

PREVALENCE OF PERIPHERAL ARTERIAL DISEASE AMONG HEMODIALYSIS PATIENTS

By

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ABSTRACT

Background: Peripheral arterial disease (PAD) is common in patients with end-stage renal disease on hemodialysis, but is frequently underdiagnosed. The risk factors for PAD are well known within the general population, but they differ somewhat in hemodialysis patients. This study aimed to determine the prevalence of PAD and its risk factors in patients on hemodialysis.

Objective: To assess the prevalence of peripheral arterial disease in end stage renal disease patients on hemodialysis.

Patients and Methods: This was across-sectional study carried out at Hemodialysis Unit of Al-Hussein University Hospital over a period of six month; from September 2019 to April 2020, and conducted on 80 hemodialysis patients. Demographic data and clinical information were recorded. Laboratory data including CBC, calcium, phosphate, total cholesterol, triglyceride, high-density lipoprotein, and iron profile were evaluated. The ankle-brachial index was measured in all patients. PAD was diagnosed if ankle-brachial index < 0.9. Duplex ultrasound for arterial system of both lower limb was done for patient with ankle / brachial index > 0.9.

Results: As regard description of demographic data, the mean age of all studied patients was 45.3 ± 8.8 years with minimum age of 24 years and maximum age of 62 years. There were 43 males (53.8%) and 37 females (46.3%). Thirty-five patients (43.7%) were diabetic, and 48 patients (60%) were hypertensive. According to laboratory profile, the mean of WBCs, Hb, platelets, serum calcium, PO₄, and iPTH were $6.5 \times 10^3/\text{ul}$, 10.4 g/dl, $228.2 \times 10^3/\text{ul}$, 8.3 mg/dl, 9.4 mg/dl and 477.2 ug/ml respectively. Regarding lipid profile, the mean of total cholesterol, HDL and triglyceride were 214.7 mg/dL, 41.9 mg/dL, and 172.2 mg/dL, respectively. Regarding to iron profile, the mean of iron serum, ferritin and TIBC were 62.7 mg/dl, 603.3 ng/ml and 236.7 mg/dl, respectively. According to ABI, there were 22 patients (27.5%) ≤ 0.9 , while there were 58 patients (72.5%) > 0.9 . The prevalence of peripheral arterial disease among HD patients was 27.5%.

Conclusions: High prevalence of peripheral arterial disease in CKD patients on hemodialysis and Ankle – brachial index was clearly more sensitive than physical examination in detecting of peripheral arterial disease in CKD patients on hemodialysis.

Key words: Peripheral arterial disease among hemodialysis Patients, ankle brachial index.

INTRODUCTION

Peripheral arterial disease (PAD) of the lower extremities is widespread, and it affects over 200 million people

worldwide. The prevalence of PAD has increased over the last decade, particularly in low-income countries (*Fowkes et al., 2017*). It is also highly prevalent among patients with end-stage renal disease, and

it has serious consequences that influence patient outcomes (*Viazzi et al., 2017*). PAD increases with age and is 4.5–14.5% more prevalent among individuals aged ≥ 65 years (*Criqui and Aboyans, 2015*). Chronic kidney disease (CKD) is a global public health problem with a rising prevalence. Low glomerular filtration rate is associated with higher risk for kidney failure requiring dialysis, as well as with cardiovascular disease (CVD), hypertension, anemia, and other metabolic Complications (*Abdel-Hady et al., 2013*). Cardiovascular disease is still the most common cause of morbidity and mortality in hemodialysis patients (*Monfared et al., 2013*). Lower-extremity peripheral artery disease (PAD) affects approximately 10 million adults in the United States and more than 200 million adults throughout the world. Its global prevalence has increased by 24% from 2000 to 2010 (*Benjamin et al., 2019*). PAD is associated with an increased risk for other cardiovascular diseases such as myocardial infarction and stroke, reduces quality of life, and is a leading cause of nontraumatic leg amputation (*Fowkes et al., 2013*). However, it is initially asymptomatic, and it can only be diagnosed through screening tests, the ankle–brachial index (ABI) being the one used most frequently (*Aboyans et al., 2012*). Among patients on hemodialysis (HD), the prevalence of PAD is much higher, ranging from 17 to 48% (*Garimealla and Hirsch, 2014*). Therefore, many patients on HD with PAD could avoid or at least delay adverse events, such as amputations, cardiovascular events, and death if PAD was timely diagnosed and adequately treated (*Matsuzawa et al., 2015*).

