НИРКИ KIDNEYS

UDC 616.13/.14-092-089.844 *DOI: https://doi.org/10.22141/2307-1257.13.1.2024.440*

Funmilayo A. Ibitoba, Oluwaseyi A. Akpor, Agatha O. Ogunkorode, Aderemi Y. Bello, Omotomilola O. Ogunyemi
College of Medicine and Health Sciences, Afe Babalola University, Ado-Ekiti, Nigeria

Hemodialysis as a treatment option for chronic kidney disease in Ekiti State University Teaching Hospital: a retrospective study

For citation: Počki. 2024;13(1):48-54. doi: 10.22141/2307-1257.13.1.2024.440

Abstract. *The prevalence of chronic kidney disease (CKD) has surged to approximately 13 % in the past two decades due to an increase in associated risk factors. Poorly managed CKD can progress to end-stage renal disease, necessitating renal replacement therapy, with hemodialysis being the most common form. This study examines a 5-year record of hemodialysis in a healthcare facility in southwest Nigeria. Study data were collected from dialysis register and case study of patients that were consecutively dialyzed at the dialysis centre of Ekiti State University Teaching Hospital between January 2017 and December 2021. Unstructured proforma was used to extract data for the study. There was a total of 152 patients and 1600 hemodialysis sessions between January 2017 and December 2021. More than a quarter of the patients were civil servants and there were more males than females (p = 0.3325). CKD was the major indication for hemodialysis with hypertension as its main cause while post-partum hemorrhage was the most common cause of acute kidney injury. Only 3.3 % of the patients had permanent access of arteriovenous fistula. Notably, 47.2 % of the patients were lost to follow-up, 29.8 % left to other centres by either referral or self-decision, while 18.6 % died of CKD-related complications. Nevertheless, 4.4 % patients were still dialyzing in the Centre as of December 2021. Comparatively fewer hemodialysis sessions occurred, yet they led to improved patient outcomes. Regular follow-ups and government subsidies are recommended to ease patient burdens.*

Keywords: *chronic kidney disease; acute kidney injury; renal replacement therapy; dialysis; hemodialysis*

Introduction

Chronic kidney disease (CKD) is a non-communicable and irreversible damage to the renal function and structure, and a progressive decline in glomerular filtration rate (GFR) that is less than 60 ml/min/1.73 m^2 for over three months [1, 2]. The prevalence of CKD across the globe has increased to approximately 13 % in the last two decades [2, 3]. This might be due to an increase in the prevalence of CKD risks such as hypertension, diabetes and glomerulonephritis [3].

When CKD is left untreated according to Hinkle and Cheever (2018), it results in the end-stage renal disease (ESRD) which is the final stage of CKD. End-stage renal disease causes the retention of uremic waste products in the body, and this calls for renal replacement therapy (RRT). Renal replacement therapy is the treatment modalities for ESRD which could be in form of hemodialysis (HD), peritoneal dialysis, and renal transplantation [4].

Renal replacement therapy has changed the management of patients with kidney failures and approximately 4 million people are living on RRT across the globe [5]. Dialysis is a form of RRT used for individuals experiencing a rapid or gradual loss of kidney function to remove excess fluid, toxins, and solutes in order to maintain homeostasis which is a stable internal environment [6]. The word dialysis is derived from the Greek words *dia* which is "through", and *lysis* which means "to loose" or "to split" [7].

The population of people receiving dialysis treatment globally is on the increase and HD remains the most common form of RRT, accounting for approximately 69 % of all RRT and 89 % of all dialysis, in particular in low- and middle-income countries [8]. However, a considerable number of people most especially in the low-income countries such as Nigeria still lack access to RRT, and people still die in millions every year from kidney failure, often without supportive care [9].

For correspondence: Funmilayo A. Ibitoba, MSc, Postgraduate Researcher, Faculty of Nursing Sciences, Afe Babalola University, Ado-Ekiti, Nigeria; e-mail: loveibitoba03@gmail.com; phone: +2348038936033

Full list of authors' information is available at the end of the article.

