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Original Article

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Do Hemodialysis Patients Aware of the Importance of Using Home Sphygmomanometer?

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Abstract

Objective: We investigated the prevalence of patients owning a home sphygmomanometer among patients on hemodialysis, the type of home sphygmomanometer, the factors that affect owning a device, and the frequency of home blood pressure monitoring.
Materials and Methods: The study involved 359 prevalent hemodialysis patients from five hemodialysis centers. The data were collected by means of a questionnaire.
Results: A total of 272 (75.8%) patients owned a home sphygmomanometer. Most of them have been using an automated upper-arm device. The presence of diabetes and a high education level were the independent variables that affected owning of a home sphygmomanometer. Of the patients owning a home sphygmomanometer, 23.9% measured their blood pressure every day, whereas 14.7% stated that they measured it rarely or never. Of the 87 patients not having a home sphygmomanometer, 59.8% reported no reason for not buying a device.
Conclusion: A significant proportion of patients on hemodialysis owns a home sphygmomanometer, the majority of which is an upper-arm device. The rate of owning the device is higher among patients with a higher education level and among patients with diabetes. The primary reason for the patients' not buying a device is lack of information about the importance of home blood pressure monitoring.
Keywords: Blood pressure, hemodialysis, home blood pressure monitoring, home sphygmomanometer

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INTRODUCTION

Hypertension is quite common in patients with end-stage renal disease. The prevalence of hypertension among patients on hemodialysis was found to range between 78% and 91% in various countries. However, hypertension could not be controlled enough in most of the patients (1-3). Furthermore, it is associated with all-cause mortality in patients on hemodialysis (4).

There is a weak relationship in pre-dialysis and post-dialysis blood pressures of the patients between all-cause and cardiovascular (CV) mortality. It was determined that the measurements performed by means of ambulatory blood pressure monitoring (ABPM) between dialysis sessions better indicate all-cause mortality, CV mortality, and CV events (4-6). For these reasons, measurements by means of ABPM for 44 hours performed between dialysis sessions are considered as the gold standard for the diagnosis of hypertension in the patients receiving dialysis therapy (5, 7). Disadvantages of the ABPM are that it is difficult to perform it frequently in patients on hemodialysis, it may trouble the patient, and it is not cost-effective (5, 7, 8). Home blood pressure monitoring is more correlated with the 44-hour ABPM measurement than blood pressure measurement during dialysis therapy, and it is associated with CV prognosis (7, 8). In addition, it is simpler and easier to perform. Thus, home blood pressure monitoring can be used for the diagnosis of hypertension in patients on dialysis (5, 7, 8). The European Renal Association-Euro-

pean Dialysis and Transplant Association and the Hypertension and the Kidney working group of the European Society of Hypertension recommended home blood pressure monitoring or ABPM outside the dialysis unit for the diagnosis of hypertension in patients on dialysis (5).

In patients on hemodialysis, hypertension can occur due to an excessive volume, increased arterial stiffness, and the use of recombinant erythropoietin (5, 9). Blood pressure monitoring using a home sphygmomanometer is important for the diagnosis and control of hypertension in patients on hemodialysis (5). In the present study, we investigated the prevalence of owning a home sphygmomanometer among patients on dialysis, the type of home sphygmomanometer, the factors that affect owning of the device, and the frequency of home blood pressure monitoring.

MATERIALS AND METHODS

Study Population

The present study included 359 prevalent hemodialysis patients. All of the participants were older than 18 years. Patients from five different dialysis centers in four different provinces of Turkey were included in the study. While three hemodialysis centers were located in the city center, two were in the towns. There were patients visiting the dialysis centers from both rural and urban areas. All of the patients who received dialysis therapy in the hemodialysis unit over the study course were enrolled into the study. Only four dementia patients were excluded as they were unable to answer the questions. Written informed consent was obtained from the patient who participated in this study. All study procedures were conducted in accordance with the Declaration of Helsinki.

The data were collected by means of a questionnaire performed via a face-to-face interview in the dialysis units. Demographic characteristics of the patients were recorded. It was questioned whether the patient's own home sphygmomanometer and, if yes, the number and type of the devices. During the interview, the types of home sphygmomanometer (automated upper-arm, automated wrist, and nonautomated [aneroid or mercury]) were described to the patient. They were questioned about the frequency of blood pressure measuring and whether they used a home sphygmomanometer on their own. The patients not owning a home sphygmomanometer were questioned about the reason for not buying one. It was recorded whether the patients used antihypertensive medications and, if yes, the number of drugs used. The patients were also questioned about the presence of diabetes (patients receiving oral antidiabetics and/or insulin) and CV diseases (coronary artery disease, congestive heart failure, cardiac valve replacement, cardiac pacemaker, peripheral vascular disease, and cerebrovascular disease). The arithmetic mean of the last three consecutive dialysis sessions' pre-dialysis systolic and diastolic blood pressure values measured in the hemodialysis unit was calculated and recorded. Patient files at hemodialysis centers were reviewed for the patient's demographic and clinical information.

