Indonesian Annual Conference Series, Vol. 3, 2024
International Hybrid Conference on Revitalizing Global Economy for Sustainable National Development (*IHCRGESND*), Nigeria

Patients with Renal Failure and Electrolyte Disturbance

Salwa Muftah Eljamay[1*], Hibah Salim Abdulrraziq[1]
[1]College of Medical Technology, Department of Public Health Derna, Libya
***Corresponding Author**, Email: salwaeljamay@cmtd.edu.ly

Abstract

Chronic kidney disease (CKD), which is characterized by its asymptomatic nature until its end stage, is one of the most common public health problems in the world. Thus, a regular checkup, especially for those individuals with high-risk groups is inevitably important, and the screening has been done with laboratory findings. is becoming common to hear about sudden death from kidney failure. The study aimed to examine electrolyte Disturbance in Kidney Failure Patients. Material and Methods: An institutional-based cross-sectional and interview study was conducted at the hemodialysis department in al-Wahda Hospital, Derna City, Libya. All volunteer patients in the hemodialysis department aged between 10 and more than 71 years who were in the department during the hemodialysis period participated in this study. The study participants were selected based on a convenient sampling technique and a total of 96 study participants were included. Results: Relationship between Kidney Failure Patients and Electrolytes, Chronic Diseases, Gender, and Age, the relationship between kidney failure and chronic disease, p-value < 0.05 and there is no relationship with Electrolytes, gender, or age. p-value > 0.05, the relationship between kidney failure and chronic diseases Conclusion: those suffering from kidney failure have chronic diseases; a total of 106 (60) have chronic diseases. is no relationship between electrolytes and kidney failure. The results vary in patients with kidney and disease failure who do not suffer from kidney failure, and there is no correlation between kidney failure and age because kidney failure includes all ages and not only a certain age.

Keywords: *Chronic Diseases, Electrolyte, Hemodialysis, Renal Failure.*

INTRODUCTION

The first basic human needs are the physiological needs, which are seen as the most basic needs for the survival of the human being (Pereira, 2023). Electrolytes abnormalities can be divided into increased (hyper-) or decreased (hypo-) concentration of a electrolyte (regarding plasmatic concentrations and not absolute total body quantities), (Petrosino et al., 2022), The Extracorporeal Life Support Organization (ELSO) Guidelines for Fluid and Electrolyte Management have been written to present a consensus for the clinical care of neonatal, pediatric, and adult patients supported with extracorporeal membrane oxygenation (ECMO). (Bridges et al., 2022), Electrolyte disturbances are common in critically ill patients, and the incidence of complex electrolyte abnormality was found to be as high as 67%, (Baeg et al., 2022).

Electrolytes are positively and negatively charged ions that are found within cells and extracellular fluids, including intestinal fluid, blood, and plasma. (Ara et al., 2011.) The main kidney function is the removal of toxic waste products, and fluid overload as well as maintaining the balance for acid-base (pH) and electrolytes (e.g. Na^+, K^+, Ca^{2+})(Abdulla et al., 2020), Changes in electrolyte levels have been reported with cisplatin. Specifically, it has been linked to hypomagnesemia, hypocalcemia, and hypokalemia. (Alrfaei et al., 2023). The Dialysis Outcomes and Practice Patterns Study (DOPPS) showed relatively low potassium (<4.0 meq/l) was not related to all-cause mortality (Arif, 2022). The common electrolyte abnormalities are hyponatremia, hypokalemia, and hypomagnesemia (Biswas et al., 2022). The standard values for electrolytes can vary according to a facility's laboratory; the ranges used in this article may vary minimally from the standard ranges at any given institution (Bulloch et al., 2024). Acute kidney injury (AKI) is associated with electrolyte and acid-base disturbances such as hyperkalemia, metabolic acidosis, hypocalcemia, and hyperphosphatemia (Claure & Bouchard, 2012), the electrolyte imbalances above, as well as the opposing high or low electrolyte clinical scenarios (Colbert et al., 2023). There is a paucity of contemporary data examining electrolyte changes during and immediately after hemodialysis (HD), and their relationship with dialysate prescriptions (Correa et al., 2021). They regulate electrolytes (a type of nutrient) and activate vitamin D, too. Kidneys don't work well when they're damaged (D.m, 2024), electrolytes and acid-base balance, CKD, and ESRD predictably result in multiple derangements including hyperkalemia, metabolic acidosis, and hyperphosphatemia which, in turn, lead to serious complications including muscle wasting, bone-mineral disorder, vascular calcification, and mortality (Dhondup & Qian, 2017).

The prevalence of CKD was higher in acute HF patients (53%) compared with chronic HF patients (42%). Kidney impairment is a predictor of a poor prognosis in patients with HF and it has a strong association with worse outcomes(Guaricci et al., 2024), Kidney handles sodium, water, and potassium excretion. Glomerular filtration and tubular transport harmoniously participate in these processes. (Kim, 2023), Electrolyte and acid-base disturbances are the consequence of neoplastic spread, anticancer treatment, or, more rarely, paraneoplastic phenomena of all types of tumors. (Lameire et al., 2010).

The DAPA-CKD trial showed that among patients with chronic kidney disease (CKD), regardless of the presence or absence of T2DM, the risk of a combination of sustained decline in the estimated GFR of at least 50%, end-stage kidney disease, or death from renal or cardiovascular causes, was significantly lower with dapagliflozin than with placebo (Lopes et al., 2024). Electrolytes, such as sodium, chloride, potassium, calcium, magnesium, and phosphate, play crucial roles in regulating plasma osmolality, acid-base homeostasis, cellular metabolism, cellular membrane potentials of nerve and muscle cells (Lv et al., 2022), Hyperkalemia and hypokalemia were the major electrolyte disorders in the study participants (Molla et al., 2020). The importance of fluid and electrolytes for maintaining homeostasis is involved in sustaining and the regulation of physiological functions of cells, keeping the balance of acid-base, as well as managing the perfusion of tissues (Nadeem et al., 2023), Electrolyte disturbances, and loss of fluid homeostasis may occur.