Hemodialysis is a medical technology applied for various renal diseases and it is the most common method of RRT in Nigeria [10]. Whenever the function of the kidney is altered, HD replaces only the filtration function but does not replace the hormonal functions [11, 12]. Hemodialysis is the main treatment modality for patients with kidney failure practiced in many countries in the sub-Saharan region. In Nigeria, HD has been the stay of RRT since its commencement in the 1980s [13].

An appropriate vascular access is required for effective dialysis to withdraw and return blood to the patient. The perfect HD access should be able to deliver adequate flow rates to sustain prescribed dialysis, it must also be easy to access/cannulate, cost-effective, and acceptable to patients [14]. There are permanent and temporary vascular accesses [15].

Though HD is a life-saving intervention to replace the functions of a damaged kidney, it is also associated with significant side effects and complications hence, this seminar aims to provide a 5-year record of HD in Ekiti State University Teaching Hospital between January 2017 and December 2021.

Methods

This is a retrospective study of dialysis register and case study of patients that were consecutively dialyzed at the dialysis centre of Ekiti State University Teaching Hospital between January 2017 and December 2021. Unstructured proforma which consists of number of patients dialyzed, socio-demographic characteristic, number of hemodialysis done, indications for hemodialysis, etiology of chronic kidney disease and acute kidney injury (AKI), vascular access type, treatment outcome, hemodialysis and complications was applied to extract data used for the study.

All the patients that were seen in the Centre and those referred from other facilities either for AKI or ESRD during the period under review were involved in the study. Patients who dialyzed once that were referred from other facilities due to technical issues in their centres were excluded from the study. Ethical clearance for the use of the record was obtained from the ethics and research committee of the hospital.

Data analysis

The completed questionnaires retrieved were coded and analyzed using Statistical Package for the Social Sciences version 25. Data were descriptively and inferentially analyzed (chi-square) and presented in tables and charts. Inferential analysis such as chi-square was used to determine the relationship between: 1) gender and indication for dialysis, and 2) age distribution and the indication for dialysis. The probability $p < 0.05$ was taken as the minimum level of significance.

Results

This section presents the record of HD in the Ekiti State University Teaching Hospital, Ado-Ekiti, between January 2017 and December 2021. Ethical approval was obtained from the ethics and research committee of the hospital to access HD record.

One hundred and fifty-two patients had 1,600 HD sessions done between January 2015 and December 2021. More than half (55.3 %) of the participants were males while the remaining were females. Patients aged 41–50 and 51–60 years have the highest frequency of 21.7 % each, while those aged 11–20 have the lowest frequency of 5.9 %.

From 152 patients, about 71.1 and 15.1 % have CKD and AKI, respectively, while the remaining 13.8 % had acute on CKD as the indication for HD. The main cause of CKD in more than half (53.7 %) of the patients was hypertension, this was followed by chronic glomerulonephritis (21.3 %) while the least was systemic lupus erythematosus (SLE) with 1.9 %. Post-partum hemorrhage in more than two-third (60.9 %) was the major cause of AKI. Those with AKI were promptly treated, hence they didn't progress to CKD.

Temporary access for HD was mostly used. Femoral access was the most common in 69.7 % of the patients while only 3.3 % has permanent access of arteriovenous (AV) fistula. Only 3.9 % of the patients could afford 3 sessions per week while 41.4 % patients were able to do only one session of HD per week. All the patients except two that had their first six session paid by the NHIS paid out of pocket through the period under review. Almost half (47.2 %) of the patients were lost to follow-up, 29.8 % were either referred or left for other dialysis centre while 18.6 % died from CKD-related complications. However, 4.4 % of the patients were still dialyzing in the Centre as of December 2021. Complications recorded among the patients during HD were hypotension (9.9 %), hypertension (1.3 %), rigor (15.8 %), respiratory distress (3.9 %), muscle cramps (5.9 %) and headache (3.3 %). Complications from vascular access were hemorrhage, infection, failed cannulation, and pains.

Number of patients dialyzed

As shown in Table 1, a total number of 152 patients was seen during the period under review with the highest number of patients seen in 2017 and the lowest in 2021, with 37 and 20 patients, respectively.

