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Prevalence of uncontrolled hypertension in hemodialysis patients: A cross-sectional study from Palestine

Rowa' AL-Ramahi[1,*] *& Ruba Amr*[1]

[1] Department of Pharmacy, An-Najah National University, Nablus, Palestine.

*Corresponding author: rawa_ramahi@najah.edu

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ABSTRACT

Background: Hypertension (NTN) is very common among the hemodialysis (HD) population, and controlling high blood pressure (BP) is essential to decrease the risk of cardiovascular diseases and mortality in HD patients. This study aimed to assess the prevalence of hypertension among HD patients, the percentage of patients who reached predialysis and post-dialysis recommended goals of BP, and to find any possible association between controlled HTN and some socio-demographic and clinical factors. **Method**: The study was a cross-sectional observational at three hemodialysis units in the south of Palestine. The minimum calculated sample size was 308, so all adult hemodialysis patients who met the inclusion criteria in the selected units were included. Controlled NTN was defined as predialysis BP of <140/90 mmHg and post-dialysis BP of <130/80 mmHg according to KDOQI Clinical Practice Guidelines **Results**: A total of 390 patients participated in the study; 203 males (52.1%), mean age ±SD was 52.4±16.2, diabetes mellitus (DM) was the leading cause of ESRD (43.3%) followed by uncontrolled HTN (29.2%). The average duration of hemodialysis therapy ±SD was 37.47±37.57 months. Of the 390 patients, 356 (91.3%) had HTN, and 231 (64.9%) patients with HTN did not achieve the predialysis and post-dialysis BP target goals of less than 140/90 and 130/80, respectively. There was a significant association between control of BP and gender only, as 59.2% of patients who achieved the target BP goals were female (p-value = 0.002). Patients have prescribed 2875 medication orders of 53 different medications with a mean of 7.37±2.38; calcium carbonate was the most frequently prescribed medication (67.4%), followed by amlodipine (64.6%) and aspirin (56.7%). Amlodipine was the most prescribed antihypertensive medication. **Conclusion**: The study showed a very high rate of HTN among HD patients. The control of BP was inferior as the majority of patients did not achieve the target blood pressure goals. It is recommended to individualize HD session duration and frequency to meet patients' needs, in addition to counseling patients about the appropriate non-pharmacological interventions such as sodium restriction and being adherent to antihypertensive medication dose and timing.

Keywords: Hypertension, Hemodialysis, Palestine.

INTRODUCTION

Chronic kidney disease (CKD) is a rising global health issue, affecting 8-16% of the population worldwide (1) and requiring high human and economic costs (2). Risk factors for CKD include initiation factors such as diabetes mellitus (DM), hypertension (HTN), obesity, smoking, medication toxicity, and glomerulonephritis (3). Progression factors include poor glycemic control, high blood pressure, obesity, and proteinuria (3, 4). Early screening and detection of CKD can be cost-effective for many people, especially patients with diabetes mellitus and hypertension (3, 5).

Diabetes mellitus is the first leading cause of CKD worldwide; in the United States, 50% of newly diagnosed CKD patients have diabetic nephropathy (3). In a study from Palestine, the vast majority of end-stage renal disease (ESRD) patients were either diabetic (22.5%) or hypertensive (11.1%), or both at the same time (10.6%) (6). In another study from Palestine, the prevalence of CKD among diabetic adults in the North West Bank was found to be 23.6%; 19.7% had stage 3 CKD, 2.6% had stage 4 CKD, and 1.3% had stage 5 CKD, and risk increased with hypertension, smoking and advanced age (7).

Hypertension is the second leading cause of CKD and ESRD; it accounts for 27% of ESRD patients in the United States (3) and 25% of ESRD cases in the west bank/Palestine (6). Close monitoring of high-risk individuals

is essential to improve outcomes and prevent the early progression of the disease (8). Hypertension can be considered both cause and complication of CKD. Many mechanisms are responsible for the development of HTN in CKD, including activation of the renin-angiotensin-aldosterone system (RAAS), which in turn increases water and sodium retention (9), endothelial dysfunction, oxidative stress, and volume overload also play a significant role in hypertension development (10). Blood pressure control in patients with CKD, especially in patients with high proteinuria, is crucial to delay disease progression and reduce the risk of CVD (8, 9, 11).