Despite this rapid decline in kidney function, patients with acute renal failure often have few symptoms (Needham, 2005). Acute kidney injury (AKI) and electrolyte disorders are important complications of hospitalized coronavirus disease 2019 (COVID-19) patients (Nogueira et al., 2022). Minerals perform a physiological role in the human body consisting of both macroelements and microelements. Calcium (Ca), phosphorus (P), potassium (K), sulfur (S), sodium (Na), chlorine (Cl), and magnesium macroelement compounds (Prasetyorini & Suratun, 2023). CKD and is associated with wide electrolyte and calcium abnormalities (Rk & Nagdeve, 2023). The prevalence of hyperuricemia and electrolyte abnormalities in patients with CKD have been reported in clinical and epidemiological studies (Sofue et al., 2020). Patients with chronic kidney disease (CKD) often develop metabolic acidosis (MA), which is defined as a serum bicarbonate level < 22 mmol/L (Sorohan et al., 2024), electrolyte disturbance, and hypervolemia.

This approach may be superior to the traditional diagnostic approach due to its contribution to more accurate and rapid diagnostic interpretation and better planning of further patient treatment (Tasic et al., 2022), the major regulator of Na^+ reabsorption (and K^+ and H^+ secretion) in the distal nephron; it is secreted by the zona glomerulosa of the adrenal cortex in response to a raised plasma angiotensin II concentration or high plasma K^+ concentration (Trepiccione et al., 2023). Hyperphosphatasemia, on the other hand, occurs in renal failure (phosphate levels are higher in chronic as compared to acute renal failure) (Van Regenmortel & Duška, 2023). Electrolyte disturbances are highly heterogeneous and severely affect the prognosis of critically ill patients. Our study was to determine whether data-driven phenotypes of seven electrolytes have prognostic relevance in critically ill patients (Xiao et al., 2024). There was a significant fall in serum calcium levels with a decrease in eGFR in CKD patients. There was no significant correlation between serum sodium levels and eGFR in CKD patients (Nagar, 2024).

METHODS

Study design and setting: An institutional-based cross-sectional and interview, the study was conducted from February 1 to Jun 28, 2024, at the hemodialysis department in al-Wahda Hospital, Derna City, Libya.

Study participants and size: All volunteer patients in the hemodialysis department aged between 10 and more than 71 years who were in the department during the hemodialysis period participated in this study. The study participants give them informed consent before the start of data collection. The study participants were selected based on a convenient sampling technique and a total of 96 study participants were included.

Data collection and variables: Data were collected using an interviewer-administered questionnaire with a Google form survey recorded in Microsoft Excel, The questionnaires were prepared based on the previous related literature and Kidney Disease Improving Global Outcomes (KDIGO) guidelines. It was developed in the English language since the source populations of the study were fully communicated in English. The questionnaire includes socio-demographic variables (sex, age, resident place, source of drinking)

Data analysis: Data from the biochemical analysis was then cleaned and transferred into a statistical package for the social science (SPSS) version 26 software for the statistical analysis. The descriptive data analysis was conducted and presented as frequency and percentage. We also used a chi-square test to check the significance differences and P- value < 0.05 was used as a statistical significance.

Results and Discussion

Figure 1. Percentage and Frequency of Gender

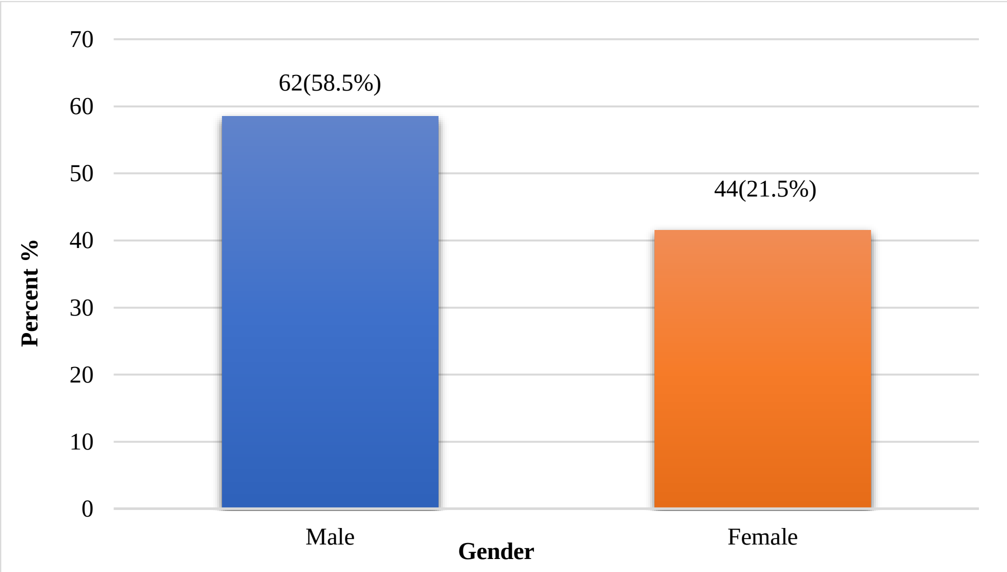


Figure 1. illustrates the Frequency and Percentage of Gender, with males more than females followed by 62(58.5%), 44(21.5%)

Table 1. Illustrates the Percentage and frequency of the hemodialysis Period

Period of hemodialysis	Frequency	%
Few Months	5	4.7
2 years	5	4.7
3 years	9	8.5
4 years	9	8.5
5 years	15	14.2
More than 6 years	54	50.9
Healthy	9	8.5
Total	106	100.0

