RESEARCH ARTICLE

Epidemiological Profile of Twice per Week Hemodialysis Patients of Top Referral National Hospital in Indonesia

Lucky Aziza Bawazier

Department of Internal Medicine, Faculty of Medicine Universitas Indonesia – Cipto Mangunkusumo Hospital, Jakarta, Indonesia

Corresponding author: luckyazizabawazir@gmail.com
Accepted 11 August 2018
DOI: 10.23886/ejki.6.9726.

Abstract

Data regarding the epidemiology and laboratory test results of end-stage renal disease (ESRD) patients on twice per week hemodialysis in Indonesia remain limited. This study was conducted to describe the epidemiological and laboratory profiles of ESRD patients undergoing hemodialysis twice a week. This was a cross-sectional study in which the medical records data of all ESRD patients on hemodialysis at Cipto Mangunkusumo Hospital in 2017. Of 145 subjects, 51% were male. The mean age was 50.1 (SD 13.5) years and the mean body mass index (BMI) was 23.1 kg/m^2 (SD 4.8). The aetiology of ESRD in these patients was primarily hypertension (40.7%). There was a significant difference in systolic blood pressure (SBP) and diastolic blood pressure (DBP) before and after hemodialysis (p=0.001 and p<0.001) The mean estimated glomerular filtration rate (eGFR) was 4.3 mL/min/1.73 m^2 (SD 2.2) and significantly different between those <60 years old and ≥60 years old (p=0.004). In addition, there was an association between uric acid and post-hemodialysis SBP (p = 0.02). It is concluded that age and sex distribution played a significant role in determining epidemiological profile patients undergoing twice per week hemodialysis.
Keywords*: epidemiological profile; laboratory profile; twice per week hemodialysis*.

Profil Epidemiologi Pasien Hemodialisis Dua Kali per Minggu di Rumah Sakit Pusat Rujukan Nasional Indonesia

Abstrak

Data epidemiologi dan hasil laboratorium pada pasien penyakit ginjal kronik (PGK) stadium akhir yang menjalani hemodialisis dua kali per minggu di Indonesia masih terbatas. Studi ini dilakukan untuk menggambarkan epidemiologi dan profil laboratorium pasien PGK stadium akhir yang menjalani hemodialisis dua kali per minggu.Studi potong lintang ini menggunakan rekam medis seluruh pasien PGK stadium akhir yang menjalani hemodialisis di Rumah Sakit Cipto Mangunkusumo pada tahun 2017. Dari 145 subjek, 51% adalah laki-laki. Rerata usia 50,1 tahun (SD 13,5) dan rerata indeks massa tubuh adalah 23,1 kg/m^2 (SD 4,8). Etiologi PGK stadium akhir didominasi oleh hipertensi (40,7%). Terdapat perbedaan signifikan antara tekanan darah sistolik dan diastolik sebelum dan sesudah hemodialisis (p=0.001 dan p<0.001). Rerata laju flitrasi glomerulus (LFG) adalah 4,3 mL/min/1,73 m^2 (SD 2.2) dan secara signifikan berbeda antara kelompok <60 tahun dan ≥60 tahun (p=0,004). Selain itu, terdapat hubungan antara asam urat dan tekanan darah sistolik pascahemodialisis (p=0,02). Disimpulkan bahwa usia dan jenis kelamin berperan penting dalam menentukan profil epidemiologi pada pasien yang menjalani hemodialisis dua kali per minggu.
Kata kunci*: profil epidemiologi; profil laboratorium; hemodialisis dua kali per minggu*.

Introduction

Chronic kidney disease (CKD) has been defined as a decrease in estimated glomerular filtration rate (eGFR) to a level of <60 mL/min/1.73 m^2 or evidence of albumin excretion or both over a three-month period with or without structural changes. An eGFR level of less than 15 mL/min/1.73 m^2 was defined as the final stage of CKD, called end-stage renal disease (ESRD).[1] ESRD refers to the kidneys' inability to maintain homeostasis and requires patients to rely on a renal replacement therapy (RRT). Hemodialysis continues to be the predominant RRT modality in Singapore, Malaysia, Thailand, and Indonesia.[2,3] The mean global prevalence of CKD based on the study by Hill et al.[4] was 13.4% for the 44 population studies that measured prevalence by all 5 stage and 10.6% for the sixty-eight population studies measuring stages 3 to 5.

The latest data from the Indonesian Renal Registry[5] showed that 92.1% of 382 renal units in Indonesia were in hospital settings and 7.9% were in clinics. The highest proportion of ESRD patients on hemodialysis in 2015 was in the 45-64 year old age group. In 2015, the financial source supporting hemodialysis patients dramatically changed, with the percentage of patients with national health insurance markedly rising to 71%. Hence, the total proportion of patients on hemodialysis who were using the national health insurance system was 86%. The most common aetiology of renal failure in 2015 was hypertensive renal failure (44%).[5]

A study by Bae et al.[6] showed that survivors of hemodialysis were younger than non-survivors (60.2 years; SD 14.6 vs 64.7 years; SD 14.9; p value<0.001). Non-survivors had significantly higher white blood cell counts, as well as lower albumin and serum creatinine levels. Lijie et al[7] showed that age, diabetes mellitus (DM) and ferritin were factors associated with increased risk of all-cause mortality, whereas BMI, haemoglobin, albumin, total iron-binding capacity (TIBC), and iron were among those that were associated with reduced risk of all causes mortality. Therefore, this study was performed to describe the epidemiological and laboratory profiles of ESRD patients undergoing hemodialysis over a one-year period (2017) in a referral national government teaching hospital in Indonesia. The results were needed to obtain more data for better health services and for the formulation of health policy and regulations. This study also aimed to explore the associations between BMI and total cholesterol, uric acid level and blood pressure, and between total cholesterol and blood pressure among hemodialysis patients.