The relation between HTN and all-cause mortality in HD patients decided on target BP goals in this population (12) (13). For the HD population, this is not the reality; in other words, it is not a linear relationship between elevated BP and all-cause mortality, as many studies revealed a U-shaped relationship meaning that increased risk of mortality was linked with both very low and very high BP. This does not include patients without co-morbid conditions and who are young; this sub-group of HD patients showed a linear relationship between increased BP and all-cause mortality (12-16). Therefore the optimal target blood pressure and treatment plan should be individualized according to each patient's condition, age, and co-morbidities (10). According to the JNC-8 guidelines, in the population 18 years or older with CKD goals of treatment, SPB <140 mm Hg and DBP<90 mm Hg (16), for the dialysis population, it seems that predialysis BP of <140/90 mm Hg and post-dialysis BP of < 130/80 are reasonable levels (15, 16).

Beta-blockers are frequently used in the treatment of HTN in dialysis patients; trials have proven the efficacy of beta-blockers in lowering BP, reducing CV mortality risk, and regression of LVH among HD patients, which makes this class an excellent first-line therapy of HTN in HD patients (17-19). Calcium channel blockers (CCBs), the main dihydropyridines, are considered in treating HTN in HD patients. Non-dihydropyridines are not preferred as less data is available about their effectiveness in dialysis patients (12, 19, 20). Angiotensin-converting-enzyme-inhibitors and angiotensin-receptor-blockers (ACE-Is and ARBs)are considered reasonable first-line agents as these agents provide cardioprotective effects (21). Diuretics are with little or no role in ESRD patients on dialysis without urine output, while patients with residual renal function (at least 100 ml of urine\day) may benefit from loop diuretics in reducing volume overload and improving BP; high doses of loop diuretics are required, therefore, side effects mainly ototoxicity is a concern (12, 17). Other antihypertensive agents may be needed as add-on therapy in case of specific co-morbid conditions and if HTN is not controlled with one or two antihypertensive agents (19, 21).

Limited data on hypertension in ESRD prevalence, control, and epidemiology in Palestine is available. This study aimed to assess the prevalence of hypertension among ESRD patients, the percentage of patients who reached predialysis and post-dialysis recommended goals of BP, and to find any possible association between controlled HTN and some socio-demographic and clinical factors.

METHODS

Study design and setting

The study was a cross-sectional observational study. It was performed in three different hemodialysis units of governmental hospitals in the south of Palestine, Hebron hospital (Alia), Beit Jala hospital (Al Housein), and Yatta hospital (AbuAlhasan Al Kassem) between the first of June 2019 and the end of August 2019. Palestinian Ministry of Health is responsible for providing hemodialysis treatment and clinical care for ESRD patients in Palestine. According to the annual health report in Palestine 2019, 264 dialysis machines were serving 1545 HD patients distributed within 11 HD units in West Bank (22).

The population of the study and sample size

Raosoft sample size calculator was used to calculate the minimum sample size based on this number of HD patients; the recommended sample was 308. The study

included 390 ESRD patients treated with chronic hemodialysis in the south of Palestine who fitted the inclusion criteria and agreed to participate in the study; they were 220 patients from Hebron hospital (Alia), 111 patients from Beit Jala hospital (Al Housein), and 59 patients from Yatta hospital (Abu Alhasan Al Kassem). Inclusion criteria were all adult patients on chronic hemodialysis who were able and willing to participate in the study. Exclusion criteria were patients < 18 years old, severely ill patients, psychotic patients unable to provide information, and patients with acute renal failure.