Table 1. illustrates the Percentage and frequency of the hemodialysis Period, with the highest period of more than 6 years by 54(50.9%)

Figure 2. The water source that the patients drink

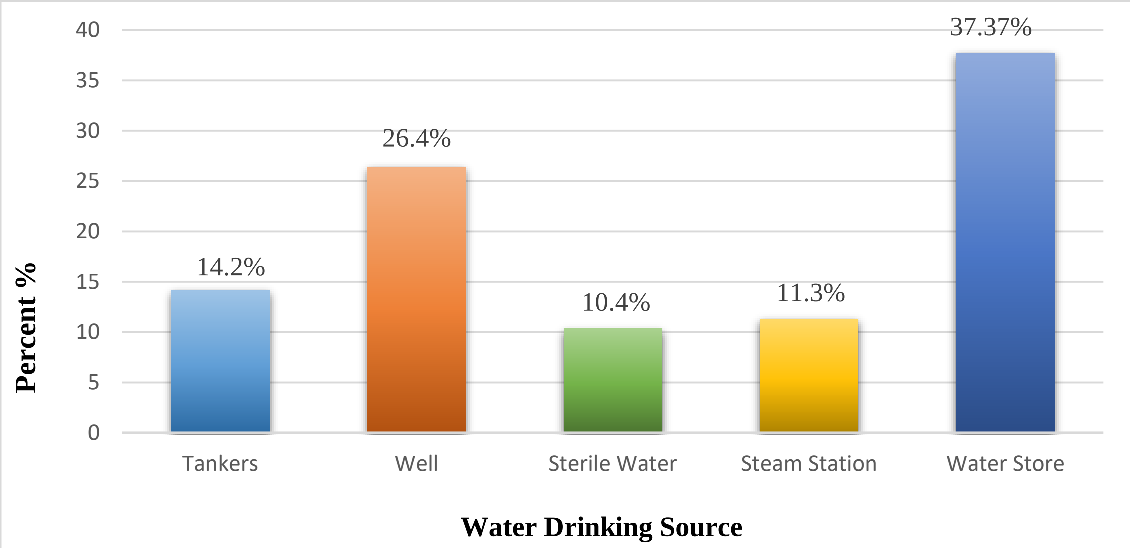


Figure (2) shows the water source that the patients drink in the water store was the highest percentage 37.37%, followed by 26.4% for wells and 14.25% for tankers.

Table 2. Percentage and frequency of the presence of chronic diseases

Chronic Diseases	Frequency	%
Yes	60	56.6
No	46	43.4
Total	106	100.0

Table 2. shows the Percentage and frequency of the presence of chronic diseases in 106 patients 60(56.6%) patients suffer from Chronic Diseases

Table 3. Percentage of family members suffer from kidney failure

Does a family member suffer from kidney failure?	Frequency	%
Yes	22	20.8
No	76	71.7
I Don't Know	8	7.5
Total	106	100.0

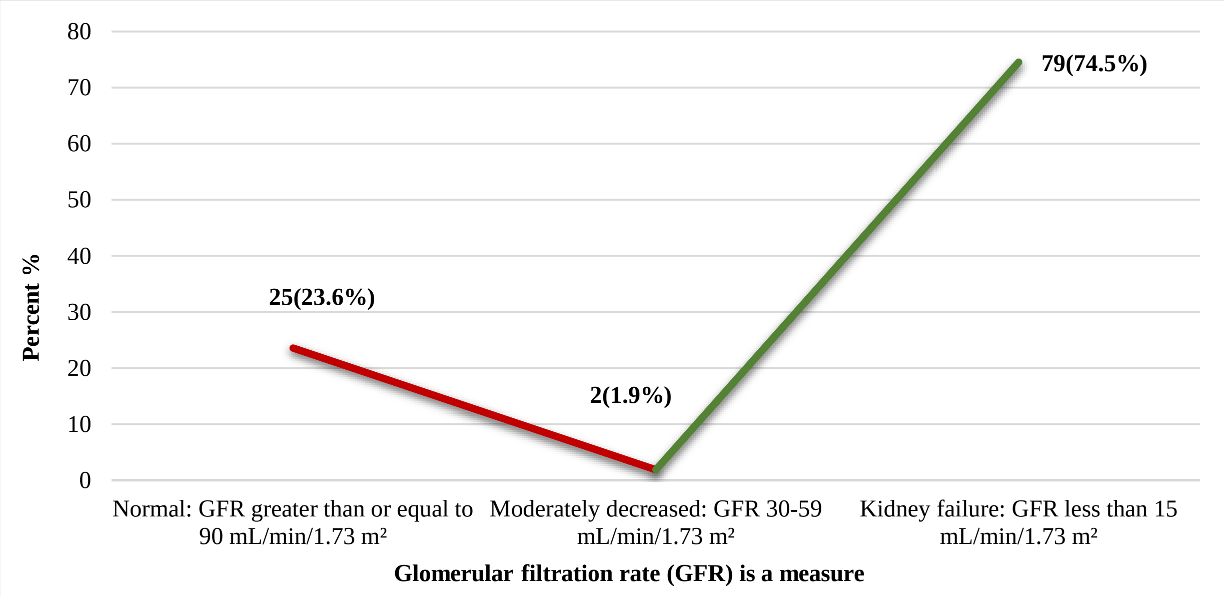
In Table 3. Shows the Percentage of family members who suffer from kidney failure by 22(20.8%), and family members who do not suffer from kidney failure 76 (71.7%)

Table 4. Result of kidney failure patient analysis

Result of kidney failure analysis	Normal	Law	V. Law	High
Electrolytes result	33(31.1%)	60(56.6%)	13(12.3%)	0(0.0%)
Creatinine Result	10(9.4%)	0(0.0%)	0(0.0%)	96(90.6%)
Albumin result	10(9.4%)	85(80.2%)	11(10.4%)	0(0.0%)
Protein Result	10(9.4%)	81(76.4%)	15(14.2%)	0(0.0%)
Urea Result	10(9.4%)	0(0.0%)	0(0.0%)	96(90.6%)

