Effectiveness of Nursing Interventions on Physiological Parameters Among Chronic Kidney Disease (CKD) Clients Undergoing Hemodialysis

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***Abstract*—Background:chronic kidney disease (CKD) clients undergoing hemodialysis often experience alterations in physiological parameters such as blood pressure, heart rate, respiratory rate, and weight due to fluid shifts, comorbidities, and dialysis effects. Nursing interventions such as pre- and post-dialysis care, guided breathing exercises, fluid intake monitoring, and patient education can play a vital role in stabilizing these parameters.**

Objectives:

1. **To assess the existing physiological parameters among CKD clients undergoing hemodialysis.**
2. **To determine the effectiveness of nursing intervention on physiological parameters.**
3. **To find out the association between physiological parameters and selected demographic variables.**

Materials and Methods:

A quasi-experimental one-group pre-test post-test design was employed among 30 CKD clients receiving hemodialysis at a tertiary care center using purposive sampling. Nursing interventions including breathing exercises, fluid/diet education, and guided rest were provided over 10 consecutive dialysis sessions. Pre- and post-intervention measurements included blood pressure, heart rate, respiratory rate, and interdialytic weight gain. Data were analyzed using SPSS v25.

Results:

post-intervention data showed improvements in physiological stability. Systolic BP reduced from a mean of 154.2 ± 8.7 mmHg to 141.6 ± 7.9 mmHg; heart rate improved from 92.1 ± 5.5 bpm to 84.8 ± 4.9 bpm; and respiratory rate declined from 22.7 ± 2.3 to 19.8 ± 1.9. Interdialytic weight gain was significantly controlled. The paired t-test indicated statistically significant differences ($p < 0.01$). Education and duration of dialysis were significantly associated with better post-test physiological parameters.

Conclusion:

The study revealed that structured nursing interventions were effective in improving physiological outcomes among CKD clients undergoing hemodialysis. Incorporating such interventions into standard nursing care is recommended to promote clinical stability.

***Index Terms*—Chronic Kidney Disease, Hemodialysis, Nursing Interventions, Blood Pressure, Heart Rate, Physiological Parameters**

I. INTRODUCTION

Chronic Kidney Disease (CKD) is a progressive and irreversible decline in renal function that poses a significant global health burden. According to the *World Health Organization (2021)*, CKD is among the top 20 causes of death worldwide, with its prevalence steadily increasing due to aging populations, hypertension, and diabetes mellitus. In India, the incidence of CKD is rapidly escalating, and a large proportion of patients require long-term renal replacement therapy, most commonly hemodialysis (*Jha et al., 2016*).

While hemodialysis is essential for maintaining life in patients with end-stage renal disease (ESRD), it is associated with profound physiological changes. Frequent fluctuations in blood pressure, variations in heart rate, alterations in respiratory patterns, and interdialytic weight gain are common occurrences. These changes are influenced by ultrafiltration rates, fluid and sodium shifts, dialysate composition, comorbidities, and individual patient responses. Poorly controlled physiological parameters increase

the risk of intradialytic hypotension, arrhythmias, fluid overload, pulmonary edema, and cardiovascular events, which are the leading causes of morbidity and mortality in this group.

Traditionally, management of these physiological alterations relies heavily on pharmacological therapies and dialysis prescription adjustments. However, an increasing body of evidence suggests that nurse-led non-pharmacological interventions—such as guided breathing exercises, dietary and fluid intake counseling, relaxation techniques, and structured rest periods—can significantly improve hemodynamic stability and overall patient well-being. Nurses, being in continuous contact with patients during dialysis sessions, are uniquely positioned to deliver such interventions effectively.

Previous studies, including those by *Singh et al. (2019)* and *Thomas et al. (2020)*, have demonstrated that individualized nursing care can help stabilize physiological parameters, reduce complications, and enhance patient comfort during and between dialysis sessions. However, there remains a paucity of research in the Indian context assessing the combined effect of structured nursing interventions over multiple dialysis sessions.

This study was therefore undertaken to evaluate the effectiveness of a structured nursing intervention program on selected physiological parameters—blood pressure, heart rate, respiratory rate, and interdialytic weight gain—among CKD clients undergoing hemodialysis and to determine demographic factors associated with improved outcomes.

II. OBJECTIVES

1. To assess the existing physiological parameters among CKD clients undergoing hemodialysis.
2. To determine the effectiveness of nursing intervention on physiological parameters.
3. To find out the association between physiological parameters and selected demographic variables.