Data collection

A data collection form was prepared depending on a literature review of previous studies, review articles, and guidelines (23-25). All information was collected from governmental electronic health records of hemodialysis units (Avicenna HIS program), which was used to identify long-term hemodialysis patients. Baseline demographics, co-morbid conditions, and information about the medications were collected. In addition, patients were interviewed to obtain information regarding medications and socio-demographic information not provided in the electronic health records; the last medication order was documented for each patient. BP readings were measured for each patient before and after the HD session. Controlled NTN was defined as predialysis BP of <140/90 mmHg and post-dialysis BP of <130/80 mmHg according to KDOQI Clinical Practice Guidelines (23).

The study protocol was approved by local institutional review boards (IRB) of An-Najah National University (Reference number: PH March 2019) and the Ministry of Health before the beginning of this study. All subjects were informed of their rights to refuse or discontinue participation in the study according to ethical standards. Informed verbal consent was obtained before starting the interviews.

Statistical analysis

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS version 21). Mean ± standard deviation was computed for continuous data. Frequencies and percentages were calculated for categorical variables. The Chi-square test was used for testing relationships between categorical variables. A probability (p) value of less than 0.05 was considered statistically significant for all analyses.

RESULTS

Socio-demographic characteristics

This study included 390 chronic HD patients; 203 males (52.1%) and 187 females (47.9%). Age was between 18-85 years, mean age ± SD was 52.4±16.16years. The mean predialysis weight ± SD was 74.9±17.16 kg, while the mean post-dialysis weight ± SD was 72.38±17.3 kg. The mean height ± SD was 163.87±9.79 cm. Regarding smoking, 18.5% of patients were smokers. Most of the patients were not working (94.9%). A middle school degree was the highest level of education among patients (33.1%). The majority of the patients (67.9%) were living in villages. (Table 1) shows the socio-demographic characteristics of the included patients.

Table (1): Socio-demographic characteristics of the included patients (N = 400).

Characteristic	**Mean ± SD**	
Age	52.4±16.2	
Predialysis weight	74.9±17.2	
Postdialysis weight	72.38±17.3	
Height	163.87±9.8	
Characteristic	**Frequency**	**Percentage**
Gender		

Characteristic	Mean ± SD	
Male	203	52.1%
Female	187	47.9%
Living place		
City	114	29.2%
Village	265	67.9%
Camp	11	2.8%
Educational level		
Primary and illiterate	108	27.7%
Middle school	129	33.1%
High school	102	26.2%
Graduate	49	12.6%
Postgraduate	2	0.5%
Work		
Yes	20	5.1%
No	370	94.9%
Smoking		
Yes	72	18.5%
No	318	81.5%

Hypertension and other co-morbidities

Among the 390 patients, 356 (91.3%) patients undergoing hemodialysis were diagnosed with HTN, 279 (78.4%) of them had HTN before developing ESRD, and the rest of them (77 patients) became hypertensive after starting hemodialysis treatment representing 21.6% of all hypertensive patients.

Based on past medical history, many causes for ESRD were documented in patients' files; DM was the leading cause (43.3%), followed by uncontrolled hypertension (29.2%), and 14.1% of cases were of unknown causes. While 5.6% were related to glomerulonephritis, 5% were reduced kidney mass, 2% were mono kidney, and 1% were drug-induced.

Hemodialysis information

The average duration of renal replacement therapy ± SD was 37.47±37.57 months, ranging from one to 216 months. Most patients received three dialysis sessions per week (71.8%), 25.1% received two sessions, 1.8%, and 1.3% received one and four sessions per week, respectively, 180 minutes was the length of dialysis session in the majority of patients (70.8%), 24.1% of patients received 240 minutes sessions, and less than 10% received shorter sessions.