Methods

This retrospective cross sectional study was conducted in Dr. Cipto Mangunkusumo National Central Hospital Jakarta, also known as Cipto Mangunkusumo Hospital (CMH). The hemodialysis unit of CMH is one of the largest hemodialysis units, serving as a national referral hospital for kidney disease patients and not only for the population of Jakarta. Every patient in this unit undergoes two sessions of approximately 5 hours of hemodialysis weekly and has routine laboratory tests. Data were collected from medical records over a period of one year from 1st January to 31st December 2017. The inclusion criterion was ESRD patients on hemodialysis.

Patients with medical records who did not have complete or pertinent data were excluded from this study. A total of 145 patients had data that met the inclusion criterion and were analysed. The epidemiological profile included gender, age, hemodialysis duration, aetiology of ESRD, vascular access, financial source, infection status, employment status, origin, religion, ethnic group and marital status. The laboratory profiles included haemoglobin, haematocrit, platelets, leukocytes, serum glutamic oxalo-acetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), total protein, albumin, globulin, serum iron, TIBC, transferrin saturation, ferritin, creatinine, estimated glomerular filtration rate (eGFR), uric acid, triglycerides, total cholesterol, HDL cholesterol, low density lipoprotein (LDL) cholesterol, and blood electrolytes (sodium, potassium, chloride, calcium, and organic phosphate). The blood pressures, heights and weights of patients were also recorded. The study was started after obtaining ethical clearance and administrative authorization from CMH.

Data were analysed statistically using SPSS version 20.0 (IBM Corp., Armonk, NY). The results were presented as numbers and percentages, means and standard deviations, and medians. For the analytical tests, we used the chi square test, dependent t-test, Mann-Whitney test, and ANOVA. P values of <0.05 were considered significant.

Ethics Approval and Consent to Participate

The protocol of this study was approved by the Health Research Ethics Committee, Faculty of Medicine, Universitas Indonesia with ethical approval reference number 0370/UN2.F1/ETIK/ 2018 and protocol number 18-04-0451. This study only used secondary data which was hemodialysis patient's medical record and had no treatment or contact with patients. Therefore, informed consent to participate was not obtained in this study. All of data gained

from medical records were stored at Hemodialysis Unit of Cipto Mangunkusumo Hospital to preserve its confidentiality.

Results

Epidemiological Profile of Participants

As seen in Table 1, there were 145 hemodialysis patients. The overall mean age of patients was 50.1 years (SD 13.5). Total mean age at first hemodialysis was 44.2 years (SD 14.0) and there was no significant difference in current age or age at first hemodialysis between males and females (p-value 0.319 and 0.379). Significantly (p-value <0.001) more males were employed (54.1%) than females and there were more patients who were married than who were unmarried. The patients were most likely to receive hemodialysis for 1-4 years (71 patients) and most of the hemodialysis costs were funded by national health insurance. The majority of the patients were from Jakarta. The mean BMI was 23.1 (SD 4.8) and BMI did not differ significantly between males and females (p-value 0.205). The aetiologies of ESRD were mostly hypertension (40.5% of males and 40.8% of females) and glomerulonephritis (32.4% of males and 25.4% of females). The most common vascular access in these hemodialysis patients was via the arteriovenous (AV) fistula. Most of these patients did not have infections.

Overall Laboratory Profile of Participants and by Gender and Age

As seen in Table 2, there was a significant difference in both mean systolic blood pressure (SBP) and diastolic blood pressure (DBP) before and after hemodialysis (pre vs post SBP p-value 0.001 and pre vs post DBP p-value <0.001). The overall mean values of SBP pre- and post-hemodialysis were 147.9 mmHg (SD 27.0) and 141.4 mmHg (SD 30.1), while the overall mean DBP values pre- and post-hemodialysis were 79.1 mmHg (SD 15.4) and 80.1 mmHg (SD 17.1). Mean SBP before hemodialysis was higher than after hemodialysis for both genders and in all age groups. In contrast, the DBP values increased after hemodialysis for both genders and all age groups. There were significant mean differences in DBP pre-hemodialysis and post-hemodialysis in both age groups with a p-value of 0.004 for DBP pre-hemodialysis and a p-value of 0.018 for DBP post-hemodialysis.

The mean haemoglobin concentration was 9.9 g/dL (SD 1.76). The mean haematocrit was 29.9% (SD 5.6) and was higher in males (30.1%; SD 5.7) and in the <60 years age group (mean 30.0%; SD 5.7). The mean platelet count was 223,910.3/µL (SD 66,727.8), and was significantly higher in males. The mean leukocyte count was 7,900/µl (SD 2,600). The mean leukocyte count in the <60 years age group (7,990.9/µl; SD 2,744.5) was higher than that in the ≥60 years age group (7,658.9/µl; SD 2,137.4). There was a significant difference in creatinine levels between the male and female groups and between the <60 and ≥60 years age groups (p-value <0.001). The mean eGFR was 4.3 mL/min/1.73 m^2 (SD 2.2) and was higher in females (4.5 mL/min/1.73 m^2; SD 1.5) and significantly different between the <60 and ≥60 age groups.