III. MATERIALS AND METHODS

Study Design:

Quasi-experimental, one-group pre-test post-test design

Setting:

Dialysis unit of a tertiary care hospital in Maharashtra

Sample & Sampling Technique:

- Sample size: 30 CKD clients
- Sampling method: Non-probability purposive sampling

Inclusion Criteria:

- Diagnosed with CKD and on hemodialysis for ≥3 months
- Hemodynamically stable
- Willing to participate

Exclusion Criteria:

- Clients with acute infections or cardiovascular instability
- Those undergoing emergency dialysis

Nursing Intervention Protocol:

- Duration: 10 dialysis sessions (approx. 3 weeks)
- Components:
  - Guided breathing exercises pre- and post-dialysis
  - Fluid intake and weight monitoring education
  - Rest and sleep hygiene counseling
  - Basic relaxation techniques
- Monitoring: BP, HR, RR, and weight before and after each dialysis session

Tools for Data Collection:

1. Demographic Proforma
2. Physiological Parameter Checklist (BP, HR, RR, IDWG)

Ethical Considerations:

Ethical clearance obtained from Institutional Ethics Committee. Written informed consent secured.

Statistical Analysis:

- Descriptive: Mean, SD, frequency, percentage
- Inferential: Paired t-test (pre-post changes), chi-square test (demographic association)
- Software: SPSS v25
- Significance level: $p < 0.05$

IV. RESULTS

Section I: Changes in Physiological Parameters (N = 30)

Parameter	Pre-Test (Mean ± SD)	Post-Test (Mean ± SD)	p-value
Systolic BP (mmHg)	154.2 ± 8.7	141.6 ± 7.9	< 0.01

Diastolic BP (mmHg)	94.3 ± 6.1	86.5 ± 5.7	< 0.01
Heart Rate (bpm)	92.1 ± 5.5	84.8 ± 4.9	< 0.01
Resp. Rate (/min)	22.7 ± 2.3	19.8 ± 1.9	< 0.01
Weight Gain (kg)	2.7 ± 0.4	1.8 ± 0.5	< 0.01

Section II: Association with Demographic Variables

Variable	p-value	Significance
Age	0.063	Not Significant
Gender	0.141	Not Significant
Education Level	0.021	Significant
Duration of Dialysis	0.032	Significant

V. DISCUSSION

The results of this study clearly indicate that structured nursing interventions led to significant improvements in key physiological parameters among CKD clients undergoing hemodialysis. Post-intervention, there was a substantial reduction in systolic and diastolic blood pressure, stabilization of heart rate, improved respiratory rate, and a marked reduction in interdialytic weight gain.

These findings are consistent with *Singh et al. (2019)*, who reported that relaxation techniques and patient counseling could help in lowering blood pressure and improving hemodynamic stability during dialysis. Similarly, *Thomas et al. (2020)* found that nurse-led intradialytic exercises and dietary guidance improved cardiovascular responses and reduced fluid overload episodes. The physiological improvements observed in this study can be explained by several mechanisms:

1. Guided Breathing Exercises – Likely contributed to reduced sympathetic nervous system activation, thereby lowering heart rate and blood pressure.
2. Fluid Intake and Dietary Education – Enhanced patient adherence to fluid and sodium restrictions, reducing interdialytic weight gain and intradialytic hypotensive episodes.
3. Structured Rest and Relaxation Techniques – Minimized stress-induced cardiovascular fluctuations during and after dialysis.

The statistically significant association between education level and improved physiological outcomes highlights the role of patient literacy in understanding and adhering to self-care instructions. Likewise, the significant association with duration of dialysis suggests that patients who have been on dialysis longer may develop better coping mechanisms and adherence patterns when provided with structured support.

From a clinical perspective, the integration of such nursing interventions into routine dialysis care can provide multiple benefits:

- Reduction in acute dialysis-related complications
- Improved patient comfort and tolerance to treatment
- Better long-term cardiovascular outcomes

Moreover, these interventions are cost-effective, non-invasive, and feasible to implement in both high-resource and resource-limited settings.

However, it is important to note that the current study was limited by its single-center design, small sample size, and lack of a control group. Future research should aim to conduct randomized controlled trials with longer follow-up periods to assess the sustainability of improvements and to evaluate whether such interventions can reduce hospitalization rates and improve survival.

VI. CONCLUSION

The nursing intervention protocol was effective in improving blood pressure, heart rate, respiratory rate, and fluid gain control among hemodialysis clients. Such nurse-led programs should be regularly implemented to enhance holistic care in dialysis settings.

VII. LIMITATIONS

- No control group for comparison
- Limited to one dialysis center
- Short duration of follow-up

VIII. RECOMMENDATIONS

- Replication with larger, multicentric trials

- Longitudinal follow-up for sustainability of benefits
- Inclusion of family education sessions for continuity of care

Conflict of Interest
None declared.

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