Statistical Analysis

The suitability of the variables for normal distribution was analyzed by the Kolmogorov-Smirnov test. Descriptive statistics were presented as the median and interquartile range (25%-75%) for the variables not normally distributed. Categorical variables were presented as frequencies and percentages. The variables not showing normal distribution were compared using the Mann-Whitney U test. A chi-squared test was used to investigate whether there was any difference between the groups in terms of frequencies. A multivariate analysis was performed using the significant factors identified in univariate analysis. Multivariate logistic regression analysis was used to determine the independent predictors affecting owning of a home sphygmomanometer. A p-value smaller than 0.05 was considered statistically significant.

RESULTS

Of 359 patients, 164 (45.7%) were female, and 195 (54.3%) were male. A total of 272 (75.8%) patients had a home sphygmomanometer. The rate of owning a home sphygmomanometer among the patients in each of five different hemodialysis centers was 67.8%, 71.4%, 73.6%, 79.6%, and 80%, respectively. There was no difference between the dialysis centers in terms of the rate of owning a home sphygmomanometer (p=0.368).

Most of the patients who had a home sphygmomanometer were using an automated upper-arm device. Of the patients owning a home sphygmomanometer, 247 (90.8%) had a single, 22 (8.1%) had two, and 3 (1.1%) had three devices (Table 1).

There was no difference between those owning or not owning a home sphygmomanometer in terms of age, gender, duration of hemodialysis, number of antihypertensive drugs, and pre-dialysis blood pressure. A high education level, living in the urban area, and having diabetes were associated with a higher rate of

Table 1. Types of home sphygmomanometers used

Types of Sphygmomanometers	Patients Owning a Home Sphygmomanometer (n=272) (100%)
Automated upper-arm	155 (57%)
Automated wrist	70 (25.7%)
Nonautomated	23 (8.5%)
Automated upper-arm and wrist	10 (3.7%)
Automated upper-arm and nonautomated	8 (2.9%)
Automated upper-arm, wrist, and nonautomated	3 (1.1%)
Automated wrist and nonautomated	2 (0.7%)
Automated wrist and wrist	1 (0.4%)

Table 2. Factors associated with the possession of a home sphygmomanometer

Clinical Characteristic	Patients Owning Home Sphygmomanometer (n=272)	Patients Not Owning Home Sphygmomanometer (n=87)	p
Age (years)	64.5 (56-72)	67 (54-73)	0.684
Gender			
Female	125 (46%)	39 (44.8%)	0.854
Male	147 (54%)	48 (55.2%)	
Duration of hemodialysis (months)	50 (17-99)	49 (23-87)	0.741
Education			
Illiterate or literate	79 (29%)	33 (37.9%)	0.036
Primary or middle school graduate	155 (57%)	50 (57.5%)	
High school or university graduate	38 (14%)	4 (4.6%)	
Residence			
Urban	226 (83.1%)	62 (71.3%)	0.016
Rural	46 (16.9%)	25 (28.7%)	
Number of antihypertensive drugs			
0	96 (35.3%)	31 (35.6%)	0.825
1	105 (38.6%)	36 (41.4%)	
≥ 2	71 (26.1%)	20 (23%)	
Diabetes mellitus	102 (37.5%)	20 (23%)	0.013
Cardiovascular disease	126 (46.3%)	38 (43.7%)	0.666
Average pre-dialysis blood pressure <140/90 mm Hg	130 (47.8%)	39 (44.8%)	0.629

Data are expressed as median (interquartile range 25%-75%) and number (percentage)
BP: blood pressure

Table 3. Factors associated with ownership of home sphygmomanometer (multivariate logistic regression analyses)

Variables	Odds Ratio	95% Confidence Interval	p
Education			
Illiterate or literate	1		
Primary or middle school graduate	1.38	0.81-2.37	0.238
High school or university graduate	4.77	1.52-14.98	0.008
Residence			
Rural	1		
Urban	1.70	0.95-3.03	0.072
Diabetes mellitus			
Absent	1		
Present	2.38	1.34-4.24	0.003

owning a home sphygmomanometer (Table 2). A multivariate logistic regression analysis revealed that having diabetes and being a high school or university graduate were the independent variables for the possession of a home sphygmomanometer (Table 3).

