Original Article

A Study of Blood Velocity and Blood Pressure in Kidney Disease Patients on Regular Dialysis

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ABSTRACT

Objective: Assessment of the changes in blood velocity and blood pressure for patients with chronic kidney diseases undergoing hemodialysis.

Study Design: Cross-sectional study

Place and Duration of Study: This study was conducted at the Al-Hussein and Al-Nasiriyah Teaching Hospitals, Iraq from 1st July 2023 to 30th November 2023.

Methods: Ninety patients were effects of hemodialysis on blood velocity and blood pressure was (aged 21-70 years) selected using convenient sampling methods were enrolled. Blood pressure was measured using a sphygmomanometer, and blood flow velocity was assessed using Doppler ultrasonography before and after hemodialysis.

Results: Significant alterations in blood velocity and blood pressure were observed pre and post hemodialysis.

Conclusion: The dramatic changes in blood velocity during dialysis. Monitoring for low blood pressure may help to adjust the dialysis schedule, such as electrolyte levels and hemofiltration rates, to reduce complications.

Key Words: Hemodialysis, Blood pressure, Blood velocity

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INTRODUCTION

Chronic kidney disease is a common health problem where kidney replacement therapy becomes needed for treating end-stage kidney failure (ESRF). Hemodialysis is a widely used treatment; however, it often causes problems, with low blood pressure caused by dialysis (dialysis-induced hypotension) being one of the most serious. Dialysis-induced hypotension, which happens in 20-30% of hdemodialysis patients, usually appears during or toward the end of a session.[1-3] When it happens, it needs careful watching, because severe episodes can lead to issues like heart disease, stroke, and gut damage.[4,5] In these cases, dialysis may need to be stopped, which makes it less effective.[6]

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The main cause of dialysis-induced hypotension is lower blood volume caused by too much fluid removal and slower refilling of plasma into the blood vessels.[7] Other things that add to the problem include weak narrowing of blood vessels, existing heart problems[8], or less common causes like bleeding, severe infection, or air bubbles in the blood. The body's natural responses to dialysis-induced hypotension include a drop in vein capacity, an increase in artery tightness, and stronger heart pumping.

Compared to hemodialysis, peritoneal dialysis has a lower chance of causing low blood pressure because of the way it removes fluid. dialysis-induced hypotension can show up suddenly as a drop in the top blood pressure number (systolic) below 90 mmHg, or it can happen repeatedly over time (chronic episodes). Blood velocity, which means how fast blood moves through the vessels is affects by things like blood pressure, blood volume, and how stretchy the artery walls. Doppler ultrasound works well to measure blood flow speed, and it helps show changes caused by hemodialysis.[9]

Even though some researchers disagree that there is a direct link between relative blood volume (RBV) and blood pressure changes during hemodialysis[10-12], studies show clear changes in brain artery speed after dialysis.[13] There is not much research on how hemodialysis affects blood volume and blood pressure levels in kidney failure patients, so more studies are needed in this area.

METHODS

This cross-sectional study was conducted at Al-Hussein and Al-Nasiriyah Teaching Hospitals, Iraq from 1st July 2023 to 30th November 2023 vide letter No. MEC-2001/Approval/JSDJNS dated June 21, 2023. A total of 90 CKD patients (50 men and 40 women) who were having HD on a regular basis were enrolled. The patients were split into five age groups as 21-30 years: 7 patients (3 men, 4 women), 31-40 years: 18 patients (10 men, 8 women), 41-50 years: 42 patients (22 men, 20 women), 51-60 years: 14 patients (11 men, 3 women) and 61-70 years: 9 patients (4 men, 5 women). Those patients who had chronic kidney disease and were on hemodialysis, with no past episodes of sudden kidney failure or diabetes were included. Patients had too much body fluid, fistulas in the cubital fossa (inner elbow area), or any other major health problems not related to chronic kidney disease were excluded.

Blood pressure was recorded using a regular mercury blood pressure device before the dialysis session and (4 hours) after it ended. The readings followed the Korotkoff sounds method to make sure they were correct.

Blood velocity was measured using Siemens Acuson X300 Doppler ultrasound device (Germany) at the same time points before and after dialysis.

All measurements were made under normal conditions in the hospital's dialysis unit. Patients were watched closely for signs of low blood pressure caused by dialysis (dialysis-induced hypotension), which was defined as a drop in the top blood pressure number (systolic) below 90 mmHg or symptoms of low blood pressure during hemodialysis. The data was analyzed to look at changes in blood pressure and blood velocity before and after hemodialysis. Statistical significance was determined using a two-tailed paired t-test, with a p-value at 0.05 considered statistically meaningful.

RESULTS

The study found a clear increase in blood velocity after hemodialysis in most age groups. On the other hand, blood pressure showed a clear drop, especially in groups 4 and 5 (P<0.0001). Low blood pressure (hypotension) was seen in 27.7% of patients, mostly in the older age groups (Tables 1-2, Fig. 1).