The mean total protein levels in females (7.4 g/dL; SD 0.9) and in the <60 years age group (7.3 g/dL; SD 0.8) were higher than those in the male group (7.2 g/dL: SD 0.6) and the ≥60 years age group (7.1 g/dL; SD 0.9). The overall mean albumin level was 4.0 g/dL (SD 0.80) and was significantly higher in the <60 years age group.

Total cholesterol and HDL cholesterol were significantly higher in females (p-value <0.001). The mean ferritin serum (556.1 ng/mL; SD 593.5) and uric acid (10.9 mg/dL, SD 18.0) levels were higher in females, and the mean uric acid was significantly higher in the <60 years age group (11 mg/dL, SD 16 mg/dL; p-value <0.001). The mean triglyceride levels were higher in females and the ≥60 years age group.

Table 1. Epidemiological Profiles of the Patients

Variables	Overall	Male	Female	p-Value
n (%)	145 (100)	74 (51)	71 (49)	-
Mean age in years (SD)	50.12 (13.49)	49.03 (13.38)	51.27 (13.6)	0.319
Age, min-max, year	18-79	18-78	18-79	-
Median age (25-75th percentiles), years	52	50.50	52	-
Mean age at first hemodialysis years(SD)	44.9 (14)	43.91 (13.4)	45.9 (14.7)	0.379
Age at first hemodialysis, min-max,	16-79	16-76	16-79	-
Median age at first hemodialysis (25-75th percentiles), years	45	44	46	-
Employment status, n (%)				<0.001
Employed	51 (35.2)	40 (54.1)	11 (15.5)	
Unemployed	94 (64.8)	34 (45.9)	60 (84.5)	
Marital status, n (%)				0.070
Married	134 (92.4)	65 (87.8)	69 (97.2)	
Unmarried	11 (7.6)	9 (12.2)	2 (2.8)	
Treatment period, n (%)				0.962
< 1 year	13 (9.0)	6 (8.1)	7 (9.9)	
1-4 years	71 (49)	37 (50)	34 (47.9)	
5-10 years	40 (27.6)	21 (28.4)	19 (26.8)	
>10 years	21 (14.5)	10 (13.5)	11 (15.5)	
Financial source, n (%)				0.490
JKN/BPJS	144 (99.3)	74 (100)	70 (98.6)	
Private Insurance	1 (0.7)	0 (0)	1 (1.4)	
Origin, n (%)				0.153
Jakarta	101 (69.7)	56 (75.7)	45 (63.4)	
Outside Jakarta	44 (30.3)	18 (24.3)	26 (36.6)	
Religion, n (%)				-
Islam	134 (92.4)	65 (87.8)	69 (97.2)	
Christian	10 (6.9)	8 (10.8)	2 (2.8)	
Buddhist	1 (0.7)	1 (1.4)		
Ethnicity, n (%)				-
Javanese	67 (46.2)	31 (41.9)	36 (50.7)	
Betawinese	26 (17.9)	12 (16.2)	14 (19.7)	
Sundanese	25 (17.2)	16 (21.6)	9 (12.7)	
Others	27 (18.6)	15 (20.3)	12 (16.9)	
BMI mean (SD)	23.1 (4.8)	22.6 (4.8)	23.6 (4.7)	0.205
Aetiology of ESRD, n (%)				0.664
Hypertension	59 (40.7)	30 (40.5)	29 (40.8)	
Glomerulonephritis	37 (25.5)	21 (28.4)	16 (22.5)	
Diabetes Mellitus	36 (24.8)	16 (21.6)	20 (28.2)	
Others	12 (8.3)	6 (8.1)	6 (8.5)	
Unknown	1 (0.7)	1 (1.4)	-	
Vascular access, n (%)				0.401
Fistula AV (Cimino)	84 (57.9)	43 (58.1)	41 (57.7)	
Tunnel Catheter	49 (33.8)	27 (36.5)	22 (31)	
Femoral	12 (8.3)	4 (5.4)	8 (11.3)	
Infection status, n (%)				0.537
No Infection	78 (53.8)	40 (54.1)	38 (53.5)	
Hepatitis B	5 (3.4)	4 (5.4)	1 (1.4)	
Hepatitis C	58 (40)	29 (39.2)	29 (40.8)	
Hepatitis B and C	3 (2.1)	1 (1.4)	2 (2.8)	
Hepatitis C and HIV	1 (0.7)	-	1 (1.4)	
Systolic blood pressure, n (%)				
Pre-hemodialysis				-
<140 mmHg	49 (33.8)	23 (31.1)	26 (36.6)	
≥140 mmHg	96 (66.2)	51 (68.9)	45 (63.4)	
Post-hemodialysis				-
<140 mmHg	65 (44.8)	33 (44.6)	32 (45.1)	
≥140 mmHg	80 (55.2)	41 (55.4)	39 (54.9)	
Diastolic blood pressure, n (%)				
Pre-hemodialysis				-
<90 mmHg	106 (73.1)	51 (68.9)	55 (77.5)	
≥90 mmHg	39 (26.9)	23 (31.1)	16 (22.5)	
Pre-hemodialysis				-
<90 mmHg	102 (70.3)	48 (64.9)	54 (76.1)	
≥90 mmHg	43 (29.7)	26 (35.1)	17 (23.9)	