While 23.9% of the patients who had a home sphygmomanometer have been measuring their blood pressure every day, 14.7% reported that they are measuring it rarely or never (Table 4). Of the patients owning a home sphygmomanometer, 69.1% were able to measure their blood pressure on their own, but 30.9% were unable to measure their blood pressure without someone else's help; 54.8% had bought their own device, but 45.2% had the device bought by their children, spouse, or other relatives.

When the 87 patients not owning a home sphygmomanometer were questioned about the reason for not buying one, the most frequent answer was "No reason, I just have not bought" (59.8%) (Table 5).

Table 4. Home blood pressure monitoring frequency

Home Blood Pressure Monitoring Frequency	Patients Owning a Home Sphygmomanometer (n=272) (100%)
Everyday	65 (23.9%)
Once a week-few times a week	86 (31.6%)
Once a month-few times a month	81 (29.8%)
Very rare or never	40 (14.7%)

Table 5. Answers of the patients not owning a home sphygmomanometer to the question "why have you not bought a home sphygmomanometer?"

Patients' Answers	Patients Not Owning a Home Sphygmomanometer (n=87) (100%)
No reason, I just have not bought.	52 (59.8%)
My blood pressure is good.	17 (19.5%)
I have never been in need of having a home sphygmomanometer.	4 (4.6%)
It is expensive.	4 (4.6%)
It is out of order; I did not buy again.	3 (3.4%)
My blood pressure is already being measured during hemodialysis.	3 (3.4%)
Other	4 (4.6%)

DISCUSSION

In the present study, we determined that 75.8% of patients on hemodialysis have been using a home sphygmomanometer and that the most common type was an automated upper-arm device. Today, home sphygmomanometers are widely used. They are available for home blood pressure monitoring and are relatively cheap, affordable, user friendly, repeatable, and useful in taking hypertension under control (10-13). It is necessary for the diagnosis of white-coat hypertension and masked hypertension (10, 11, 13). Nevertheless, a home sphygmomanometer needs to be validated and to measure accurately. An appropriate cuff size should be used for upper-arm devices (11, 14, 15). The patients who are going to use a home sphygmomanometer must be trained how to measure blood pressure and how to use the device (13).

The prevalence rates of owning a home sphygmomanometer and performing home blood pressure monitoring have been investigated in many countries, and in general, both were found higher in the developed countries as compared to the developing countries. In Canada, 78% of patients who are hypertensive own a home sphygmomanometer (16). Seventy percent of the patients who are hypertensive in Germany (17) and 74.7% of the patients who are hypertensive in Italy (18) regularly perform home blood pressure monitoring. Two studies from Turkey determined that 20.1%-46.6% of the patients who are hypertensive in this country own a home sphygmomanometer (12, 19). The rate of owning a home sphygmomanometer among hypertensive patients is 61.7% in Pakistan (20), 55% in Czech Republic (21), and 24% in Singapore (22). In a study that examined patients with chronic kidney disease (CKD) not receiving dialysis therapy, 66% of the patients had a home sphygmomanometer (23). In the present study, the rate of those owning a home sphygmomanometer was very high among hemodialysis patients. It was higher than that in the CKD and/or hypertension patients from both Turkey and the other countries. The fact that hypertension and blood pressure variability are common among hemodialysis patients (24), that hypotension can occur during dialysis therapy (25), and that clinicians may recommend home blood pressure monitoring might have caused patients on hemodialysis buying a home sphygmomanometer more frequently.

In the present study, most of the patients owning a home sphygmomanometer have been using an automated upper-arm device. The guidelines as well recommend an automated upper-arm sphygmomanometer for home blood pressure monitoring (10, 13). In the developed countries, the patients more frequently use an automated upper-arm device (16, 18). Two studies from Turkey, however, determined that hypertensive patients most frequently use an automated wrist device (12, 19). Contrary to the studies conducted in Turkey, hemodialysis patients in the present study have been mostly using an automated upper-arm device. Patients have preferred an automated upper-arm device probably because the automated upper-arm devices are used by the hemodialysis centers and recommended by their physicians.

The rate of owning a home sphygmomanometer was higher among patients with a higher education level, living in urban areas and having diabetes. A multivariate logistic regression analysis revealed that the presence of diabetes and being high school or university graduate are the independent variables for owning the device. In different studies, a high education level was found to be associated with a higher rate of owning a home sphygmomanometer and more frequent home blood pressure monitoring (12, 18-21). The rate of owning a sphygmomanometer was higher also in diabetes patients. Such a result could not be found in the other studies conducted with hypertensive patients and with patients with CKD not receiving dialysis therapy (18, 21-23). Hypertension is quite common among patients with diabetes (26). The fact that hypertension is present in most of the patients with diabetes before the development of CKD and that they have been living for a long time with hypertension might have increased the rate of owning a home sphygmomanometer.

