Kidney Disease, n (%)	2(1.3)
Unknown, n (%)	2(1.3)

Table 1 shows the general characteristics of CKD patients during the 2021-2022 period who have undergone chronic Hemodialysis, with a total of 150 patients. Based on the data above, the average age of the patients is 45 years old, with 75 male and 75 female patients. There were six recorded etiologies of CKD, dominated by hypertensive nephrosclerosis (52.7%).

Table 2. Characteristics of Anemia Profile in CKD Patients who have undergone Hemodialysis at RSHS Period 2021-2022

Variable	Total	Normality Test ^a
Hemoglobin		
Mean±SD	9.18±1.50	Normal (p=0,2)*
Serum Iron (µg/dL)		
Mean±SD	69.14±42.36	
Median (Min-Max)	55(18-256)	
TIBC Level (µg/dL)		
Mean±SD	198.96±14.46	
Median (Min-Max)	193.5 (41-289)	
Transferrin Saturation		
Mean±SD	43.43±62.19	
Median (Min-Max)	27.33(7.26-555.31)	

^aNormality test using Kolmogorov-Smirnov test

*data are normally distributed

Table 2 shows the characteristics of the Anemia profile of CKD patients in this study. The measured Anemia profile includes Hemoglobin, serum iron (Fe), TIBC levels, and transferrin saturation. Based on the data above, the patients' Hemoglobin levels are, on average, 9.18 with a standard deviation of ±1.50, and the data are normally distributed (p>0.05). The average Hemoglobin levels of the patients classify them as anemic according to male and female

Anemia criteria. The patients' serum iron levels are, on average, 69.14 with a standard deviation of ± 42.36 and a median value of 55, with a minimum value of 18 and a maximum of 256. The patients' TIBC levels are, on average, 198.96 with a standard deviation of ± 14.46 and a median value of 193.5, with a minimum value of 41 and a maximum of 289. The patients' transferrin saturation levels are, on average, 43.43 with a standard deviation of ± 62.19 and a median value of 27.33, with a minimum value of 7.26 and a maximum of 555.31.

Table 3. KDQOL Score of Quality of Life in CKD Patients who have undergone Hemodialysis at RSHS Period 2021-2022

Variable	Median (Min-Max)	Normality Test*
Physical Functioning	60.91 (33-83)	
Emotional Role	100(50-100)	
Social Functioning	61.33(39-78)	
Physical Role	64(32-100)	
Pain Perception	45(20-82.5)	
Vitality	30 (16.67-63.33)	
General Health	44 (20-92)	
Mental Health	35(20-80)	
Total Score	50.11 (40.92-67.28)	0.001*

^aNormality Test Kolmogorov-Smirnov

*data are not normally distributed

Table 3 shows the KDQOL scores for each of the eight questionnaire components and overall. Based on the data above, the KDQOL scores for each element and total are not normally distributed ($p < 0.05$). Overall, the KDQOL scores for patients in this study have a median value of 50.11, with a minimum value of 40.92 and a maximum value of 67.28.

Table 4. Correlation of Hemoglobin with Quality of Life Scores in CKD Patients who have undergone Hemodialysis at RSHS Period 2021-2022

	Quality of Life Score ^a	
	Correlation Coefficient r	p-value*
Hemoglobin (g/dL)	-0.130	0.057

^aSpearman rank correlation test

*no significance (>0.05)

Table 4 presents the correlation test results between Hemoglobin and quality of life scores in this study. Quality of life scores are not normally distributed, so the correlation analysis between Hemoglobin and quality of life scores was conducted using Spearman rank correlation. It was found that the correlation coefficient (r) is -0.157 (indicating a weak negative correlation), and the p-value is 0.057 (>0.05 , not significant), meaning that the trend is negative; as Hemoglobin increases, quality of life scores decreases. However, the correlation strength is weak and insignificant, indicating no meaningful correlation or relationship. Like Figure 1, the scatterplot shows points scattered away from the curve, suggesting that the relationship between Hb and quality of life scores is weak or non-existent.