Table 2. Distribution of Laboratory Profiles of Patients According to Age and Gender

Parameter Overall	Mean (SD)	Gender Mean (SD)		P-Value	Age Mean (SD)		P-Value
		Men n = 74	Women n = 71		<60 years n =108	≥60 years n = 37	
Systolic blood pressure							
Pre-hemodialysis (mmHg)	147.9 (27.0)	151.0 (27.0)	144.7 (26.8)	0.166	147.0 (27.4)	150.5 (25.9)	0.495
Post-hemodialysis (mmHg)	141.46 (30.1)	144.1 (31.9)	138.6 (28.1)	0.267	140.4 (30.4)	144.5 (29.5)	0.472
Diastolic blood pressure							
Pre-hemodialysis (mmHg)	79.1 (15.4)	80.8 (16.3)	77.3 (14.2)	0.178	81.2 (15.2)	72.8 (14.2)	0.004
Post-hemodialysis (mmHg)	80.1 (17.1)	81.7 (14.6)	78.35 (19.2)	0.234	82.0 (17.6)	74.3 (14.1)	0.018
Haemoglobin	9.9 (1.7)	10 (1.7)	9.7 (1.7)	0.255	9.9 (1.8)	9.7 (1.6)	0.554
Haematocrit	29.9 (5.5)	30.1 (5.7)	29.7 (5.4)	0.663	30.0 (5.7)	29.6 (5.0)	0.685
Platelets	223910.3 (66727.8)	204891.8 (52929.1)	243732.3 (73872.8)	<0.001	225425.9 (70179.1)	219486.4 (56079.6)	0.642
Leukocyte	7900 (2600)	7500 (2100)	8200 (3000)	0.334	7900 (2700)	7600 (2100)	0.502
Creatinine	12.1 (4)	13.7 (4.1)	10.4 (3.1)	<0.001	13.1 (3.7)	9.2 (3.4)	<0.001
eGFR	4.3 (2.2)	4.1 (1.5)	4.5 (2.7)	0.583	3.9 (1.6)	5.3 (3.1)	0.004
Blood urea nitrogen	139.8 (43.4)	147.5 (45.3)	131.8 (40.1)	0.029	143.3 (43.8)	129.7 (41.2)	0.103
Total Protein	12.1 (4.0)	7.2 (0.6)	7.4 (0.9)	0.579	7.3 (0.8)	7.1 (0.9)	0.440
Albumin	4 (0.8)	4 (0.9)	3.9 (0.6)	0.73	4 (0.8)	3.9 (0.8)	0.035
Globulin	3.2 (0.7)	3.2 (0.6)	3.3 (0.8)	0.561	3.2 (0.6)	3.3 (0.8)	0.828
SGOT	20.2 (16.4)	17.6 (12.5)	22.9 (19.4)	0.148	19 (16.2)	23.6 (16.9)	0.094
SGPT	19.3 (20)	19.3 (19)	19.3 (21.2)	0.585	18.6 (18.8)	21.3 (23.4)	0.897
Calcium	9.8 (8.7)	8.9 (1)	10.9 (12.3)	0.421	10.3 (10.0)	8.7 (1.8)	0.993
Phosphorus	5.9 (3.3)	5.8 (2.1)	6.1 (4.3)	0.624	6 (2.2)	5.8 (5.5)	0.034
Potassium	4.6 (0.8)	4.5 (0.8)	4.6 (0.8)	0.676	4.6 (0.8)	4.5 (0.9)	0.623
Sodium	138.3 (12.8)	139.2 (7.7)	137.3 (16.5)	0.252	137.9 (14.6)	139.4 (4.3)	0.721
Chloride	98 (15.3)	99 (21)	97 (4.7)	0.815	98 (17.5)	98.0 (4.9)	0.205
Glucose, mg/dl	124.7 (85.3)	116. 9 (77.4)	132.9 (92.7)	0.141	114.2 (74.2)	155.3 (107)	0.024
Serum iron	62.7 (25.6)	63.2 (25.2)	62.2 (26.2)	0.859	62.1 (26.9)	64.5 (21.5)	0.215
TIBC	216.7 (52.1)	220.8 (52.5)	212.4 (51.7)	0.604	214.8 (51.5)	222.3 (54.4)	0.388
Transferrin saturation	29.7 (13.9)	29.7 (13.5)	29.8 (14.4)	0.851	29.1 (12.8)	31.6 (16.8)	0.686
Ferritin serum	485.9 (561.9)	418.5 (524.9)	556.1(593.5)	0.021	489.3 (561.3)	475.9 (571.2)	0.991
Total cholesterol, mg/dl	164.6 (40.6)	153 (36.1)	176.7 (41.7)	<0.001	161.7 (36.7)	173.1 (49.9)	0.206
HDL cholesterol, mg/dl	36.7 (12.3)	32.5 (11)	41.2 (12.2)	<0.001	35.9 (11.4)	39.1 ± (14.6)	0.227
LDL cholesterol, mg/dl	104.8 (33.6)	98.3 (32.3)	111.5 (33.8)	0.025	103.4 (31.2)	108.7 (39.9)	0.637
Triglycerides, mg/dl	156.3 (122.4)	148.8 (140)	164 (101.2)	0.121	145 (73.6)	189.1 (205.8)	0.281
Uric acid	10 (13.9)	9 (8.1)	10.9 (18)	0.791	11 (16)	7 (1.4)	<0.001

Association between BMI and Total Cholesterol

As seen in Table 3, 120 (82.8%) hemodialysis patients had normal total cholesterol. The highest number of hemodialysis patients with normal and high total cholesterol was found in patients with normal BMI. In contrast, patients who had normal total cholesterol levels were more likely to be obese than overweight or underweight. BMI of hemodialysis patients did not have a significant association with total cholesterol levels (p-value 0.479).