In the present study, the number of patients with systolic and diastolic blood pressures under 140 mmHg and 90 mmHg, respectively, measured before dialysis therapy was similar between those owning and not owning the device. In some studies, that

involved hypertensive patients, owning a home sphygmomanometer was found to be associated with a lower blood pressure (12). The present study comprised all the patients in the hemodialysis center whether or not they had hypertension. For this reason, owning a home sphygmomanometer might have not influenced the blood pressure. In addition, patients on hemodialysis can perform home blood pressure monitoring even they do not have hypertension just because of the blood pressure variability (24) or for hypotension (25).

When we asked the patients why they have not bought a home sphygmomanometer, they most frequently answered with, "No reason, I just have not bought it." In addition, "I have never been in need of having a home sphygmomanometer," "My blood pressure is good," and "My blood pressure is already being measured during hemodialysis" were the other answers. All these answers indicate that patients on hemodialysis are not aware of the importance of home blood pressure monitoring. In the other earlier studies, the patients not owning a home sphygmomanometer have given similar answers (22, 23). In a study conducted on patients with CKD, the most common cause of not owning a device was found to be the physicians not giving an advice on this subject (23). Moreover, some of the patients do not perform blood pressure monitoring even though they own a home sphygmomanometer. Doctors should inform their hemodialysis patients about hypertension, explain the importance of home blood pressure monitoring, and give advice about owning a device.

The patient should be trained on how to measure blood pressure at home and use the device appropriately. In addition, training family members as well may be needed (13). In the present study, 30.9% of the patients owning a home sphygmomanometer stated that they were unable to use the device without help of another person. Dialysis patients' inability to use the device on their own results probably from senility, motor or cognitive dysfunction, poor education, and visual problems (13).

CONCLUSION

A substantial proportion of patients on hemodialysis own a home sphygmomanometer, most of which is an upper-arm device as recommended in guidelines. The rate of owning a device was higher among those with a high education level and in patients with diabetes. Some patients do not or rarely perform blood pressure monitoring, even though they have a home sphygmomanometer. The most common cause of patients on hemodialysis not buying a device was lack of knowledge about the importance of home blood pressure monitoring.

Ethics Committee Approval: Authors declared that the research was conducted according to the principles of the World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects", (amended in October 2013).

Informed Consent: Informed consent form received from the patients who participated in this study.

Peer-review: Externally peer-reviewed.

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REFERENCES

1. Agarwal R, Nissenson AR, Batlle D, Coyne DW, Trout JR, Warnock DG. Prevalence, treatment, and control of hypertension in chronic hemodialysis patients in the United States. Am J Med 2003; 115: 291-7. [CrossRef]
2. Ecder T, Utas C, Ates K, Bieber B, Robinson BM, Pisoni RL, et al. The Dialysis Outcomes and Practice Patterns Study (DOPPS) in Turkey. Hemodial Int 2017; 21: 430-9. [CrossRef]
3. Iseki K, Nakai S, Shinzato T, Morita O, Shinoda T, Kikuchi K, et al. Prevalence and determinants of hypertension in chronic hemodialysis patients in Japan. Ther Apher Dial 2007; 11: 183-8. [CrossRef]
4. Agarwal R. Blood pressure and mortality among hemodialysis patients. Hypertension 2010; 55: 762-8. [CrossRef]
5. Sarafidis PA, Persu A, Agarwal R, Burnier M, de Leeuw P, Ferro CJ, et al. Hypertension in dialysis patients: a consensus document by the European Renal and Cardiovascular Medicine (EURECA-m) working group of the European Renal Association-European Dialysis and Transplant Association (ERA-EDTA) and the Hypertension and the Kidney working group of the European Society of Hypertension (ESH). Nephrol Dial Transplant 2017; 32: 620-40. [CrossRef]
6. Parati G, Ochoa JE, Bilo G, Agarwal R, Covic A, Dekker FW, et al. Hypertension in Chronic Kidney Disease Part 1: Out-of-Office Blood Pressure Monitoring: Methods, Thresholds, and Patterns. Hypertension 2016; 67: 1093-101. [CrossRef]
7. Zoccali C, Tripepi R, Torino C, Tripepi G, Mallamaci F. Moderator's view: Ambulatory blood pressure monitoring and home blood pressure for the prognosis, diagnosis and treatment of hypertension in dialysis patients. Nephrol Dial Transplant 2015; 30: 1443-8. [CrossRef]
8. Agarwal R. The controversies of diagnosing and treating hypertension among hemodialysis patients. Semin Dial 2012; 25: 370-6. [CrossRef]
9. Agarwal R. Epidemiology of interdialytic ambulatory hypertension and the role of volume excess. Am J Nephrol 2011; 34: 381-90. [CrossRef]
10. Pickering TG, Miller NH, Ogedegbe G, Krakoff LR, Artinian NT, Goff D, et al. Call to action on use and reimbursement for home blood pressure monitoring: a joint scientific statement from the American Heart Association, American Society of Hypertension, and Preventive Cardiovascular Nurses Association. J Cardiovasc Nurs 2008; 23: 299-323. [CrossRef]
11. Akpolat T. Home sphygmomanometers: what should a nephrologist know? J Nephrol 2011; 24: 300-6. [CrossRef]
12. Akpolat T, Arici M, Sengul S, Derici U, Ulusoy S, Erturk S, Erdem Y. Home sphygmomanometers can help in the control of blood