Blood pressure monitoring

Around two-thirds, 243(62.3%) of the patient did not depend on home blood pressure measurement, 147(37.7%) patients who claimed that they measure their BP at home had different values, and more than 40% of these patients had readings within the goals (<140\90), 26.5% of them had instability in BP readings, that sometimes they obtained readings within goals, and sometimes their BP readings were high, and around 30% had high BP all the time. In addition, 24.9% of patients said they suffered from hypotension in the interdialytic phase (the time between dialysis sessions).

In hospitals, the average predialysis systolic blood pressure was 140.8 ± 20.8mmHg, the average predialysis diastolic blood pressure was 75.1±11.5mmHg, and the average post-dialysis systolic blood pressure was 127.7±17.3mmHg, the average post-dialysis diastolic blood pressure was 70.5 ± 9.5mmHg. The number of patients with HTN who achieved the predialysis and post-dialysis blood pressure targets of less than140/90 and

130/80, respectively, was 125(35.1%), meaning that 231 (64.9%) of patients had no adequate blood pressure control.

Patterns of drug prescription

The patients have prescribed 2875 medications, and 53 different medications were used to treat patients' chronic and acute conditions. The last prescription for every patient was included. The minimum number of medications was 2 per patient, and 16 was the maximum, with a mean of 7.37±2.38 (Figure 1). The most frequently prescribed agents were calcium carbonate (67.4%), amlodipine (64.6%), and aspirin (56.7%), respectively. When patients were asked if they were compliant with their medications, 338 (86.7%) claimed they were compliant with their medication doses and timing.

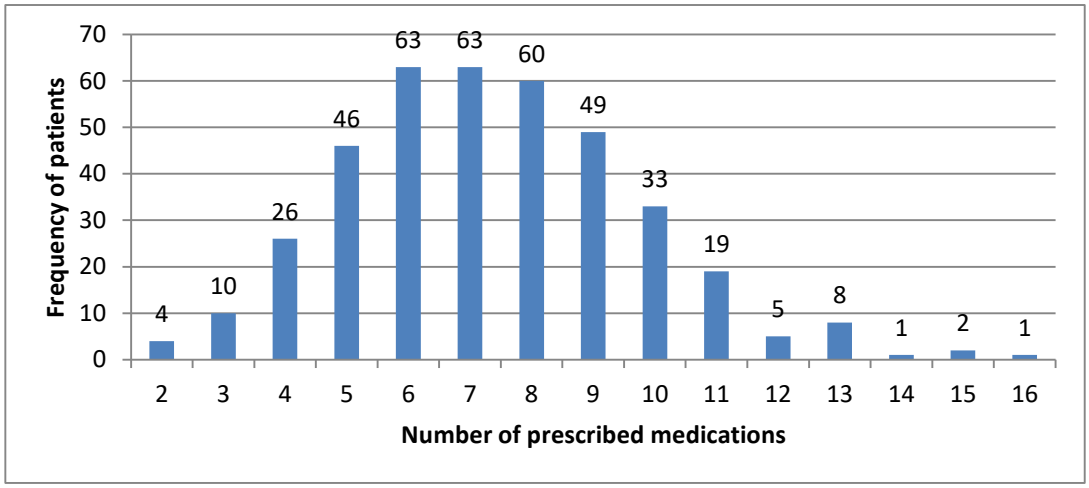

Figure (1): Frequency of patients according to the number of prescribed medications.

Association between socio-demographic and clinical factors and blood pressure control

There was a significant association between control of BP and gender; as 57.3% of patients who achieved the target BP goals were females (p-value = 0.003). There was no significant association between controlled BP and other socio-demographic and clinical factors (Table 2).

Table (2): Association between socio-demographic and clinical factors and blood pressure control (N= 356).