Although these studies were valuable, they had different methods for PAD diagnosis. The early diagnosis and management of PAD can improve the prognosis for patients on HD (*Ogata et al., 2010*).

The present work aimed to assess the prevalence of peripheral arterial disease among hemodialysis patients.

PATIENTS AND METHODS

This cross-sectional study included 80 hemodialysis patients at Nephrology Unit Al Hussein University Hospital from September 2019 to April 2020. Written informed consent obtained from the patients for all procedures that performed. All procedures followed Al-Azhar University Ethical Committee Regulation.

All patients received 3 hemodialysis sessions weekly.

Inclusion Criteria:

1. Patient`s age between 18 and 60 years.
2. Duration of hemodialysis more than 6 months.
3. Uses of native arteriovenous fistula in all patients.

Exclusion Criteria:

1. Patients less than 18 years or more than 60 years.
2. Duration of hemodialysis less than 6 months.
3. Un controlled hypertension or diabetes mellitus.
4. Recent infection.
5. Known to be collagen disease.
6. Diagnosis of PAD based on ankle / brachial index.

All Patients in this study were subjected to the following:

1. History and clinical examination stressing on ischemic symptoms.
2. Laboratory Investigations (Serum Creatinine – serum Calcium – serum phosphorus – intact parathyroid hormone – serum iron – serum ferritin – transferrin saturation - lipid profile.
3. Ankle / brachial index measured by Doppler ultrasound.

4. Duplex ultrasound for arterial system of both lower limb for patient with ankle / brachial index > 0.9 will be done.

Statistical analysis of data was done by using Statistical Program for Social Science (SPSS) version 24. Quantitative data were expressed as mean \pm standard deviation (SD). Qualitative data were expressed as frequency and percentage.

RESULTS

As regard description of demographic data, the mean age of all studied patients was 45.3 ± 8.8 years with minimum age of 24 years and maximum age of 62 years.

There were 43 males (53.8%) and 37 females (46.3%). Thirty five patients (43.7%) were diabetic, and 48 patients (60%) were hypertensive (**Table 1**).

Table (1): Demographic data of studied patients

Variables		Studied patients (N = 80)	
Age (years)	Mean \pm SD	45.3 \pm 8.8	
	Min – Max	24 – 62	
Sex	Males	43	53.8%
	Females	37	46.2%
DM	No	45	56.3%
	Yes	35	43.7%
HTN	No	32	40%
	Yes	48	60%

According to laboratory profile, the mean of WBCs, Hb, platelets, serum calcium, PO₄, and iPTH were $6.5 \times 10^3/\text{ul}$, 10.4 g/dl, $228.2 \times 10^3/\text{ul}$, 8.3 mg/dl, 9.4 mg/dl and 477.2 ug/ml respectively. Regarding lipid profile, the mean of total

cholesterol, HDL and triglyceride were 214.7 mg/dL, 41.9 mg/dL, 172.2 mg/dL, respectively. Regarding to iron profile, the mean of iron serum, ferritin and TIBC were 62.7 mg/dl, 603.3 ng/ml and 236.7 mg/dl, respectively (**Table 2**).

Table (2): Laboratory profiles in studied patients

Variables		Studied patients (N = 80)
Iron (mg/dl)	Mean \pm SD	62.7 \pm 24.3
	Min – Max	28 – 169
Ferritin (ng/ml)	Mean \pm SD	603.3 \pm 778.3
	Min – Max	15 – 5558
TIBC (mg/dl)	Mean \pm SD	236.7 \pm 778.3
	Min – Max	44 – 555
T. CHOL (mg/dl)	Mean \pm SD	214.7 \pm 50.4
	Min – Max	146 – 388
T.G (mg/dl)	Mean \pm SD	172.2 \pm 48.3
	Min – Max	122 – 321
HDL (mg/dl)	Mean \pm SD	41.9 \pm 5.9
	Min – Max	30 – 56
CA (mg/dl)	Mean \pm SD	8.3 \pm 1.2
	Min – Max	4.5 – 14
PO4 (mg/ml)	Mean \pm SD	5.4 \pm 1.8
	Min – Max	2 – 9.9
PTH (ug/ml)	Mean \pm SD	477.2 \pm 476.7
	Min – Max	12 – 2087

According to ABI, there were 22 patients (27.5%) \leq 0.9, while there were 58 patients (72.5%) $>$ 0.9 (Table 3).