Table 1. Number of patients dialyzed per year

Year	Number of patients	Percentage
2017	37	24.3
2018	32	21.1
2019	34	22.4
2020	29	19.1
2021	20	13.1
Total	**152**	**100**

Gender distribution of the patients

As shown in Fig. 1, between January 2017 and December 2021, a total of 152 patients have HD done. More than half (55.3 %) were males while the remaining were females. Male were more than females in all the years under review except 2019.

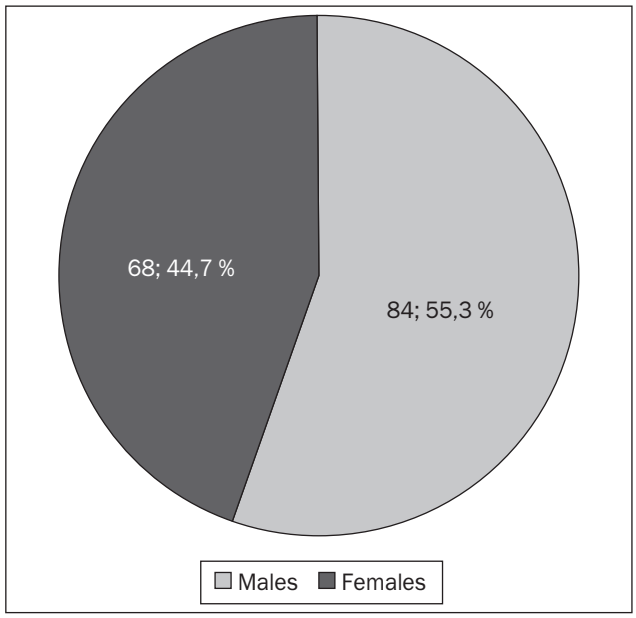

Figure 1. Gender distribution of the patients

Age distribution of the patients

As presented in Table 2, patients aged 41–50 and 51–60 years have the highest frequency of 33 (21.7 %), this was followed closely by patients that are 60 years and above with frequency of 31 (20.4 %) while patients aged 11–20 have the lowest frequency of 9 (5.9 %).

Table 2. Age distribution of the patients

Age	Frequency	Percentage
Below 20	9	5.9
21–30	15	9.9
31–40	31	20.4
41–50	33	21.7
51–60	33	21.7
60 and above	31	20.4
Total	**152**	**100**

Aggregate of hemodialysis done

As revealed in Table 3, between January 2017 and December 2021, there were 1,600 HD sessions. During the period under review, there was a progressive decline in the number of HD done with the highest in 2017 (402 sessions) and the lowest in 2021 (219 sessions).

Table 3. Number of sessions done

Year	Number of sessions	Percentage
2017	402	25.1
2018	393	24.4
2019	314	19.5
2020	272	16.9
2021	219	13.7
Total	**1,600**	**100**

Indications for hemodialysis

As shown in Fig. 2, out of 152 patients that were seen during these 5 years, 108 (71.1 %) were dialyzed as a result of CKD. This was followed by 23 (15.1 %) patients with AKI while the remaining 21 (13.8 %) patients were dialyzed due to acute on CKD.

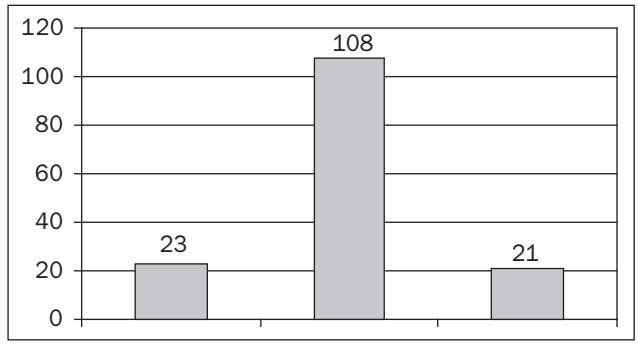

Figure 2. Patients' indications for dialysis

Causes of chronic kidney disease

As displayed in Table 4, hypertension was the main cause of CKD in more than half of the patients with 53.7 % which was followed by chronic glomerulonephritis and diabetes mellitus with 21.3 and 15.7 %, respectively. The least cause of CKD among the patients was SLE with 1.9 %.