Factors	Controlled BP N= 125	Uncontrolled BP N= 231	P-value*
Gender			
Male	51(40.8%)	133 (57.6%)	0.002
Female	74 (59.2%)	98 (42.4%)	
Age			
18-40	29 (23.2%)	49 (21.2%)	0.259
41-60	55 (44.0%)	86 (37.2%)	
>60	41 (32.8%)	96 (41.6%)	
Work			
Yes	6 (4.8%)	12 (5.2%)	0.871
No	119 (95.2%)	219 (94.8%)	
Living place			
City	27 (21.6%)	75 (32.5%)	0.095

Factors	Controlled BP N= 125	Uncontrolled BP N= 231	P-value*
Village	94 (75.2%)	149 (64.5%)	
Camp	4 (3.2%)	7 (3.0%)	
Smoking			
Yes	21 (16.8%)	46 (19.9%)	0.473
No	104 (83.2%)	185 (80.1)	
Educational level			
High school or less	107 (85.6%)	203 (87.9%)	0.541
Graduate study or more	18 (14.4%)	28 (12.1%)	
Number of dialysis sessions per week			
1	2 (1.6%)	4 (1.7%)	0.798
2	35 (28.%)	57 (23.4%)	
3	86 (68.8%)	176 (73.6%)	
4	2 (1.6%)	3 (1.3%)	
Length of dialysis sessions			
≤180 minutes	92 (73.6%)	165 (41.4%)	0.663
≥210 minutes	33 (26.4%)	66 (28.6%)	
Number of medications			
≤5	26 (20.8%)	41 (17.7%)	0.482
>5	99 (79.2%)	190 (82.3%)	

*: Chi-square test

DISCUSSION

Among 390 patients, 356 (91.3%) were diagnosed with HTN; in 2016, an observational study conducted in ten hemodialysis units in Palestine found that 78.5% of patients were hypertensive (24). The results in our study are higher but close to other studies from different parts of the world; in a study of 1382 patients on maintenance hemodialysis in 11 dialysis units in Shanghai, HTN prevalence was 86.3% (25). Another cross-sectional study was conducted in Ohio to assess adherence to hypertension treatment among HD patients; 89% were diagnosed with HTN (26). These findings show that hypertension among ESRD patients is prevalent and requires special attention.

Many causes of ESRD were documented; DM was the leading cause (43.3%), followed by uncontrolled HTN (29.2%), 14.1% of cases were recorded from unknown causes, while 5.6% were related to glomerulonephritis, and 5% were reduced kidney mass, these results seem consistent with a previous study conducted in Palestine to identify the leading causes of CKD in Jenin district, the study included 84 CKD patients, DM was the leading cause (33.3%), followed by HTN (16.7%), and chronic glomerulonephritis was the third leading cause (13.1%) (27). More than 50% of patients suffered from co-morbid conditions, including diabetes mellitus, congestive heart failure, ischemic heart disease, and hepatitis. In one study from Palestine, which included ten dialysis units in the West Bank, HTN was the leading cause of ESRD (30.9%) of cases, followed by DM (29.5%), 19.6% of cases were recorded for unknown causes, 6.2% were polycystic kidney disease, 89.9% of patients had co-morbid conditions, including DM, myocardial infarction, congestive heart failure, hyperlipidemia, and gout (24). This confirms the importance of monitoring renal function in patients with co-morbidities, especially DM

and HTN, and trying to control these diseases to prevent renal failure.

The average duration of renal replacement therapy ± SD was 37.47±37.57 months, one month was the minimum duration and 216 months was the maximum, 180 minutes was the length of dialysis session in the majority of patients (70.8%), and most patients received three dialysis sessions per week (71.8%), and 25.1% received two sessions. These results are close to results from another study from Palestine that included ten HD units in the West Bank; among 275 HD patients, the minimum duration of dialysis was one month, and the maximum was 300 months. Most patients received 210-minute dialysis sessions (72.4%), 120 minutes in 0.4% cases, 180 minutes in 0.7% cases, and 26.5% received 240 minutes, and most of the patients (79.3%) received three HD sessions per week. (24). Individualization of the frequency and duration of HD sessions is essential to reach the target blood pressure and electrolyte levels, so it is highly recommended to calculate the correct duration for each patient.