Table 3. Association of Body Mass Index and Total Cholesterol

BMI Classification	Total Cholesterol Category			p value
	Normal	High	Total	
	n (%)	n (%)	n (%)	
Underweight	17 (77.3)	5 (22.7)	22 (100)	0.479
Normal	47 (83.9)	9 (16.1)	56 (100)	
Overweight	18 (75)	6 (25)	24 (100)	
Obese	38 (88.4)	5 (11.6)	43 (100)	
Total	120 (82.8)	25 (17.2)	145 (100)	

Association of Uric Acid and Blood Pressure

As seen in Table 4, normal or high uric acid levels were more likely in patients who had pre-hemodialysis SBP levels falling within the stage 2 hypertension category. Levels of uric acid had no significant association with pre-hemodialysis SBP (p-value 0.426). Normal or high uric acid levels were seen in patients with pre-hemodialysis DBP levels falling within the stage 2 hypertension category. Uric acid levels did not have a significant association with pre-hemodialysis DBP (p-value 0.964). Patients with high uric acid had higher post-hemodialysis SBP, with only 29.4% showing normal post-hemodialysis SBP, and uric acid levels had a significant association with post-hemodialysis SBP (p-value 0.02). Patients with high uric acid levels were more likely to have a normal post-hemodialysis DBP (50%), as the uric acid level was not shown to be statistically associated with the post-hemodialysis DBP

Table 4. Association of Uric Acid and Blood Pressure

Uric Acid	Normal		Pre-Hypertension		Stage 1 Hypertension		Stage 2 Hypertension		Total		p value
	n	%	n	%	n	%	n	%	n	%	
Pre-Hemodialysis Systolic Blood Pressure											
Normal	6	14	5	11.6	11	25.6	21	48.8	43	100	0.426
High	19	18.6	19	18.6	32	31.4	32	31.4	102	100	
Total	25	17.2	24	16.6	43	29.7	53	36.6	145	100	
Pre-Hemodialysis Diastolic Blood Pressure											
Normal	6	14	5	11.6	11	25.6	21	48.8	43	100	0.964
High	19	18.6	19	18.6	32	31.4	32	31.4	102	100	
Total	25	17.2	24	16.6	43	29.7	53	36.6	145	100	
Post-Hemodialysis Systolic Blood Pressure											
Normal	7	16.3	10	23.3	6	14	20	46.5	43	100	0.02
High	30	29.4	18	17.6	29	28.4	25	24.5	102	100	
Total	31	25.5	28	19.3	35	24.1	45	31	145	100	
Post-Hemodialysis Diastolic Blood Pressure											
Normal	17	39.5	9	20.9	13	30.2	4	9.3	43	100	0.253
High	51	50	25	24.5	16	15.7	10	9.8	102	100	
Total	68	46.9	34	23.4	29	20	14	9.7	145	100	

Association of Total Cholesterol and Blood Pressure

As seen in Table 5, normal and high total cholesterol were mostly observed in patients with pre-hemodialysis SBP levels at stage 2. A bivariate analysis was performed and found no significant association between cholesterol levels and pre-hemodialysis SBP. High total cholesterol was more commonly seen in patients who had normal pre-hemodialysis DBP (40%), but total cholesterol was not associated with pre-hemodialysis DBP (p-value 0.826). High cholesterol was seen in patients who had post-hemodialysis SBP levels in the category of stage 2 hypertension (40%). Total cholesterol did not correlate significantly with post-hemodialysis SBP. High cholesterol was mostly observed in patients with normal blood pressure (36%). Total cholesterol was not significantly associated with post-hemodialysis DBP.

Table 5. Association of Total Cholesterol and Blood Pressure

Total Cholesterol	Normal		Pre-Hypertension		Stage 1 Hypertension		Stage 2 Hypertension		Total		p value
	n	%	n	%	n	%	n	%	n	%	
Pre-Hemodialysis Systolic Blood Pressure											
Normal	22	18.3	20	16.7	34	28.3	44	36.7	120	100	0.826
High	3	12	4	16	9	36	9	36	25	100	
Total	25	17.2	24	16.6	43	29.7	53	36.6	145	100	
Pre-Hemodialysis Diastolic Blood Pressure											
Normal	63	52.5	26	21.7	18	15	13	10.8	120	100	0.536
High	10	40	7	28	6	24	2	8	25	100	
Total	73	50.3	33	22.8	24	16.6	15	10.3	145	100	
Post-Hemodialysis Systolic Blood Pressure											
Normal	34	28.3	23	19.2	28	23.3	35	29.2	120	100	0.371
High	3	12	5	20	7	28	10	40	25	100	
Total	37	25.5	28	19.3	35	24.1	45	31	145	100	
Post-Hemodialysis Diastolic Blood Pressure											
Normal	59	49.2	27	22.5	24	20	10	8.3	120	100	0.514
High	9	36	7	28	5	20	4	16	25	100	
Total	68	46.9	34	23.4	29	20	14	9.7	145	100	

