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Overview of Reticulocyte Counts in Patients with Chronic Kidney Failure at Ciamis Regional General Hospital

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ABSTRACT

Background & Objectives: The prevalence of chronic kidney failure in Ciamis Regency based on medical records data from Ciamis Regional General Hospital in 2023 was 318 patients. Chronic kidney failure often causes complications, one of which is anemia. Reticulocyte examination in patients with chronic kidney failure can help diagnose complications such as anemia and determine the response to bone marrow. The purpose of this study was to determine the number of reticulocytes in patients with chronic kidney failure.
Method: This research method is descriptive with purposive sampling technique. The respondents in this study were 39 people with chronic kidney failure at Ciamis Regional General Hospital. This study was conducted at the Hematology Laboratory of STIKes Muhammadiyah Ciamis in May 2024. The examination technique was carried out using brilliant crystal blue solution staining and examined under a microscope. The examination results were compiled into tables and explained narratively.
Results: The results of this examination showed that 34 people (87%) had normal reticulocyte counts and 5 people (13%) had above-normal reticulocyte counts.
Conclusion: It can be concluded that the average reticulocyte count in patients with chronic kidney failure is normal.

Keywords: Acute Kidney Failure, Anemia, Reticulocytosis.

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INTRODUCTION

Chronic kidney disease is a complex condition caused by various disease factors, which can lead to permanent damage to kidney function and structure over a long period of time. Diagnosis is based on the identification of chronic kidney function decline and structural damage to the kidneys (Webster et al., 2017). The kidneys play an important role in the body by regulating metabolism, endocrine function, and contributing to the production of red blood cells, known as erythropoiesis (Amudi & Palar, 2021).

According to (Rindiastuti, 2017), decreased kidney function can be caused by factors such as nephron damage, impaired renal blood flow, chronic inflammation, and toxin buildup. Ultimately, this process leads to kidney failure, requiring interventions such as dialysis or kidney transplantation to sustain life.

Hemodialysis is a process in which the dissolved substances in the blood are changed through a semi-permeable membrane using another solution. This procedure has been proven to be very beneficial and improves the quality of life of patients. In general, hemodialysis is usually performed on patients with chronic kidney disease 1-2 times a week, and it is recommended to continue treatment consistently for at least 3 months (Sitanggang et al., 2021).

According to the World Health Organization (2020), the incidence of chronic kidney failure worldwide reaches 10% of the population. The number of kidney failure patients in Indonesia increased from 0.20% in 2013 to 0.38% in 2018, based on Indonesia's population of 252,124,458. The prevalence of chronic kidney disease in West Java is 0.48%, ranking sixth, with 21,051 active hemodialysis patients, increasing to 33,828 in 2018 (Ministry of Health of the Republic of Indonesia, 2020). Based on medical records at Ciamis Regional General Hospital, there were 318 patients with chronic kidney failure in 2023.

The identification of a disease and the success of its treatment can be confirmed by determining the specific disease being treated. A supporting test in diagnosing anemia in patients with chronic kidney failure is a reticulocyte count.

Anemia can occur in patients with chronic kidney disease, often characterized by a decrease in the number of erythrocytes or hemoglobin levels. Cardiovascular events and kidney disease prognosis often occur in patients with kidney failure, which can be predicted by anemia. Anemia is also associated with a decrease in quality of life and an increase in morbidity and mortality (Yuniarti, 2021). The etiology of anemia in patients with chronic kidney disease is very complex, involving various factors such as shortened red blood cell lifespan caused by uremia, iron deficiency, bone marrow fibrosis, decreased erythropoietin production, and hyperparathyroidism (Amudi & Palar, 2021).

Anemia in patients with kidney failure is caused by low production of the hormone erythropoietin. Erythropoiesis deficiency is a condition in which erythrocyte formation occurs in the bone marrow. Under normal circumstances, 90% of erythropoietin hormone is produced by the peritubular interstitial (endothelial) structure of the kidney, and the remaining 10% is produced in the liver (Aliviameita & Puspitasari, 2021).

The mechanism of anemia in chronic renal failure is multifactorial, functioning to maintain a progressive increase in endogenous erythropoietin (EPO) at classic levels. This factor has also been shown to contribute to anemia in patients with chronic renal failure. This includes absolute iron deficiency due to red blood cell loss or impaired iron absorption, systemic reactions to chronic kidney disease, patient-related diseases, decreased bone marrow response to EPO due to uremic toxins, and decreased quality of life due to iron deficiency or vitamin B12 or folic acid deficiency (Jose P., Leyre M., Jose J. P., 2021).

Clinical laboratory tests that aid in diagnosing a disease are routine examinations, one of which is a reticulocyte count to assess anemia (Syarifah et al., 2020). Reticulocytes are a type of young red blood cell without a nucleus that still contains RNA (with supravital staining). Hemolytic anemia, acute bleeding, and therapy for iron, folate, or vitamin B12 deficiency can increase the number of reticulocytes. Most erythroblasts developing in the bone marrow will die before becoming mature erythrocytes, with approximately 10%-15% of erythroblasts failing to produce mature erythrocytes (Aliviameita & Puspitasari, 2021).

Based on previous research conducted by Yane Liswanti and Firda Nur Arifah, which examined reticulocyte counts before and after blood donation, the results from five donor samples showed that all five samples (100%) experienced an increase in reticulocytes. Based on the above background, the researchers were interested in conducting research on reticulocyte counts in patients with chronic kidney failure.

OBJECTIVE

To Determine the Number of Reticulocytes in Patients with Chronic Kidney Failure.