Unfortunately, 62.3% of patients did not depend on home blood pressure measurement, indicating poor monitoring compliance. In HD patients, it is essential to monitor BP all the time because it is subjected to many variables 37.7% of patients who answered positively about using home monitoring had different values. More than 40% of these patients had readings within goals (less than 140\90 mm Hg), 26.5% of them had instability in BP readings, sometimes they obtained readings within goals, and sometimes their BP readings were high, around 30% of patients had high BP all the time, 24.9% of patients said that they suffered from hypotension in the interdialytic phase. Many patients need to improve BP control through proper counseling and treatment modifications.

The number of patients who did not achieve the predialysis and post-dialysis blood pressure targets of less than140/90 and 130/80, respectively, was 240 (67.4%). These results reflect poor compliance with target goals of blood pressure. The results of this study are lower than the results of one study which was conducted at Hebron governmental hospital in Palestine to evaluate the prescribing patterns and estimate the degree of compliance with treatment guidelines and target goals of therapy among dialysis patients, where of the 158 HD patients 77.2% achieved the target predialysis BP goals, while 57.6% achieved target post-dialysis BP goals (24), but these results are close to another study from the United States of America which was conducted to assess the prevalence, treatment, and control of HTN in 2535 HD patients, only 30% of hypertensive patients achieved the target BP goals, 58% were inadequately treated, and 12% of patients had untreated HTN (28). This confirms that efforts are needed to improve BP control among HD patients.

In this study, there was a significant association between control of BP and gender only, as 59.2% of patients who achieved the target BP goals were female (p-value = 0.002). Females usually take care of themselves and others; they may listen to doctors' advice more. This may explain this finding. There was no significant association between controlled BP and other socio-demographic and clinical factors.

The patients have prescribed 2875 medications, and 53 different medications were used to treat patients' chronic and acute conditions. The mean number of medications was 7.37±2.38. The most frequently prescribed agents were calcium carbonate (67.4%), amlodipine (64.6%), aspirin (56.7%), atorvastatin (49.5%), and ranitidine (41.3%) respectively. These results are slightly different from the results of a cross-sectional observational study that was conducted in India to evaluate the drug use pattern in 100 HD patients; 1098 medications were prescribed, and the median number of medications in each prescription was 10, diuretics (9.29%), proton pump inhibitors (7.56%), calcium channel blockers (5.92%), multivitamins and calcium carbonate (5.56%), and calcium acetate (5.46%) were the most five prescribed medication classes (29). However, are close to results from Palestine in HD patients, 90 different medications were prescribed, the mean (±SD) was 7.87± 2.44, and the most frequently prescribed medications were calcium carbonate (77.1%), alfacalcidol (73.8%), iron/folic acid (65.5%),

aspirin (54.9%), and amlodipine (49.5%) respectively (24). Patients with HD use many medications to treat disease complications and other co-morbid diseases; medications of these patients need to be reviewed regularly to achieve treatment goals.

The study had some limitations; some information regarding patients was missing from the electronic system, which was the reason behind interviewing patients and taking their answers which could not be validated. Another limitation is the absence of national treatment guidelines to compare with. However, the results can give some baseline data about the situation.

CONCLUSION

The study showed a very high rate of HTN among HD patients; most patients did not achieve the target blood pressure goals. It is recommended to individualize HD session duration and frequency to meet patients' needs, in addition to counseling patients about the appropriate non-pharmacological interventions such as sodium restriction and being adherent to antihypertensive medication dose and timing.

Ethics approval and consent to participate

Before starting, the study protocol was approved by the An-Najah National University Institutional Review Boards (IRB) and the Ministry of Health. Verbal consent was obtained from the patients before the interview.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon request.

Author's contribution

Rowa' Al Ramahi designed the study, analyzed the data, and wrote and edited the manuscript. **Ruba Amr** met the patients and collected the data. She participated in writing the manuscript. This paper is derived from her master's thesis. Both authors read and approved the final manuscript.

Competing interest

The authors declare that they have no competing interests

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