Table (3): Ankle brachial index in all studied patients

Ankle brachial index Studied Patients (N=80)	Index \leq 0.9	Index $>$ 0.9
N (%)	22 (27.5%)	58 (72.5%)
Mean \pm SD	0.83 \pm 0.07	1.12 \pm 0.08
Min – Max	0.7 – 0.9	1 – 1.3

According to duplex result, the prevalence of Peripheral arterial disease among HD patients was 27.5% (Table 4).

Table (4): Duplex results in all studied patients

Duplex	Studied patients (N = 80)	
Ischemia	22	27.5%
No ischemia	58	72.5%

DISCUSSION

This study was carried out at Hemodialysis Unit of Al-Hussein University Hospital over a period of six month; from September 2019 to April

2020, and conducted on 80 Hemodialysis Patients.

As regard description of demographic data, the mean age of all studied patients was 45.3 \pm 8.8 years with minimum age of

24 years and maximum age of 62 years. There were 43 males (53.8%) and 37 females (46.3%). Thirty five patients (43.7%) were diabetic and 48 patients (60%) were hypertensive. Regarding pretreatment laboratory profile, results showed that the mean of WBCs, Hb, platelets, serum calcium, PO₄, and iPTH were 6.5 x10³/ul, 10.4 g/dl, 228.2 x10³/ul, 8.3 mg/dl, 9.4 mg/dl and 477.2 ug/ml respectively. Regarding lipid profile, results showed that the mean of total cholesterol, HDL and triglyceride were 214.7 mg/dL, 41.9 mg/dL, 172.2 mg/dL, respectively.

Regarding iron profile, results showed that the mean of iron serum, ferritin and TIBC were 62.7 mg/dl, 603.3 ng/ml and 236.7 mg/dl, respectively.

Regarding results of ABI, there were 22 patients (27.5%) \leq 0.9, while there were 58 patients (72.5%) $>$ 0.9. The prevalence of Peripheral arterial disease among HD patients was 27.5%.

The results of current study were supported by *Laghari et al. (2015)* in which a total of 72 CKD patients were included. The age of the patients ranged from 18 to 75 years, with a mean of 53.22 years. Of all the patients, 46 patients (63.9%) were male and 26 patients (36.1%) were female. Twenty-five patients (34.7%) were in stage 3 CKD with a GFR of 30–60 mL/min, 27.8% were in stage 4 CKD with a GFR of 15–30 mL/min and 27 patients (37.5%) were in stage 5 CKD with a GFR of $<$ 15 mL/min; of these patients, 25 (34.7%) were on hemodialysis. Twenty patients (27.8%) had an ABI $<$ 0.9 and hence had PVD. In accordance with our results *Arroyo et al. (2017)* in a large multicenter

cohort enrolled 2445 CKD subjects in 81 Spanish hospitals and dialysis clinics, 559 controls with an MDRD $>$ 60 mL/min/1.73 m² were recruited from nine primary care centers from different regions of the country. The mean age of the CKD population was 57.9 \pm 12.8 years, and 61.7% were male patients. Prevalence of hypertension, dyslipidemias and diabetes were 89.3, 64.9 and 25.7%, respectively. CKD patients had a higher prevalence of subclinical PAD than non-CKD controls (28.0% versus 12.3%, $P <$ 0.00).

PAD is a regular complication of hemodialysis patients and is associated with poor outcomes. However, it is initially asymptomatic, and it can only be diagnosed through screening tests, the ankle-brachial index (ABI) being the one used most frequently (*Aboyans et al., 2012*).

CONCLUSION

High prevalence of peripheral arterial disease in CKD patients on hemodialysis and Ankle-brachial index was clearly more sensitive than physical examination in detecting of peripheral arterial disease in CKD patients on hemodialysis.