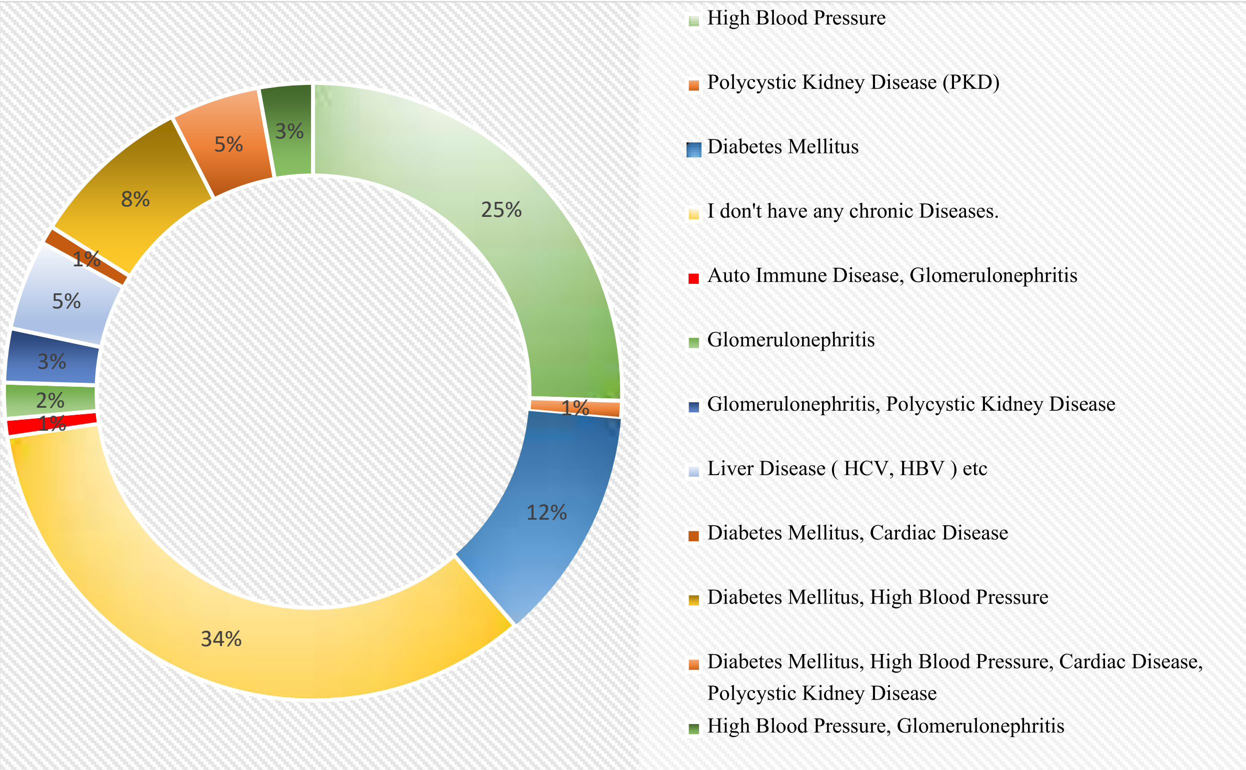
Table 4. shows the result of kidney failure patient analysis The result of electrolyte was 60 (56.6%) for the lower and lower percentage was 13 (12.3%)

Figure 3. Glomerular filtration rate (GFR) is a measure in hemodialysis patients



In Figure 3. Illustrated that the highest percentage for Glomerular filtration rate (GFR) is a measure in hemodialysis patients of Kidney failure: GFR less than 15 mL/min/1.73 m², by79 (74.5%)

Figure 4. The type of chronic disease in kidney failure patients



In Figure 4. Illustrated The type of chronic disease in kidney failure patients, that the highest proportions of chronic illnesses complained of by dialysis patients were pressure by 27(25.5%) and diabetes by 13 (12.3%) or two together by 9(8.5%) followed by cardiac disease by 5(4.7%) and then hepatitis by 5(4.7%), the highest percentage for haven't any chronic Diseases by 36(34.0%).

Table5. Relationship between Kidney Failure Patients and Electrolytes, Chronic Diseases, Gender, and Age, we find a strong relationship between kidney failure and chronic disease, p-value < 0.05 and there is

no relationship with Electrolytes, gender, or age. p-value > 0.05.

Figure 5 illustrates the relationship between kidney failure and chronic diseases it is clear in the graph that those suffering from kidney failure have chronic diseases; a total of 106 (60) have chronic diseases.

Table 5. The Correlations between Kidney Failure Patients and Electrolyte, Chronic Diseases, Gender, and Age

Correlations		Kidney Failure
Gender	R	-0.023
	P-Value	0.813
Age	R	-0.075
	P-Value	0.446
The result of Electrolytes	R	0.085
	P-Value	0.384
Do you have chronic Diseases?	R	0.326**
	P-Value	0.001
	N	106

Figure 5. Relationship between kidney failure patients with chronic disease.