Discussion

The results of this study regarding proportion of male patients, employment status, and hypertension as most frequent aetiology of ESRD were in line with those of Halle et al.[8] Most male patients who participated in this study were the family financial surety/insurer. The mean age of participants in the present study was similar to that of participants in the Vijayalaksmi et al.[9] study in India (50.1 years; SD 13.4 vs 53.5 years; SD 14.5). In addition, that study also showed that there were significant differences in the mean SBP and DBP values between males and females and that there was a significant difference in serum creatinine and urea levels between males and females.[9] The main aetiology of ESRD found in this study contrasted with that found in data from developed countries. According to data from the US Renal Data System 2014 cited by National Center for Chronic Disease Prevention and Health Promotion,[10] the primary causes of ESRD in the United States were diabetes (44% of cases in 2014 and 37.47% of cases in 2015) followed by hypertension/high blood pressure (29% of cases in 2014 and 25.1% cases in 2015).

This study showed that the AV fistula was the most frequently used vascular access in hemodialysis patients at CMH. The ANSWER[11] study in Spain also showed that 52% of all patients had an AV fistula as their vascular access for hemodialysis. Other vascular access points used by hemodialysis patients at CMH were femoral and tunnel catheter. The usage of femoral vascular access in hemodialysis practice at CMH was because some patients could not receive an AV fistula and had difficulty using the tunnel catheter.

Caetano et al.[12] suggested that a high BMI between 25 and 29.9 kg/m^2, and even a BMI in the range of morbid obesity (>35 kg/m^2), showed a protective effect for survival of patients who underwent hemodialysis. In other words, higher BMI was associated with better survival

compared normal BMI, a reverse epidemiological phenomenon. In contrast, the mean BMI of hemodialysis patients in this study was 23.1 kg/m^2 (SD 4.8), which is still considered in the normal BMI range. Therefore, further study regarding the association between BMI and survival among the participants of this study is needed, as BMI has shown a reverse epidemiological phenomenon.

In this study, the overall mean haematocrit was <33%. A clinical review by Fishbane et al.[13] showed that a haematocrit of <33% was associated with decreased eGFR (<30 mL/min/1.73 m^2 in women and <20 mL/min/1.73 m^2 in men). Supporting this evidence, we showed that the eGFR in both men (4.1 mL/min/1.73 m^2; SD 1.5) and women (4.5 mL/min/1.73 m^2; SD 2.7) was lower than the threshold in the above mentioned review.

The mean eGFR in the group of patients <60 years in age was significantly lower than that of patients ≥60 years old. The serum creatinine level of the patients <60 years old was significantly lower than that of the ≥60 years old group. We showed that the residual renal function of the younger age group was worse than that of the older age group, a finding supported by a study by Vijayalakshmi et al.[9]

Contrary to a clinical review by Daugirdas et al.[14] which stated that platelet number was potentially reduced in hemodialysis patients to the range of 175-180,000/µL, we showed that the mean platelet count of all patients was at a higher level than the range mentioned earlier (223,910/µL).

In this study, the mean leukocyte count of all patients was 7,900/µl (SD 2,600/µl). This result was somewhat similar to that for all patients in a study by Sibarani et al.[15] (mean leukocyte count of 7,883/µl (SD 3,494)). We showed that the male group had lower leukocyte counts than the female group, and this result was contrary to the results of Fan et al.[16] which showed that men were more likely to have higher leukocyte counts.

This study showed that serum total protein in women and in those <60 years old was significantly higher than in men and those ≥60 years old. However, studies have suggested that plasma protein cannot be used as a single criterion for nutritional status, due to other contributing factors including age, comorbidities, hypervolemia, and weight loss.[16]

The mean SGOT and SGPT were in normal value ranges (as seen in Table 3), a result supported by Hou et al.[17] who reported that there was no observed impairment in the liver function of hemodialysis patients.

Electrolytes are important laboratory profile measures associated with risk of mortality in hemodialysis patients.[17] The mean potassium level of all patients in this study was more than 4 mEq/L (4.62 mEq/L; SD 0.84), considered in the safe level range (as seen in Table 3); a study by Korgaonkar et al.[18] reported that serum potassium levels of 3.5-4 mEq/L were associated with higher risk of mortality. The mean sodium level of all patients in this study was in the normal range of 135-145 mEq/L; low sodium levels were associated with higher risk of mortality according to a study by Sun et al.[19]

In terms of lipid profiles, we reported that the female group had significantly higher levels of cholesterol (LDL, HDL, and total) and triglycerides than the male group. A similar result was reported by Bashardoust et al.[20] The normal range of chloride levels at CMH is 94—111 mEq/L (as seen in Table 3). In this study, the mean chloride level of all patients was in the normal range. Hypochloraemia was associated with cardiovascular risk and mortality in patients with CKD, according to a study by Mandai et al.[21]

The mean blood glucose of all patients in this study (124.7 mg/dL; SD 85.3) was better than that observed in a study by Osonoi et al.[22] who reported a mean blood glucose of 138.7 mg/dL (SD 35.3). This result indicates that there is good blood glucose control in patients on hemodialysis at CMH, specifically in patients who had diabetes mellitus (24.8%).