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معدل إنتشار أمراض الشرايين الطرفية في المرضى المعاشين علي الاستصفاء الدموي

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خلفية البحث: مرض الشرايين الطرفية شائع في مرضى الكلى المعاشين علي الاستصفاء الدموي، ولكن في كثير من الأحيان لا يتم تشخيصه. وعوامل الخطر الخاصة باعتلال الشرايين الطرفية معروفة جيداً، ولكنها تختلف إلى حد ما في مرضى الكلى المعاشين علي الاستصفاء الدموي.

الهدف من البحث: تقييم مدى إنتشار مرض الشرايين الطرفية في مرضى الكلى المعاشين علي الاستصفاء الدموي.

المرضى وطرق البحث: أجريت هذه الدراسة المقطعية على ثمانين مريض كلى خضعوا للغسيل الكلوي. وقد تم أخذ التاريخ المرضي الكامل وفحص إكلينيكي شامل، واختبارات معملية لكل المرضى بما في ذلك صورة الدم والكالسيوم والفوسفات والكوليسترول الكلي والدهون الثلاثية والبروتين الدهني عالي الكثافة وملف الحديد. وقد تم قياس مؤشر الكاحل والعضد في جميع المرضى، وإعتلال الشرايين الطرفية إذا كان مؤشر الكاحل والعضد أقل من 9,0 كما تم إجراء الموجات فوق الصوتية المزدوجة للجهاز الشرياني للطرف السفلي للمريض الذي لديه مؤشر الكاحل/العضد أكبر من 9,0.

نتائج البحث: فيما يتعلق بوصف البيانات الديموغرافية، كان متوسط العمر لجميع المرضى الخاضعين للدراسة 8.8 ± 45.3 سنة مع الحد الأدنى للعمر 24 سنة والحد الأقصى للعمر 62 سنة. وكان هناك 43 ذكور (53.8%) و 37 إناث (46.3%). كما كان 35 مريضاً (43.7%) مصابين بالسكري، علاوة على 48 مريضاً (60%) يعانون من إرتفاع ضغط الدم وكان متوسط كرات الدم البيضاء، والهيموجلوبين، والصفائح الدموية، ومصل الكالسيوم، والفوسفور،

وهرمون الغدة الجاردرقية، $5,6 \times 310$ خلايا/ ميكرو لتر، $4,10$ جم/ ديسيلتر، 228.2×310 خلايا/ ميكرو لتر، $3,8$ مجم / ديسيلتر $4,5$ مجم/ ديسيلتر، 477.2 ميكروجرام/ ديسيلتر على التوالي. وفيما يتعلق بملف الدهون، كان متوسط الكوليسترول الكلي، والبروتين الدهني العالي الكثافة، والدهون الثلاثية $7,214$ مجم/ ديسيلتر، 41.9 مجم/ ديسيلتر، 172.2 مجم/ ديسيلتر على التوالي. وفيما يتعلق بملف الحديد، كان متوسط مصّل الحديد، والفيريتين، وإجمالي قدرة ارتباط الحديد $7,62$ مجم/ ديسيلتر، 603.3 نانوجرام/ مل و 236.7 مجم/ ديسيلتر على التوالي. تماشياً مع مؤشر الكاحل والعضد، كان هناك 22 مريضاً (27.5%) أقل من $9,0$ ، كما كان هناك 58 مريضاً (72.5%)، أكبر من $9,0$. كانت نسبة الإصابة بأمراض الشرايين الطرفية بين مرضى الغسيل الكلوي هي (27.5%).

الإستنتاج: إرتفاع معدل إنتشار مرض الشرايين الطرفية في مرضى الكلى المزمن الذين يخضعون لغسيل الكلى (27.5%) ومؤشر الكاحل والعضد أكثر حساسية من الفحص البدني في الكشف عن مرض الشرايين الطرفية في مرضى الكلى المزمن المعاشين علي الاستصفاء الدموي.

الكلمات الدالة: مرض الشرايين الطرفية في المرضى المعاشين على الاستصفاء الدموي، مؤشر الكاحل والعضد.