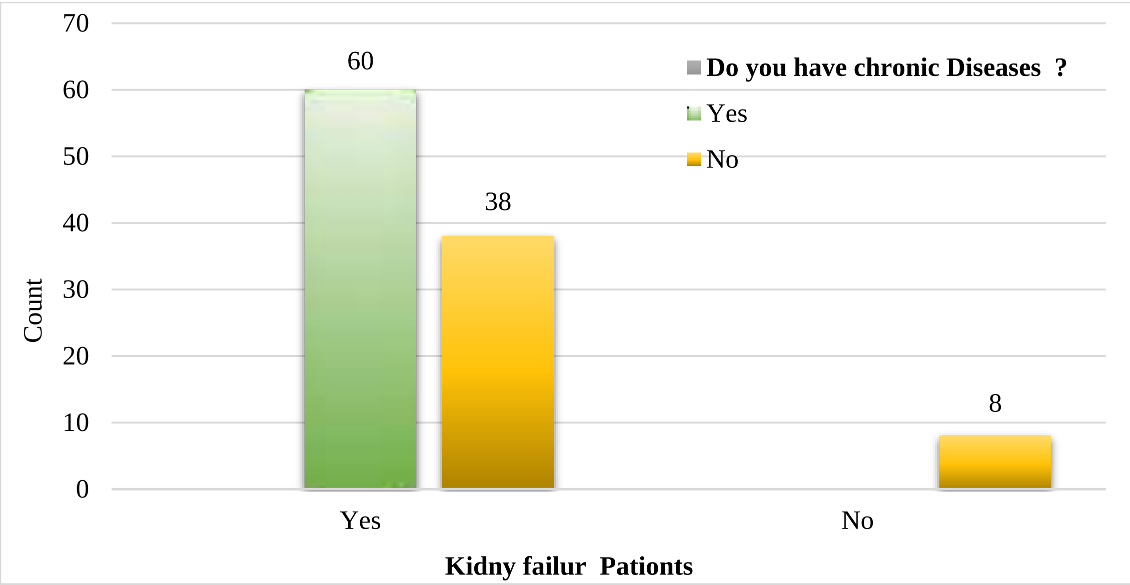


Figure 6 shows that there is no relationship between electrolytes and kidney failure. Because the results vary in patients with kidney and disease failure who do not suffer from kidney failure.

Figure 6. Number and gender of kidney failure patients with electrolyte result

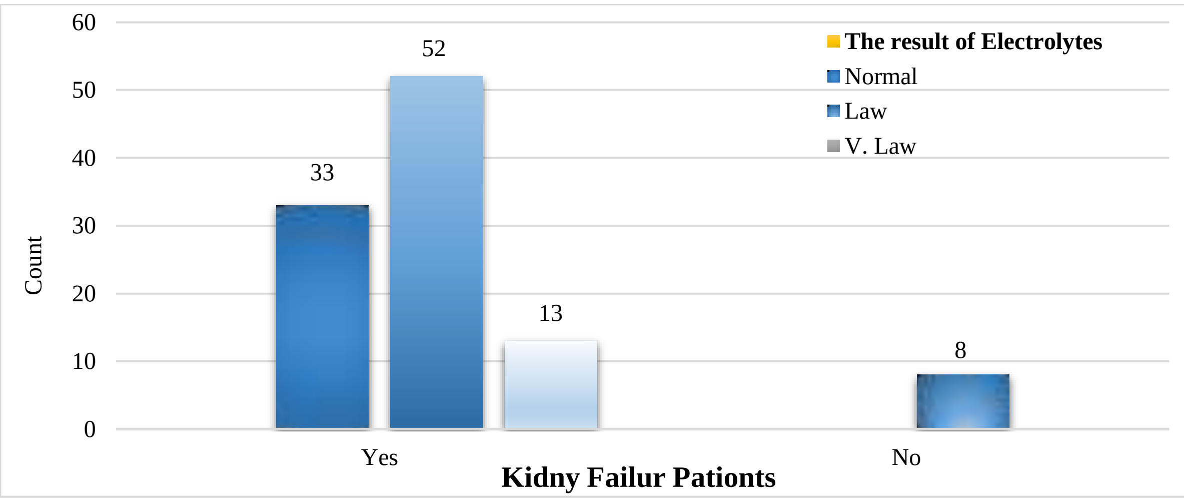


Figure 7. Relationship between kidney failure and Gender

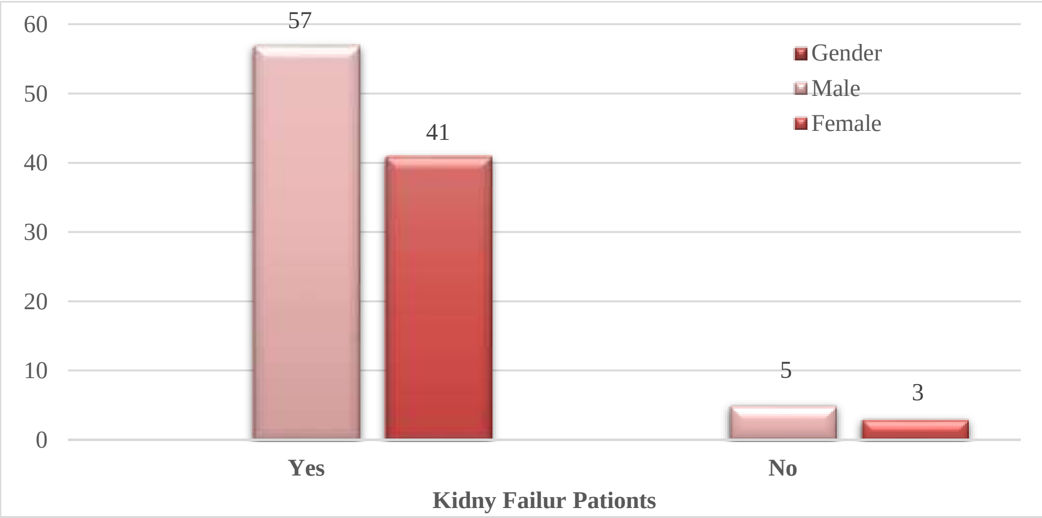


Figure 7 shows that there is no correlation between kidney failure and gender as kidney failure encompassed both genders without specifying a specific gender.