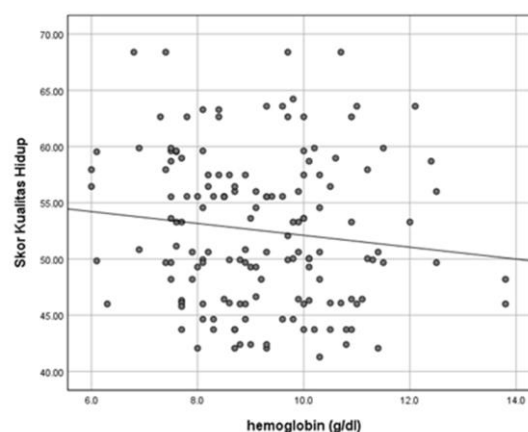


Figure 1. Scatterplot of Hemoglobin with Quality of Life Score

Discussion

This study obtained a sample of 150 patients with a mean age of 45. This is consistent with data from the Indonesian Renal Registry 2020, which shows that patients' second highest age distribution is in the 45-54 age group.

The kidney is a vital organ in the body responsible for excreting metabolic waste products, maintaining the balance of fluid and electrolytes in the blood, producing erythropoietin to stimulate red blood cell production, and synthesizing vitamin D.⁸

However, between the ages of 40 and 80, there is a decline in kidney function due to anatomical and physiological changes, including a 20% decrease in kidney mass, increased permeability of the filtration membrane, and gradual degeneration of the kidney tubules replaced by connective tissue.⁹ Physiological changes include electrolyte imbalance, decreased creatinine clearance, and decreased metabolites.¹⁰ This results in most CKD patients being in the 50-59 age range. However, not only do aging processes contribute to kidney function decline, but it can also occur at younger ages due to other risk factors such as lifestyle, kidney diseases, and family history of diseases such as hypertension, diabetes mellitus, and kidney failure.⁸

The mean Hemoglobin level in the study subjects is classified as Anemia (9.18 g/dL) according to male and female Anemia criteria. Anemia is present in 80-90% of chronic kidney disease patients.⁸ Renal Anemia is primarily caused by decreased erythropoietin production capacity. Other contributing factors to renal Anemia include iron deficiency (inadequate intake, repeated phlebotomy for laboratory testing, blood retention in dialysis or tubing, gastrointestinal bleeding), shortened erythrocyte lifespan, severe hyperparathyroidism, inflammation and infection, aluminum toxicity, folate deficiency, hypothyroidism, and Hemoglobinopathies.⁴

Many factors can be etiologies of Anemia in chronic kidney disease (CKD) patients. Types of Anemia based on possible etiologies found in CKD patients undergoing Hemodialysis include post-hemorrhagic Anemia, chronic disease Anemia, iron deficiency Anemia, and hemolytic Anemia. Iron deficiency Anemia in CKD consists of absolute iron deficiency Anemia when transferrin saturation (TS) is <20% and serum ferritin (SF) is <100 ng/mL (CKD-nonDialysis, CKD-Peritoneal Dialysis) and <200 ng/mL (CKD-HD). Functional iron deficiency Anemia occurs when TS is <20% and SF is \geq 100 ng/mL (CKD-nonD, CKD-PD) and \geq 200 ng/mL (CKD-HD). However, this study's Anemia profile results cannot determine the type of Anemia in CKD due to the lack of some data

such as serum ferritin levels, erythrocyte morphology, reticulocyte count, leukocyte, and platelet levels.⁴

The analysis of KDQOL scores in CKD patients undergoing chronic Hemodialysis in this study on eight quality-of-life scales measured using the SF-36 questionnaire, namely physical function, emotional role, social function, physical role, pain, vitality, general health, and mental health, shows that most scales experience a decrease in KDQOL scores.⁷ This is consistent with a study conducted by Anees (2011), where HD patients in Pakistan had poor quality of life, as seen from the decrease in physical, psychological, social, and environmental aspects.¹¹

The results of the correlation analysis between Hb and quality of life obtained in the Hemodialysis Installation of Hasan Sadikin Hospital Bandung from May 2021 to May 2021 showed an r of -0.157 and p of 0.057, indicating a very weak negative correlation that is not statistically significant. Similar results were found by Nurchyati (2010) in a study of 95 respondents, which aimed to examine the relationship between Hb levels and quality of life. It was found that Hb levels were not associated with quality of life. These results are consistent with Ayoub et al.'s (2014) study on the relationship between Hb levels and quality of life using the SF-36 questionnaire in 130 respondents, which found that Hb levels were not associated with the total score of the SF-36 questionnaire.¹²

However, Haalen's (2020) study conducted in 7 countries on the relationship between Anemia and quality of life yielded different results, which found a relationship between severe Anemia and quality of life in CKD patients' daily lives.¹³

Conclusion

Based on the research findings and discussion, this study concludes that there is no relationship between Hb levels and the quality of life of patients with end-stage CKD undergoing chronic Hemodialysis.