METHOD

The research design used was descriptive. The population in this study consisted of 318 patients with chronic kidney failure at Ciamis Regional General Hospital. Sampling was incidental. The sample size was 39 people. The research instrument used brilliant crystal blue staining and examination with a microscope. This study was conducted at the Muhammadiyah Ciamis Hematology Laboratory.

RESULTS

The results of the study of respondents with chronic kidney failure based on gender showed that there were 21 males (54%) and 18 females (46%). The distribution of respondents can be seen in Table 1.

TABLE 1. Distribution of Chronic Kidney Disease Patients by Gender

Gender	N	%
Male	21	54%
Female	18	46%

Reticulocytes

The average number of reticulocytes in patients with chronic kidney failure is normal, namely 34 people (87%), as shown in Table 2.

TABEL 2. Reticulocyte Count in Patients with Chronic Kidney Failure

Reticulocytes	N	%
Normal	34	87%
Abnormal	5	13%

Based on Table 2, it can be seen that the results of reticulocyte count tests in patients with chronic kidney failure showed normal reticulocyte counts in 34 people and above-normal counts in 5 people. The normal range for reticulocyte count is 0.5–1.5%.

DISCUSSION

This study aims to examine the number of reticulocytes in patients with chronic renal failure at Ciamis Regional General Hospital based on Table 1. It explains that 39 patients with chronic renal failure at Ciamis Regional General Hospital were included in this study. The results show that 21 respondents (54%) were male, and 18 respondents (46%) were female. This shows that gender cannot be said to be one of the risk factors for chronic kidney disease, as there are other factors that can influence it, such as age, lifestyle, smoking, blood pressure, and diabetes mellitus.

Hypoxia or anemia stimulates erythropoietin-producing cells to produce and release erythropoietin into the bloodstream, where it circulates to the tissues that need it. Specifically, erythropoietin progenitor cells are used to increase blood cell production in the bone marrow. This leads to an increase in the release of reticulocytes into the peripheral blood, thereby alleviating the symptoms of anemia. If low reticulocyte counts are detected in infected patients, the likely cause is insufficient erythropoietin production or suboptimal response to red blood cell progenitor cells. Because erythropoietin activity is highly specific to red blood cells, many human-derived recombinant erythropoietins have been developed, which are widely used to treat patients with anemia due to kidney failure or kidney failure due to melanoma (Mutiawati, 2018).

Reticulocytosis (increased reticulocyte count) will result in normal circulation in patients with anemia whose bone marrow function is still in good condition, bone marrow stimulation in patients with bleeding or hemolytic anemia (sickle cell anemia, thalassemia, spherocytosis, G6PD deficiency, autoimmune hemolytic disease, and hypersplenism), and patients with anemia who have successfully undergone therapy. Erythropoiesis or decreased production of erythropoietin will result in normal or decreased reticulocyte counts (reticulocytopenia) in patients with anemia. Anemia can be caused by iron, folate, or vitamin B12 deficiency, aplastic anemia due to immune processes or medications, leukemia, idiopathic myelofibrosis, and other disorders that are associated with reticulocytopenia (Suega, 2010).

An increased reticulocyte count usually indicates that the bone marrow is still producing more erythrocytes in response to a decrease in mature red blood cells. It attempts to compensate by releasing more immature cells into the bloodstream. Factors that influence reticulocyte results in patients include gender, hypoxia or low oxygen levels, age, sampling technique, clinical condition, medication use, erythrocytes, and other factors (Toteles & Duraijin, 2023).

Hemolytic anemia is almost always associated with an increase in reticulocyte count due to the destruction of red blood cells. An increase in reticulocyte count can be detected using automated reticulocyte analysis or by identifying reticulocytes in peripheral blood morphology through SADT examination with Brilliant Cresyl Blue staining. The presence of reticulocytes indicates polychromasia in peripheral morphology, accompanied by erythroid hyperplasia in the bone marrow. Erythroid hyperplasia refers to an indication of increased erythrocyte production in the body. Peripheral blood morphology shows various shapes and sizes of characteristic erythrocyte abnormalities caused by a destruction process called anisopoikilocytosis (anisocytosis for size and poikilocytosis for shape). Abnormal erythrocyte forms found include sickle cells (sickle cell disease), schistocytes, bite cells, or helmet cells (Mutiawati, 2018).

The process of hematopoiesis occurs when the entire bone marrow produces red blood cells to meet the body's needs. This process requires vitamin B12 and folate to release erythropoietin formation so that it runs properly. Erythropoietin is a hormone that stimulates the production of erythrocytes by the kidneys. Healthy kidneys normally produce erythropoietin, which stimulates the bone marrow to produce the red blood cells needed to transport oxygen to vital organs. Abnormal kidneys often fail to produce significant amounts of erythropoietin. As a result, the bone marrow produces only a small number of red blood cells. Therefore, the use of folate as a supplement can help hematopoiesis development (Alvionita et al., 2016).

Based on research (Sidarti Soehita et al., 2015) conducted on 61 samples, 26.1 pg/cell patients were found to have lower reticulocyte counts, while 35.9 pg/cell patients had above-normal results. Therefore, patients with chronic kidney failure who frequently undergo routine HD twice a week will experience iron deficiency due to blood loss. Consequently, patients with chronic kidney disease often develop anemia caused by inadequate production of erythropoietin hormone. Therefore, they require iron, folic acid, and other supplements. However, for patients with chronic kidney disease, the vitamins needed during the HD process are not covered by BPJS, so most patients must purchase them themselves.

CONCLUSION

Based on the results of this study, it can be concluded that of the 39 patients with chronic kidney failure at Ciamis Regional General Hospital, 5 people (13%) had above-normal (increased) reticulocytes and 34 people (87%) had normal reticulocytes.

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CONFLICT OF INTEREST

There is no conflict of interest in preparing this research and writing this article.

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