Figure 8 shows that there is no correlation between kidney failure and age

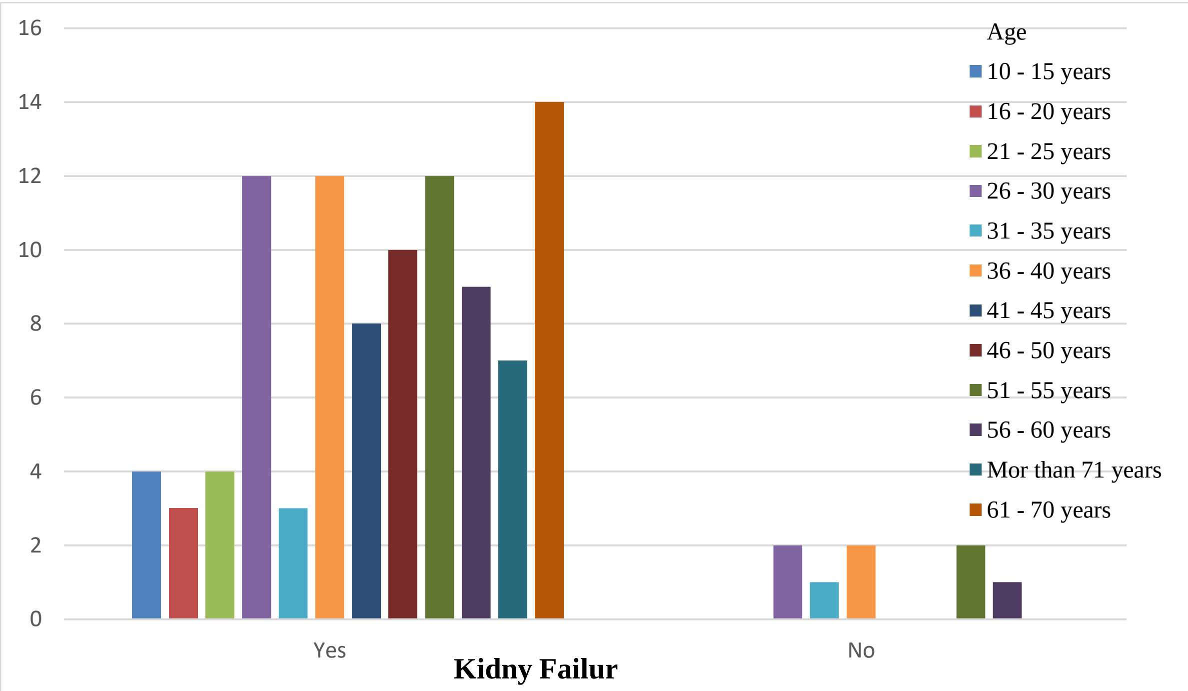


Figure 8. Shows that there is no correlation between kidney failure and age because kidney failure includes all ages and not only a certain age.

The study wanted to clarify whether there was a relationship between electrolyte and renal failure patients, but between the study results below we will clarify, Figure 1. illustrates the Frequency and Percentage of Gender, with males more than females followed by 62(58.5%), 44(21.5%), Table 1. illustrates the Percentage and frequency of the hemodialysis Period, with the highest period of more than 6 years by 54(50.9%), Figure (2) shows the water source that the patients drink in the water store was the highest percentage 37.37%, followed by 26.4% for wells and 14.25% for tankers. Table 2. shows the Percentage and frequency of the presence of chronic diseases in 106 patients and 60(56.6%) patients suffering from Chronic Diseases.

In Table 3. Shows the Percentage of family members who suffer from kidney failure by 22 (20.8%), and family members who do not suffer from kidney failure 76 (71.7%). Table 4 shows the result of kidney failure patient analysis The result of electrolyte 60 (56.6%) for the lower and lower percentage was 13 (12.3%). In Figure 3 illustrated that the highest percentage for Glomerular filtration rate (GFR) is a measure in hemodialysis patients of Kidney failure: GFR less than 15 mL/min/1.73 m^2, by79 (74.5%). In Figure 4. Illustrated The type of chronic disease in kidney failure patients, that the highest proportions of chronic illnesses complained of by dialysis patients were pressure by 27(25.5%) and diabetes by 13 (12.3%) or two together by 9(8.5%) followed by cardiac disease by 5(4.7%) and then hepatitis by 5(4.7%), the highest percentage for haven't any chronic Diseases by 36(34.0%). Table 5 Relationship between Kidney Failure Patients and Electrolytes, Chronic Diseases, Gender, and Age, we find a strong relationship between kidney failure and chronic disease, p-value < 0.05 and there is no relationship with Electrolytes, gender, or age. p-value > 0.05. Figure 5 illustrates the relationship between kidney failure and chronic diseases it is clear in the graph that those suffering from kidney failure have chronic diseases; a total of 106 (60) have chronic diseases. Figure 6 shows that there is no relationship between electrolytes and kidney failure. Because the results vary in patients with kidney and disease failure who do not suffer from kidney failure. Figure 7 shows that there is no correlation between kidney failure and gender as kidney failure encompassed both genders without specifying a specific gender. Figure 8 shows that there is no correlation between kidney failure and age because kidney failure includes all ages and not only a certain age.

This study agrees with this study that shows that electrolyte dysfunction is not limited to patients with kidney failure only, but combines with other chronic diseases such as high blood pressure, diabetes mellitus, cardiac diseases, tumours, liver disease, etc. (Alrfaei et al., 2023), and agrees with (Ara et al., 2024.) results, also agree with (Arif, 2022), also agrees with (Biswas et al., 2024.), (Lameire et al., 2010), (Lopes et al., 2024), (Molla et al., 2020).