Table 4. Causes of chronic kidney disease

Causes	Frequency	Percentage
Hypertension	58	53.7
Diabetes mellitus	17	15.7
Chronic glomerulonephritis	23	21.3
SLE	2	1.9
Hypertension and diabetes	8	7.4
Total	**108**	**100**

Causes of acute kidney injury

As shown in Table 5, post-partum hemorrage was the most frequent cause of AKI accounting for over two-third of cases seen while post-operative AKI is the least cause accounting for just 4.3 %.

Table 5. Causes of AKI

Causes	Frequency	Percentage
Post-partum hemorrage	14	60.9
Sepsis	6	26.1
Obstruction	2	8.7
Post-operative AKI	1	4.3
Total	**23**	**100**

Table 6. Access for hemodialysis

Year	Access			Total
	Femoral	Internal jugular	AV fistula	
2017	26	9	2	**37 (24.3 %)**
2018	23	7	2	**32 (21.1 %)**
2019	24	10	0	**34 (22.4 %)**
2020	20	8	1	**29 (19.1 %)**
2021	13	7	0	**20 (13.1 %)**
Total	**106 (69.7 %)**	**41 (27 %)**	**5 (3.3 %)**	**152 (100 %)**

Hemodialysis access

As revealed in Table 6, only 3.3 % of the patients have permanent access of AV fistula while the remaining used temporary access of femoral and internal jugular with 69.7 and 27 %, respectively.

Outcome of hemodialysis

As shown in Table 7, almost half (47.4 %) of the patients were lost to follow-up, 29.6 % were either referred or left for other dialysis centre in the state while 18.4 % died from CKD-related complications. However, 4.6 % of the patients were still dialyzing in the Centre as of December 2021.

Table 7. Outcome of hemodialysis

Outcome	Frequency	Percentage
Lost to follow-up	72	47.4
Left for another facility	45	29.6
Died from CKD-related complications	28	18.4
Still on dialysis	7	4.6
Total	**152**	**100**

Complications of hemodialysis

As shown in Table 8, majority of the complications recorded were treatment-related while catheter-related complications were rare. Out of the 1,600 sessions for the period under review, complications such as rigor, hypotension and muscle cramps were 15.8, 9.9, 5.9 %, respectively. Others were respiratory distress, headache, and hypertension.

Table 8. Hemodialysis complications

Treatment-related complications	Frequency	Percentage
Rigor	24	15.8
Hypotension	15	9.9
Muscle cramps	9	5.9
Respiratory distress	6	3.9
Headache	5	3.3
Hypertension	2	1.3
Total	**61**	**40.1**

Relationship between gender and indication for dialysis

Chi-square of independence was performed to examine the relationship between gender and the indication for dialysis. The relationship between the variables was significant: χ^2 (1, N = 152) = 6.8071, p = 0.3325. Men were more likely to develop CKD and acute on CKD more than women while women were likely to develop AKI more than men (Table 9).

Table 9. Relationship between gender and indication for dialysis

Gender	Indication for dialysis			Total
	AKI	CKD	Acute on CKD	
Male	7	64	13	84
Female	16	44	8	68
Total	23	108	21	152

Relationship between age distribution and indication for dialysis

Chi-square of independence was performed to examine the relationship between age distribution and the indication for dialysis. The relationship between the variables was not significant: χ^2 (2, N = 152) = 0.6946, p = 0.706591. Therefore, there is no significant relationship between the age distribution and the development of AKI, CKD and acute on chronic kidney disease (Table 10).

Table 10. Relationship between age distribution and indication for dialysis

Age	Indication for dialysis			Total
	AKI	CKD	Acute on CKD	
< 40 years	8	41	6	55
> 40 years	15	67	15	97
Total	23	108	21	152

Discussion

During the period under review, HD sessions though low were generally successful with better outcomes of the patients. However, a lot of challenges were faced which were either the patients' factor, the medical personnel factor or the management factor.