In the present study, the mean uric acid level of all patients was higher than that reported in a study by Chang et al.[23] who found mean uric acid levels of 6.2 mg/dL (SD 1.54). Contrary to popular theory, and to the results from Chang et al.[23] who reported that females had significantly lower levels of uric acid than males, we showed that the female group had significantly higher levels of uric acid. However, higher levels of uric acid are associated with a lower risk of cardiovascular mortality in hemodialysis patients, according to a study by Latif et al.[24]

Anaemia is common in patients with ESRD. One of the indicators of anaemia in ESRD patients in addition to hemoglobin is the TIBC level. A study by Bross et al.[25] reported a mean TIBC level of 208 mg/dL (SD 40). We showed a higher result, with a mean TIBC of 216.7 mg/dL (SD 52.1). Reduced TIBC levels have been significantly associated with increased risk of mortality in hemodialysis patients.[25]

Chertow et al.[26] reported that serum albumin was a potent predictor of mortality and cardiovascular events in patients with ESRD, while

higher serum albumin was related to a decrease in the risk of access-related hospitalization. In addition, advanced age, lower body weight, lower haemoglobin, and higher ferritin were predictors of all-cause hospitalization, whereas older age, higher concentration of phosphorus, calcium, and ferritin were among the predictors of cardiovascular hospitalization. The results of this study showed that mean albumin and calcium levels were considered normal, mean phosphorus and ferritin were higher than the normal range, and mean albumin was lower than the normal range in our patients. Therefore, hemodialysis and health care providers need to be aware of the future cardiovascular hospitalization possibility. In addition, the mean haemoglobin in this study was considered lower than normal, even though erythropoietin at a 2 x 3000 IU dose was given to all patients except those with certain conditions.

The mean SBP values before and after hemodialysis in this study were 147.9 mmHg (SD 27.0) and 141.4 mmHg (SD 30.1), while the pre- and post-hemodialysis DBP values were 79.10 mmHg (SD 15.4) and 80.1 mmHg (SD 17.1). According to Turner et al.[27] and Port et al.[28] both mean pre- and post-hemodialysis SBP values were in the safe range, because an SBP of more than 135 mmHg before and after dialysis was found to be a protective factor, but an SBP of less than 130 mmHg or more than 160 mmHg increased the risk of mortality. We showed that the pre-hemodialysis SBP was higher than the post-hemodialysis SBP. This could be explained by studies that showed that hemodialysis reduced SBP by decreasing plasma volume.[29] The mean DBP of patients in this study increased after hemodialysis. This result was similar to that of Yang et al.[30] although the increase of DBP observed in that study was not significant.

Strengths and Limitations of This Study

A limitation of this study was the cross-sectional design, which did not explain the causal relationships among two or more variables but showed only the association of the variables. However, this study presented not only the epidemiological profiles but also the laboratory results from a major referral national government teaching hospital in Jakarta. To the best of our knowledge, this was the first such study in Indonesia, particularly in Jakarta.

Conclusions

Patients with ESRD undergoing hemodialysis were mostly middle-aged males who were employed and married. Most of the hemodialysis costs were funded by National Health Insurance Programme. Hypertension was the most common aetiology in these populations. Patients were mostly from Jakarta and Java. Vascular access was most frequently achieved via the AV fistula followed by tunnel catheter and femoral access. In addition, more than half of the subjects did not have any infection.

There were significant differences in both SBP and DBP before and after hemodialysis in both genders. The mean albumin, calcium, haemoglobin, and haematocrit levels of participants were in the normal range, while the mean levels of phosphorus and ferritin were higher than normal values. We also found that there were associations between uric acid and post-hemodialysis SBP, but we did not find any associations between BMI and total cholesterol, between total cholesterol and all blood pressure variables (pre-/post-SBP and pre-/post-DBP), or between uric acid and pre-hemodialysis SBP or pre-/post-hemodialysis DBP.

Acknowledgements

We would like to appreciate the medical staffs of Hemodialysis Unit at Cipto Mangunkusumo Hospital for their cooperation during this study.

References

1. International Society of Nephrology. Summary of Recommendation Statements. Kidney Int Suppl. 2013;3:5–14.
2. Chaudhari ST, Sadavarte AV, Chafekar D. Clinical profile of end stage renal disease in patients undergoing hemodialysis. MVP J Med Sci. 2017;4:8-13.
3. Morad Z, Chiong HL, Tungsasa K. Suhardjono. Funding renal replacement therapy in Southeast Asia: building public-private partnerships in Singapore, Malaysia, Thailand, and Indonesia. Am J Kidney Dis. 2015;65:800.
4. Hill NR, Fatoba ST, Oke JL, Hirst JA, O'Callaghan CA, Lasserson DS, et al. Global prevalence of chronic kidney disease - a systematic review and meta-analysis. PLOS ONE. 2016;11:e0158765.
5. Indonesian Renal Registry. 8th Annual Report of Indonesian Renal Registry. Bandung: IRR; 2015. p. 1-45.
6. Bae EH, Kim HY, Kang YU, Kim CS, Ma SK, Kim SW. Risk factors for in-hospital mortality in patients starting hemodialysis. Kidney Res Clin Pract. 2015;34:154-9.
7. Lijie M, Sumei Z. Risk factors for mortality in patients undergoing hemodialysis: a systematic review and meta-analysis. Int J Cardiol. 2017;238:151-8.