The study disagrees with (Baeg et al., 2022), (Rk & Nagdeve, 2023), (Correa et al., 2021), (Bulloch et al., 2024) and (Kim, 2023), Not compatible with our study because it stated that electrolytes are one of the analyses as evidence for patients with kidney failure

Conclusion

The study wanted to clarify whether there was a relationship between electrolyte and renal failure patients, but the results show that there is no correlation between kidney failure and electrolyte analysis or the relationship between chronic diseases and kidney failure. The most important of these chronic diseases are pressure, diabetes, heart disease, and liver disease.

References

Abdulla, J. E., Shakor, J. K., Shallal, A. F., & Kheder, R. K. (2020). Effect of dialysis on some Hematological and Electrolyte parameters in chronic kidney patients. *Annals of Tropical Medicine and Public Health*, 23(11).

Alrfaei, B. M., Almutairi, A. O., Aljohani, A. A., Alammar, H., Asiri, A., Bokhari, Y., Aljaser, F. S., Abudawood, M., & Halwani, M. (2023). Electrolytes Play a Role in Detecting Cisplatin-Induced Kidney Complications and May Even Prevent Them—Retrospective Analysis. *Medicine*, 59(5), Article 5.

Ara, S., Javed, F., Jahan, N., Ahmed, N., Waseem, M., & Asif, M. (2024). Kidney Function Tests And Serum Electrolyte Disorders In Different Ethnic Groups Of Balochistan.

Arif, H. (2022). Complications of Chronic Kidney Disease: Electrolyte and Acid-Base Disorders. In J. McCauley, S. M. Hamrahian, & O. H. Maarouf (Eds.), *Approaches to Chronic Kidney Disease: A Guide for Primary Care Providers and Non-Nephrologists* (pp. 211–233). Springer International Publishing.

Baeg, S. I., Lee, K., Jeon, J., & Jang, H. R. (2022). Management for Electrolytes Disturbances during Continuous Renal Replacement Therapy. *Electrolyte & Blood Pressure: E & BP*, 20(2), 64–75.

Biswas, P. P., Amin, M. R., Akter, S., Akter, K., & Akther, S. (2022). *Electrolyte and Renal Function Status in Congestive Cardiac Failure Patients attending at Tertiary Hospital*, Dhaka, Bangladesh.

Bridges, B. C., Dhar, A., Ramanathan, K., Steflik, H. J., Schmidt, M., & Shekar, K. (2022). Extracorporeal Life Support Organization Guidelines for Fluid Overload, Acute Kidney Injury, and Electrolyte Management. *ASAIO Journal*, 68(5), 611–618.

Bulloch, M. N., Cardinale-King, M., Cogle, S., Radparvar, S., Effendi, M., Jagpal, S., & Dixit, D. (2024). Correction of Electrolyte Abnormalities in Critically Ill Patients. *Intensive Care Research*, 4(1), 19–37.

Claure, R., & Bouchard, J. (2012). Acid-Base and Electrolyte Abnormalities during Renal Support for Acute Kidney Injury: Recognition and Management. *Blood Purification*, 34(2), 186–193.

Colbert, G. B., Kher, A., Genena, K., & Lerma, E. V. (2023). Electrolytes & Acid-Base Disorders. In D. Banerjee, V. Jha, & N. M. P. Annear (Eds.), *Management of Kidney Diseases* (pp. 539–561). Springer International Publishing.

Correa, S., Scovner, K. M., Tumlin, J. A., Roy-Chaudhury, P., Koplan, B. A., Costea, A. I., Kher, V., Williamson, D., Pokhariyal, S., McClure, C. K., Mc Causland, F. R., Charytan, D. M., Committees, on behalf of the M. I. and, Committees, M. I. and, Committees, on behalf of the M. I. and, & Committees, M. I. and. (2021). Electrolyte Changes in Contemporary Hemodialysis: A Secondary Analysis of the Monitoring in Dialysis Study. *Kidney* 360, 2(4), 695.

Correlation between estimated glomerular filtration rate and serum electrolytes in chronic kidney disease patients. *Asian Journal of Medical Sciences*. Retrieved June 17, 2024, from https://openurl.ebsco.com/EPDB%3Agcd%3A14%3A7043134/detailv2?sid=ebsco%3Aplink%3Ascholar&id=ebsco%3Agcd%3A164596123&crl=c

Dhondup, T., & Qian, Q. (2017). Electrolyte and Acid-Base Disorders in Chronic Kidney Disease and End-Stage Kidney Failure. *Blood Purification*, 43(1–3), 179–188.

D.m, Y. (2024). Origin of Acute Kidney Failure. *Ethiopian International Journal of Multidisciplinary Research*, 11(02), Article 02.

Guaricci, A. I., Sturdà, F., Russo, R., Basile, P., Baggiano, A., Mushtaq, S., Fusini, L., Fazzari, F., Bertandino, F., Monitillo, F., Carella, M. C., Simonini, M., Pontone, G., Ciccone, M. M., Grandaliano, G., Vezzoli, G., & Pesce, F. (2024). Assessment and management of heart failure in patients with chronic kidney disease. *Heart Failure Reviews*, 29(2), 379–394.

H. Khalifa, N. M. Al-Awkally, S. M. Eljamay. (2022). Oral Delivery of Biologics: Recent Advances, Challenges, and Future Perspectives. *African Journal of Advanced Pure and Applied Sciences* (*AJAPAS*), 1 (2), 1-6.

Kim, G.-H. (2023). Fluid and Electrolyte Problems in Chronic Kidney Disease. In M. Arıcı (Ed.), *Management of Chronic Kidney Disease: A Clinician's Guide* (pp. 327–344). Springer International Publishing.

Lameire, N., Van Biesen, W., & Vanholder, R. (2010). Electrolyte disturbances and acute kidney injury in patients with cancer. *Seminars in Nephrology*, 30(6), 534–547.