Majority of the patients that started the procedure could not afford the recommended sessions of HD for optimal wellbeing which is 3 sessions per week despite the fact that it was subsidized by the MTN Foundation. This could be attributed to financial constraints as many of the patients belonged to either the low- or middle-income class. Also, most patients could not afford the recommended dosage on iron sucrose and erythropoietin; thereby, their packed cell volume is always low.

Limited number of trained nephrology nurses, nephrologists, two out of three functioning HD machines and no machine for infectious cases were the reasons for the number of HD sessions done in 5 years. Also, there were no renal technicians to maintain the machines, the nurses were the ones doing the little they could, as such, anytime the machine was faulty, the HD had to be put on hold till it was repaired, and this usually takes 3–7 days. Consequently, the patients were referred to a nearby hospital which is a threat to the Centre. Once they were there, they never returned.

There were 152 patients with 1,600 HD sessions during the 5 years under review. This number of HD sessions was low compared to other HD centres in the state. This could be because of the limited number of HD machines available in the Centre. The low number of sessions done was similar to the report of Abene et al. [13] that HD practice is grossly insufficient among ESRD patients where the majority of patients within the sub-region had less than three sessions of dialysis per week.

Also, it was reported from the findings that there were more males (55.3 %) than females. This might be because men may have an increased risk of reaching ESRD than women due to hormonal level differences as higher testosterone levels and unhealthy lifestyles may cause renal failure [16]. This finding was similar to the findings of Abdu et al. [17] from Northern Nigeria where males were 54.9 % and that of in the study of Okaka and Unuigbe [18] conducted in Benin City, Nigeria. This finding is not peculiar to Nigeria alone as Mukakarangwa et al. [19] reported same finding.

Chi-square of independence was performed to examine the relationship between gender and the indication for dialysis. The relationship between the variables was significant: χ^2 (1, N = 152) = 6.8071, p = 0.3325. Men were more likely to commence dialysis earlier than women. This is likely due to the renoprotective effects of estrogens in women and/or the damaging effects of testosterone in men coupled with unhealthier lifestyles. This finding was similar to that of Carrero et al. [20].

Furthermore, the patients aged 41 and above were more (63.8 %) among the patients dialyzed. This could be because as one ages, the kidney functions declines. This finding was similar to that of Okaka and Unuigbe [18] who reported that those below 40 years of age were less than patients who were over 40 years of age. However, the relationship between age distribution and indication for dialysis was not significant: χ^2 (2, N = 152) = 0.6946, p = 0.706591. Therefore, the indication for dialysis is the same for different age groups.

Chronic kidney disease was found out to be the major indication for HD procedure among the patients. Consequently, hypertension was reported as the major cause of CKD among the patients that were dialyzed in the Centre. This was similar to the study of Abene et al. [13] who reported 73.5 % had ESRD. On the contrary, Dada et al. [10] reported that chronic glomerulonephritis was the major cause of CKD. Also, post-partum hemorrhage was the most common cause of AKI among the patients that presented to the Centre for HD. Most of these patients were referred to this facility following complications encountered in their primary delivery centres.

The most frequent vascular access in the Centre was femoral access with 69.7 % while only 3.3 % had permanent access. This could be attributed majorly to the financial constraints on the part of the patients. Other reason for this was the poor state of the patients' condition on admission. Also, the Centre did not have a vascular surgeon to create permanent access such as AV graft and AV fistula, this finding was supported by the report of Abene et al. [13] where 70.6 % of the patients had femoral access of HD.

Treatment-related complications recorded among the patients during HD were rigor, muscle cramps, hypotension, respiratory distress, headache, and hypertension. Rigor was the most common complication with 15.8 %, while the least complication experienced was hypertension with 1.3 %. Rare complications from vascular access were hemorrhage, infection, failed cannulation, and pains. The type and frequency of complications seen among our patients were similar to the report of Mukakarangwa et al. [19] that reported hypotension, muscle spasms and headaches.