Table No. 1: Blood pressure in relation to age and sex pre and post dialysis

Age (years)	No.	Before dialysis Mean BP (mmHg)	After dialysis Mean BP (mmHg)	Male:Female
21-30	7	92.4	83.1	0.75:1
31-40	18	97.1	97.2	1.2:1
41-50	42	100.6	93.1	1.1:1
51-60	14	106.1	96.1	3.66:1
61-70	9	104.8	100.8	0.8:1
Total	90	100.4±7.42	94.7±8.13	

Table No. 2: Blood velocity in relation to age and sex pre and post dialysis

Age (years)	No.	Before dialysis Mean BV (cm/sec)	After dialysis Mean BV (cm/sec)	Male:Female
21-30	7	45.6	51.5	0.75:1
31-40	18	42.5	53.7	1.2:1
41-50	42	43.8	55.7	1.1:1
51-60	14	51.2	58.2	3.66:1
61-70	9	48.6	55.9	0.8:1
Total	90	48.76±6.84	56.48±6.12	

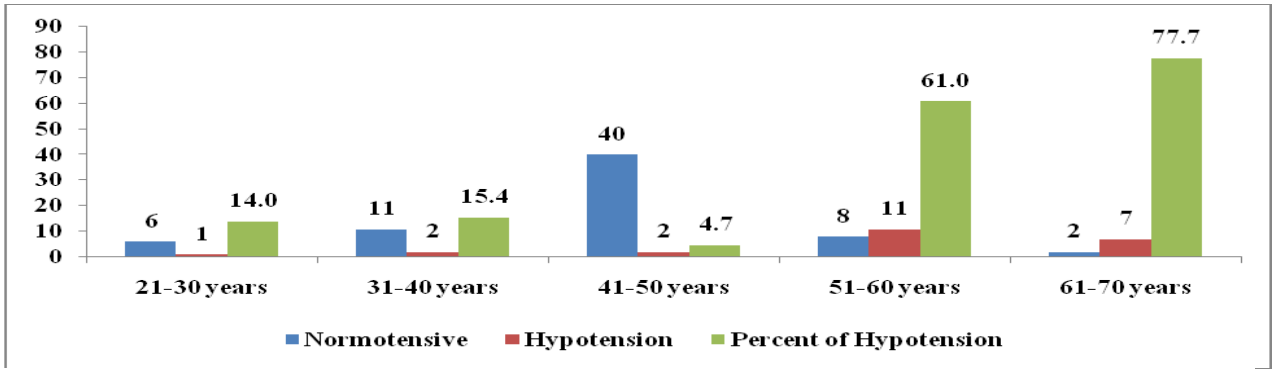

Figure No. 1: Distribution of dialysis induced hypotension according to age

DISCUSSION

The link between age, gender, and the development and worsening of chronic kidney disease has been studied a lot. Women generally have a lower risk of developing end-stage kidney disease (ESRD) during their childbearing years, likely because of the protective effects of estrogen. However, this trend flips after menopause, where women may face a higher rate of ESRD compared to men. This finding agrees with reports from the Japanese Society for Dialysis Therapy, which found lower ESRD rates in women than in men.[14] Many factors add to this gender difference, including genetics, environmental factors, lifestyle differences, and hormone effects.[15-17]

The current study showed that most ESRD patients belong to middle-aged and older groups. This result makes sense, given the natural drop-in kidney filtration rate that comes with aging kidneys. Supporting this, the National Health and Nutrition Examination Survey (NHANES) 1999–2004 indicated that about one-third of people aged 70 or older have poor kidney function.[18]

This study also showed clear differences in blood pressure before and after hemodialysis ($P < 0.0001$), with a large number of patients experiencing low blood pressure caused by dialysis (dialysis-induced hypotension). The causes of dialysis-induced hypotension are many and include lower blood volume, shifts in fluid thickness (osmolality), changes in electrolyte balance, and poor blood vessel tone and nerve responses. These factors are often made worse in patients who already have heart problems.[19-21] Also, the study found a clear increase in arm artery blood flow velocity after dialysis. This finding highlights the usefulness of BV as a sign of how well an arteriovenous fistula is working, with low flow rates often indicating that the fistula may need medical attention.[22,23]

CONCLUSION

Low blood pressure (hypotension) during hemodialysis is a common and potentially serious complication in ESRD patients. Keeping a close watch on blood pressure during dialysis sessions is necessary to lower risks. Noticing when low blood pressure occurs during the session can help guide changes to the dialysis settings, such as adjusting electrolyte levels and the speed of fluid removal. The study also shows that men are more likely to develop chronic kidney disease, which highlights the need for regular check-ups for high-risk men, especially those with diabetes or high blood pressure. Using prevention plans that are tailored to gender-based and age-based risk factors may improve patient outcomes.

Author's Contribution:

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Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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