Lopes, A. C., Lourenço, O., Morgado, S., Gaspar, A., Freire, I., Eusébio, I., Ribeiro, J., Silva, M., Mendes, M., Fonseca, O., Duarte, R., & Morgado, M. (2024). Acute Kidney Injury and Electrolyte Imbalances Caused by Dapagliflozin Short-Term Use. *Pharmaceuticals*, 17(4), Article 4.

Lv, Q., Li, D., Wang, Y., Yu, P., Zhao, L., Chen, S., Wang, M., Fu, G., & Zhang, W. (2022). Admission electrolyte and osmotic pressure levels are associated with the incidence of contrast-associated acute kidney injury. *Scientific Reports*, 12(1), 4714.

Molla, M. D., Degef, M., Bekele, A., Geto, Z., Challa, F., Lejisa, T., Getahun, T., Sileshi, M., Tolcha, Y., Ashebir, G., & Seifu, D. (2020). Assessment of serum electrolytes and kidney function test for screening of chronic kidney disease among Ethiopian Public Health Institute staff members, Addis Ababa, Ethiopia. *BMC Nephrology*, 21(1), 494.

Nadeem, M. F., Butt, A. M., Ashraf, W., Matti, N., Farooq, M. A., Nasim, M. B., Siddique, M. I., & Khan, T. M. (2023). The Impact of Fluid and Electrolyte Imbalance on the Severities of Diseases and Their Management in Developing

Countries. In Y. M. Al-Worafi (Ed.), *Handbook of Medical and Health Sciences in Developing Countries* (pp. 1–20). Springer International Publishing.

Needham, E. (2005). Management of Acute Renal Failure. *American Family Physician*, 72(9), 1739–1746.

Nogueira, G. M., Silva, N. L. O. R., Moura, A. F., Duarte Silveira, M. A., & Moura-Neto, J. A. (2022). Acute kidney injury and electrolyte disorders in Covid-19. *World Journal of Virology*, 11(5), 283–292.

Pereira, A. G. (2023). The Factors That Influence The Electrolyte Fluid Imbalance To The Patient With Chronic Kidney Disease Who Under Go Hemodialysis Treatment In The Nephrology Unit In Hngv Dili, 2023.: Research Article. *American Journal of Medical and Clinical Research & Reviews*, 2(10), Article 10.

Petrosino, A., Bagordo, D., Fürstenberg-Schaette, A., & Laing, C. (2022). Common Electrolyte Abnormalities. In M. Harber (Ed.), *Primer on Nephrology* (263–297). Springer International Publishing.

Prasetyorini, T., & Suratun. (2023). Correlation between Urea, Creatinine and Potassium Results in Kidney Failure Patients. *Tec Empresarial*, 18(1), Article 1.

Rk, Dr. S., & Nagdeve, Dr. R. (2023). A study of serum electrolytes and calcium in chronic kidney disease in rural Maharashtra. *International Journal of Advanced Research in Medicine*, 5(3), 99–104.

Salwa Muftah Eljamay, Amal.Gh.Hashem, Fatma Muftah Eljamay, Najma Ramadan Elhenshir, (2021). Relationship between Environmental Pollution and Different Diseases, *UJMS*. 3 (1).

S. M. Eljamay, R. A. Ali Elhsadi, E. S. Buegerbaweia, S. M. Alawkaly, and A. E. Buelteaia, ―Assessment of Knowledge, Attitudes, and Perception of Safety and Prevention Procedures among Libyan Health Care Workers. *African Journal of Advanced Pure and Applied Sciences* (*AJAPAS*), 1(3), 65–72.

Sofue, T., Nakagawa, N., Kanda, E., Nagasu, H., Matsushita, K., Nangaku, M., Maruyama, S., Wada, T., Terada, Y., Yamagata, K., Narita, I., Yanagita, M., Sugiyama, H., Shigematsu, T., Ito, T., Tamura, K., Isaka, Y., Okada, H., Tsuruya, K., … Kashihara, N. (2020). Prevalences of hyperuricemia and electrolyte abnormalities in patients with chronic kidney disease in Japan: A nationwide, cross-sectional cohort study using data from the Japan Chronic Kidney Disease Database (J-CKD-DB). *PLOS ONE*, 15(10), e0240402.

Sorohan, B. M., Obrișcă, B., Jurubiță, R., Lupușoru, G., Achim, C., Andronesi, A., Frățilă, G., Berechet, A., Micu, G., & Ismail, G. (2024). Sodium citrate versus sodium bicarbonate for metabolic acidosis in patients with chronic kidney disease: A randomized controlled trial. *Medicine*, 103(10), e37475.

Tasic, D., Dordevic, K., Galovic, S., Furundzic, D., Dimitrijević, Z., & Radenković, S. (2022). Is It Possible to Analyze Kidney Functions, Electrolytes and Volemia Using Artificial Intelligence? *Diagnostics*, 12(12), Article 12.

Trepiccione, F., Capasso, G., & Unwin, R. (2023). Electrolytes and acid–base: Common fluid and electrolyte disorders. *Medicine*, 51(2), 102–109.

Van Regenmortel, N., & Duška, F. (2023). Common Electrolyte Disturbances. In F. Duška, M. Al-Haddad, & M. Cecconi (Eds.), *Intensive Care Fundamentals: Practically Oriented Essential Knowledge for Newcomers to ICUs* (pp. 225–239). Springer International Publishing.

Younis F H , Eljamay S , Eldali AM. (2020). The Rate of Fast-Food Consumption among Teenagers in Derna City, Libya. *Al-Mukhtar Journal of Sciences*, 35 (1), 13-18.

Xiao, W., Huang, L., Guo, H., Liu, W., Zhang, J., Liu, Y., Hua, T., & Yang, M. (2024). Development and validation of potential phenotypes of serum electrolyte disturbances in critically ill patients and a Web-based application. *Journal of Critical Care*, 82, 154793.