Only 3.9 % of the patients were able to maintain three sessions per week recommended by the Kidney Disease Outcomes Quality Initiative for the first three months while 41.4 % patients were able to do one session of HD per week. This could be because almost all the patients paid out of pocket without any financial support from either the government or non-governmental organizations except two patients that had their first six session paid by the NHIS.

Non-adherence to the prescribed session per week could be attributed to financial constraints as many of the patients belonged to either the low- or middle-income class. A session of HD as of December 2021 in the Centre was 21,000 naira only that was cheap compared to other HD facilities. Abene et al. [13] reported about inadequate HD sessions: the average frequency of dialysis among those with ESRD was twice weekly. Only 15 (30.0 %) of those with ESRD continued dialysis after 3 months.

Also, approximately a half of the patients (47.2 %) were lost to follow-up due to unknown reason. However, it could be attributed to ignorance, religious belief, and the financial constraints. In addition to the above findings, 29.8 % of the patients either left for or were referred to another facility. This could be because the Centre did not have machine for infectious cases or for logistic reasons on the part of the machine or manpower.

About 18.6 % of the patients died of CKD-related complications in the ward during the period under review such as cardiovascular diseases. According to Bello et al. [8], cardiovascular diseases affect more than two-thirds of the patients receiving HD treatment, and this is the major cause of morbidity and almost 50 % of mortality. Majority of these

patients presented late to the hospital with several complications involving nearly all the systems. Hence, they couldn't make it with dialysis treatment.

However, despite the challenges encountered by the patients and the facility during the period under review, 4.4 % of the patients were still dialyzing as of December, 2021. This could be due to the fact that they were financially buoyant and could afford the number of sessions that would allow them line near to normal lives.

Less than one-third (31.8 %) of the patients could afford the common prescribed drugs to manage hypertension and diabetes as well as iron sucrose and/or erythropoiesis-stimulating agents. Likewise, necessary biochemical profile for monitoring and evaluation of patients could not be done regularly due to financial problem. This created a big challenge for the managing team; therefore, the decision to adjust the treatment became difficult because there was no laboratory investigation carried out to support such decision.

Conclusions

Hemodialysis sessions during the period under review were low compared to other centres in the state due to a limited number of HD machines and personnel. The HD sessions were generally successful with better outcomes of the patients, however, a lot of challenges that were faced were either the patients' factor, the medical personnel factor or the management factor.

Male patients were found to be more than the female patients that received HD treatment. Majority of the patients that started the procedure could not afford the recommended sessions of HD for optimal wellbeing which is 3 sessions per week despite the fact that it was subsidized by the MTN Foundation. Men were more likely to commence dialysis earlier than women due to the effect of sex hormone.

Chronic kidney disease was the major indication for HD procedure and hypertension was the major cause of CKD among the patients that were dialyzed in the Centre. Also, post-partum hemorrhage was the most common cause of AKI.

Femoral access was commonly used and only 3.3 % of the patients had permanent access of AV fistula. Rigor was the most common complication experienced by the patients during hemodialysis. However, there were other rare catheter-related complications that ware reported such as hemorrhage.

About 47.2 % of the patients were lost to follow-up, 29.8 % left to other centres by either referral or self-decision, and 18.6 % died of CKD-related complications. However, 4.4 % of these patients were still dialyzing in the Centre as of December 2021.

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Received 04.02.2024
Revised 14.02.2024
Accepted 23.02.2024

Information about authors

Funmilayo A. Ibitoba, MSc, Postgraduate Researcher, Faculty of Nursing Sciences, Afe Babalola University, Ado-Ekiti, Nigeria; e-mail: loveibitoba03@gmail.com; phone: +2348038936033; https://orcid.org/0009-0000-7003-7560

Oluwaseyi A. Akpor, PhD Professor, Department of Nursing Science, College of Medicine and Health Sciences, Afe Babalola University, Ado-Ekiti, Ekiti State, Nigeria; phone: +2347068531599; e-mail: akporoa@abuad.edu.ng; https://orcid.org/0000-0002-3465-135X