Limitations of the Study

There are limitations to this study. The study was conducted only in one dialysis unit, leading to homogeneous subject characteristics and minimal variability. Further research in multiple dialysis units is needed to reduce bias in social and cultural aspects. Secondly, data collection was conducted through one-on-one interviews because subjects couldn't fill out questionnaires during hemodialysis treatment, potentially resulting in differences in subject interpretation of questionnaire questions. Thirdly, the type of anemia could not be determined due to the lack of examinations on serum ferritin levels, reticulocyte counts, and erythrocyte morphology.

Declarations

Ethics approval

This work was approved by the Medical Research Council [LB.02.01/X.6.5/406/2022].

Competing interests

There are no conflicts of interest.

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Author's Contribution

Idea/concept: SFH. Design: SFH. Control/supervision: AM, LS. Data collection/processing: SFH. Extraction/Analysis/interpretation: SFH. Writing the article: SFH. Critical review: AM, LS. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

References

1. The United States Renal Data System. Incidence, Prevalence, Patient Characteristics, and Treatment Modalities. In: The United States Renal Data System 2022 Annual Data Report (ADR). 2022.
2. Afiatin. Indonesian Renal Registry Laporan Tahun 2020. Bandung; 2020.
3. Suwitra K. Penyakit Ginjal Kronik. In: Sudoyo A, Setyohadi B, Alwi I, Simadibrata M, Setiati S, editors. Buku Ajar Ilmu Penyakit Dalam. 4th ed. Jakarta: Interna Publishing; 2009.
4. Suhardjono, Lubis HR, Lydia A, Widodo, Bakri S, Widiana IGR, et al. Konsensus Manajemen Anemia pada Penyakit Ginjal Kronik. 2nd ed. Vol. 1. Jakarta: Perhimpunan Nefrologi Indonesia; 2011. 3–4 p.
5. Morton RL, Tong A, Howard K, Snelling P, Webster AC. The views of patients and carers in treatment decision making for chronic kidney disease: systematic review and thematic synthesis of qualitative studies. *BMJ*. 2010;340.
6. Billet H. Hemoglobin dan Hematocrit. In: Walker H, Hall W, Hurst J, editors. *Clinical Methods: The History, Physical, and Laboratory Examinations*. 3rd ed. Boston: Butterworths; 1990.
7. WHO. WHOQOL User Manual. WHO; 2012. 1–106 p.
8. Sukandar E. *Nefrologi Klinik*. 4th ed. Vol. 1. Bandung: IPEDE; 2013. 802–806 p.

9. Andrade M, Knight J. Exploring the anatomy and physiology of ageing: Part 4--the renal system. *Nurs Times*. 2008;104(34):22–3.
10. Nurchayati S. Analisis faktor-faktor yang berhubungan dengan kualitas hidup pasien penyakit ginjal kronik yang menjalani hemodialisis di Rumah Sakit Islam Fatimah Cilacap dan Rumah Sakit Umum Daerah Banyumas. [Depok]: Universitas Indonesia; 2011.
11. Anees M, Hameed F, Mumtaz A, Ibrahim M, Saeed KMN. Dialysis-related factors affecting quality of life in patients on Hemodialysis. 2011.
12. Ayoub A, Nelson K, Wood P, Hijazi KH. The relationship between laboratory values and quality of life of dialysis patients in the United Arab Emirates. *Renal Society of Australasia Journal*. 2014;10(1):12–2
13. Haalen H, Jackson J, Spinowitz B, Milligan G, Moon R. Impact of chronic kidney disease and Anemia on health-related quality of life and work productivity: analysis of multinational real-world data. *BMC Nephrol*. 2020;21:1–15.