pressure: a nationwide field survey. Hypertens Res 2018; 41: 460-8. [CrossRef]
13. Parati G, Stergiou GS, Asmar R, Bilo G, de Leeuw P, Imai Y, et al. European Society of Hypertension practice guidelines for home blood pressure monitoring. J Hum Hypertens 2010; 24: 779-85. [CrossRef]
14. Akpolat T, Aydogdu T, Erdem E, Karatas A. Inaccuracy of home sphygmomanometers: a perspective from clinical practice. Blood Press Monit 2011; 16: 168-71. [CrossRef]
15. Selim N, Erdem E, Aydogdu T, Sarı A, Kadı R, Bicen C, et al. Are Measurement Readings of Hospital Sphygmomanometers Accurate? Turk Neph Dial Transpl 2010; 19: 108-12. [CrossRef]
16. Logan AG, Dunai A, McIsaac WJ, Irvine MJ, Tisler A. Attitudes of primary care physicians and their patients about home blood pressure monitoring in Ontario. J Hypertens 2008; 26: 446-52. [CrossRef]
17. Krecke HJ, Lütkes P, Maiwald M. Patient assessment of self-measurement of blood pressure: results of a telephone survey in Germany. J Hypertens 1996; 14: 323-6. [CrossRef]
18. Cuspidi C, Meani S, Lonati L, Fusi V, Magnaghi G, Garavelli G, et al. Prevalence of home blood pressure measurement among selected hypertensive patients: results of a multicenter survey from six hospital outpatient hypertension clinics in Italy. Blood Press 2005; 14: 251-6. [CrossRef]
19. Akpolat T, Erdem Y, Derici U, Erturk S, Caglar S, Hasanoglu E, et al. Use of home sphygmomanometers in Turkey: a nation-wide survey. Hypertens Res 2012; 35: 356-61. [CrossRef]
20. Zahid H, Amin A, Amin E, Waheed S, Asad A, Faheem A, et al. Prevalence and Predictors of Use of Home Sphygmomanometers Among Hypertensive Patients. Cureus 2017; 9: e1155. [CrossRef]
21. Seidlerová J, Filipovský J, Wohlfahrt P, Mayer Jr O, Cifkova R. Availability and use of home blood pressure measurement in the Czech general population. Cor et Vasa 2014; 56: e158-63. [CrossRef]
22. Tan NC, Khin LW, Pagi R. Home blood-pressure monitoring among hypertensive patients in an Asian population. J Hum Hypertens 2005; 19: 559-64. [CrossRef]
23. Ye X, Shafi S, Negrete A, Davis WN, Sarac E, Negrete AM, et al. Home blood pressure monitor use in patients with chronic kidney disease. Blood Press 2016; 25: 280-5. [CrossRef]
24. Rohrscheib MR, Myers OB, Servilla KS, Adams CD, Miskulin D, Bedrick EJ, et al. Age-related blood pressure patterns and blood pressure variability among hemodialysis patients. Clin J Am Soc Nephrol 2008; 3: 1407-14. [CrossRef]
25. Erdem E. The effects of passive leg raising and ultrafiltration stopping on blood pressure in hemodialysis patients. Int Urol Nephrol 2016; 48: 877-82. [CrossRef]
26. Lago RM, Singh PP, Nesto RW. Diabetes and hypertension. Nat Clin Pract Endocrinol Metab 2007; 3: 667. [CrossRef]