Agatha O. Ogunkorode, PhD Professor, Department of Nursing Science, College of Medicine and Health Sciences, Afe Babalola University, Ado-Ekiti, Ekiti State, Nigeria; phone: +2348065821012; e-mail: ogunkorodeqo@abuad.edu.ng; https://orcid.org/0000-0003-4234-9449

Aderemi Y. Bello, MSc, Postgraduate Researcher, Department of Nursing Science, College of Medicine and Health Sciences, Afe Babalola University, Ado-Ekiti, Ekiti State, Nigeria; phone: +2349022444675; e-mail: belloaderemi82@gmail.com; https://orcid.org/0009-0009-3717-901X

Omotomilola O. Ogunyemi, MSc, Researcher, Department of Medical Laboratory Sciences, College of Medicine and Health Sciences, Afe Babalola University, Ado-Ekiti, Ekiti State, Nigeria; phone: +2348035811574; e-mail: temitomilola@yahoo.com; https://orcid.org/0009-0005-6374-6322

Conflicts of interests. Authors declare the absence of any conflicts of interests and own financial interest that might be construed to influence the results or interpretation of the manuscript.

Acknowledgments. None.

Authors' contribution. *Funmilayo A. Ibitoba* — conceptualization, data curation, formal analysis, investigation, methodology, project administration, resources, software, visualization, original draft; *Oluwaseyi A. Akpor* — conceptualization, methodology, project administration, supervision, validation, review & editing; *Agatha O. Ogunkorode* — formal analysis, supervision, review & editing; *Aderemi Y. Bello* — data curation, funding acquisition, investigation, software, original draft; *Omotomilola O. Ogunyemi* — data curation, investigation, resources, visualization.

Funmilayo A. Ibitoba, Oluwaseyi A. Akpor, Agatha O. Ogunkorode, Aderemi Y. Bello, Omotomilola O. Ogunyemi
College of Medicine and Health Sciences, Afe Babalola University, Ado-Ekiti, Nigeria

Гемодіаліз як варіант лікування хронічної хвороби нирок у навчальній лікарні Державного університету Екіті: ретроспективне дослідження

Резюме. Поширеність хронічної хвороби нирок (ХХН) зросла приблизно на 13 % за останні два десятиліття через збільшення супутніх факторів ризику. Погано контрольована ХХН може прогресувати до термінальної стадії ниркової недостатності, що потребує замісної ниркової терапії, найпоширенішою формою якої є гемодіаліз. У цьому дослідженні розглядається 5-річна історія застосування гемодіалізу в медичному закладі на південному заході Нігерії. Дані були зібрані з реєстру діалізу та при дослідженні клінічних випадків у пацієнтів, які послідовно проходили цю процедуру в центрі діалізу навчальної лікарні Державного університету Екіті в період з січня 2017 року по грудень 2021 року. Для отримання даних використовувалася неструктурована форма. Загалом між січнем 2017 року та груднем 2021 року 152 пацієнти отримали 1600 сеансів гемодіалізу. Більше чверті хворих були державними службовцями, і чоловіків було більше, ніж жінок (p = 0,3325). ХХН стала основним показанням до гемодіалізу з артеріальною гіпертензією як основною причиною, тоді як найчастішою причиною гострого ураження нирок була післяпологова кровотеча. Лише 3,3 % пацієнтів мали постійний доступ через артеріовенозну фістулу. Слід зауважити, що 47,2 % пацієнтів були втрачені для подальшого спостереження, 29,8 % перейшли до інших центрів через направлення або за власним рішенням, тоді як 18,6 % померли від ускладнень, пов'язаних із ХХН. Незважаючи на це, станом на грудень 2021 року 4,4 % хворих усе ще перебували на діалізі в центрі. Відбулося порівняно менше сеансів гемодіалізу, але вони призвели до покращення результатів у пацієнтів. Рекомендується регулярне спостереження та державні субсидії, щоб полегшити навантаження на хворих.

Ключові слова: хронічна хвороба нирок; гостре ураження нирок; замісна ниркова терапія; діаліз; гемодіаліз