8. Halle MP, Takongue C, Kengne AP, Kaze FF, Ngu KB. Epidemiological profile of patients with end stage renal disease in a referral hospital in Cameroon. BMC Nephrol. 2015;16:59.
9. Vijayalaksmi UB, Rayidi M. Laboratory Profiles of Patients on hemodialysis – a retrospective one year study in a rural tertiaty care hospital. J Clin Diagn Res. 2015;9:12-5.
10. National Center for Chronic Disease Prevention and Health Promotion. National chronic kidney disease fact sheet, 2017. http://www.cdc.gov/kidneydisease/pdf/kidney_factsheet.pdf (2017). Accessed 12 April 2018.
11. Pérez-García R, Martín-Malo A, Fort J, Cuevas X, Lladós F, Lozano J, et al. Baseline characteristics of an incident haemodialysis population in Spain: results from ANSWER--a multicentre, prospective, observational cohort study. Nephrol Dial Trans. 2009;24:578-88.
12. Caetano C, Valente A, Oliveira T, Garagarza C. Body composition and mortality predictors in hemodialysis patients. J Ren Nutr. 2016;26:81-6.
13. Fishbane S, Spinowitz B. Update on anemia in ESRD and earlier stages of CKD: core curriculum 2018. Am J Kidney Dis. 2018;71:423-35.
14. Daugirdas JT, Bernardo AA. Hemodialysis effect on platelet count and function and hemodialysis-associated thrombocytopenia. Kidney Int. 2012;82:147-57.
15. Sibarani H, Muzasti RA, Lubis HR. Association between neutrophil-to-lymphocyte ratio and survival rate patient hemodialysis in Adam Malik general hospital in 2016. Earth Environ Sci. 2018;125.
16. Fan F, Jia J, Li J, Huo Y, Zhang Y. White blood cell count predicts the odds of kidney function decline in a Chinese community-based population. BMC Nephrol. 2017;18:190.
17. Hou YC, Liu WC, Liao MT, Lu KC, Lo L, Pan HC, et al. Long-term and short-term effects of hemodialysis on liver function evaluated using the galactose single-point test. Scientific World Journal. 2014;2014:260939.
18. Korgaonkar S, Tilea A, Gillespie BW, Kiser M, Eisele G, Finkelstein F et al. Serum potassium and outcomes in CKD: insights from the RRI-CKD cohort study. Clin J Am Soc Nephrol. 2010;5:762-9.
19. Sun L, Hou Y, Xiao Q, Du Y. Association of serum sodium and risk of all-cause mortality in patients with chronic kidney disease: A meta-analysis and sysematic review. Sci Rep. 2017;7.
20. Bashardoust B, Gavami M, Maleki N, Doustkami H, Habibzadeh S. Mortality and nutritional status in patients undergoing hemodialysis. Shiraz E Med J. 2015;16:e20076.
21. Mandai S, Kanda E, Iimori S, Naito S, Noda Y, Kikuchi H, et al. Association of serum chloride level with mortality and cardiovascular events in chronic kidney disease: the CKD-ROUTE study. Clin Exp Nephrol. 2017;21:104-11.
22. Osonoi T, Saito M, Tamasawa A, Ishida H, Tsujino D, Nishimura R, et al. Effect of hemodialysis on plasma glucose profile and plasma level of liraglutide in patients with type 2 diabetes mellitus and end-stage renal disease: a pilot study. PLOS ONE. 2014;9:e113468.
23. Chang PY, Chien LN, Lin YF, Wu MS, Chiu WT, Chiou HY. Risk factors of gender for renal progression in patients with early chronic kidney disease. Medicine (Baltimore). 2016;95:e4203.
24. Latif W, Karaboyas A, Tong L, Winchester JF, Arrington CJ, Pisoni RL et al. Uric acid levels and all-cause and cardiovascular mortality in the hemodialysis population. Clin J Am Soc Nephrol. 2011;6:2470-7.
25. Bross R, Zitterkoph J, Pithia J, Benner D, Rambod M, Kovesdy CP et al. Association of serum total iron-binding capacity and its changes over time with nutritional and clinical outcomes in hemodialysis patients. Am J Nephrol. 2009;29:571–81.
26. Chertow GM, Goldstein-Fuchs DJ, Lazarus JM, Kaysen GA. Prealbumin, mortality, and cause-specific hospitalization in hemodialysis patients. Kidney Int. 2005;68:2794-800.
27. Turner JM, Peixoto AJ. Blood pressure targets for hemodialysis patients. Kidney Int. 2017;92:816-23.
28. Port FK, Robinson BM, McCullough KP, Morgenstern H. Predialysis blood pressure on survival in hemodialysis patients. Kidney Int. 2017;91:755–6.
29. Bakris GL, Burkart JM, Weinhandl ED, McCullough PA, Kraus MA. Intensive hemodialysis, blood pressure, and antihypertensive medication use. Am J Kidney Dis. 2016;68:S15–23.
30. Yang CY, Yang WC, Lin YP. Postdialysis blood pressure rise predicts long-term outcomes in chronic hemodialysis patients: a four-year prospective observational cohort study. BMC Nephrol. 2012;13:12.