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ORIGINAL RESEARCH

Knowledge and Practice of Nurses on Prevention and Management of Intradialytic Hypotension at Kiruddu and Mulago National Referral Hospitals

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Background: Intradialytic hypotension (IDH) remains a significant and distressing complication of hemodialysis, often reducing the efficiency of the dialysis procedure and leading to adverse clinical outcomes. IDH is strongly associated with increased morbidity and mortality rates among hemodialysis patients. This study aimed to evaluate the impact of an educational intervention on nurses' knowledge and practices regarding the prevention and management of IDH at Kiruddu National Referral Hospital (KNRH) and Mulago National Referral Hospital (MNRH).

Methodology: A quasi-experimental study was conducted in the dialysis units of KNRH and MNRH between May and July 2024, involving 25 dialysis nurses. Data were collected using semi-structured questionnaires to assess knowledge and an observation checklist to evaluate practices, both administered pre- and post-intervention.

Results: The study recruited 25 nurses with a mean age of 33.1 years, including 13 males. The majority had 1–4 years of dialysis experience. The mean knowledge score significantly increased from 5.3 before the intervention to 13.1 after the intervention ($p < 0.05$). Similarly, the mean practice score improved from 12 to 20, with the difference also being statistically significant ($p < 0.05$).

Conclusion: The baseline knowledge of nurses was generally low. The educational intervention significantly enhanced nurses' knowledge and practices in the prevention and management of IDH, highlighting the importance of continuous training to improve patient outcomes in hemodialysis care.

Keywords: intradialytic hypotension, management, prevention, educational intervention, nurses' knowledge and practice

Introduction

Hemodialysis is a vital treatment for approximately 3 million individuals globally with end-stage kidney disease, significantly enhancing survival and quality of life.[1] Chronic kidney disease (CKD) affects around 844 million people worldwide, surpassing the prevalence of diabetes and HIV/AIDS.[2,3] In Sub-Saharan Africa, particularly Uganda, kidney disease prevalence ranges from 10% to 13%, ranking among the top 10 causes of mortality[4] and placing a substantial burden on healthcare resources, as well as posing medical, social, and economic challenges for patients and their families.[5] In Africa, the burden of IDH is increasingly recognized, with prevalence rates varying widely across regions due to differences in patient demographics, dialysis protocols, and definitions used. For instance, studies have reported IDH prevalence rates of 12.4% in Burkina Faso,[6] 8.6% in Nigeria,[7] 2.11% in Senegal,[8] and 4.35% in northern Tanzania,[9] while another Tanzanian study identified hypotension as the leading intradialytic complication, affecting 28.1% of patients.[10] These figures underscore the heterogeneity of IDH burden across the continent and highlight the need for region-specific strategies. Within East Africa, data remain limited, but emerging evidence from Tanzania suggests that IDH is a significant concern, warranting further investigation in neighboring countries such as Uganda, where local data are still sparse. Despite its importance, hemodialysis can lead to numerous immediate and long-term complications, with intradialytic hypotension (IDH) being the most common,

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occurring in 10% to 70% of dialysis sessions.[1,11] IDH and other intradialytic complications, such as hypertension, muscle cramps, and nausea, significantly impact patient outcomes and quality of life.[12–14]

Effective management of IDH requires nurses to have up-to-date knowledge and practice, yet evidence indicates a gap in their understanding and skills in this area.[15,16] Educational interventions have been shown to improve nurses' ability to recognize, prevent, and manage IDH, ultimately reducing its incidence and severity.[16,17]

In Uganda, the knowledge and practice of nurses regarding IDH prevention and management remain poorly understood, despite its critical importance. Assessing the current status of nurses' knowledge and evaluating the impact of educational interventions are essential steps to improve patient outcomes and survival rates for those undergoing hemodialysis.

Regular updates and training for nurses are recommended to enhance their capacity to manage IDH effectively, thereby improving the overall quality of care for hemodialysis patients.

Methodology

Study Setting

The study was conducted at two dialysis units of Kiruddu and Mulago National Referral Hospitals in Central Uganda.

Study Design

The study utilized a quasi-experimental, one-group pretest-posttest design to assess the impact of an educational intervention on nurses' knowledge and practice regarding the prevention and management of IDH at KNRH and MNRH.

This design allowed for the evaluation of changes in nurses' knowledge and practices before and after the intervention, providing insights into its effectiveness in improving IDH-related care.

Study Population

The study population comprised 25 nurses who were officially employed and actively working in the dialysis units of KNRH and MNRH. The researcher included nurses who consistently worked in the dialysis units for at least three months, as they represent the current care staff. Formal "dialysis nurse" certification was not required for participation.

Sample Size Determination

The sample size for the study was determined through a prior power analysis utilizing G-power software version 3.2.9.4. For a paired *t*-test analysis, using a large effect size of d=0.8, a probability of type one error (α) = 0.05, and power ($1-\beta$) = 0.95,[18] the software indicated a required sample size of 22 participants, with an actual power of 0.956 for a two-tailed alternative hypothesis. Considering a 10% attrition rate ($0.1\times22=2.2$), the final minimum sample size required was 24 participants. The researcher chose a large effect size of 0.8 for this study because intradialytic hypotension is a significant clinical issue, and an educational intervention targeting nurses was expected to have a substantial and clinically relevant impact on their knowledge and practice, leading to meaningful improvements in patient outcomes. This rationale for a large effect size ensured adequate statistical power to detect a meaningful difference between the pre-test and post-test in our relatively small sample. The recruited sample of 25 participants was therefore adequate to measure the effect of the educational intervention on the prevention and management of IDH.[19] This sample size and effect size choice are also supported by similar studies.[20,21]

Sampling Criteria

The study employed purposive sampling to select nurses who met specific criteria, such as expertise and experience in the prevention and management of IDH. This targeted approach ensured the inclusion of participants most suitable for addressing the research questions, enabling the collection of valuable insights to enhance understanding of nurses' knowledge and practices in IDH prevention and management.

Data Collection Procedure

Upon approval from the Research ethics committee, Data was collected using two validated tools: a semi-structured questionnaire for assessing knowledge and an observation checklist for evaluating practices. The questionnaire comprised three sections: demographics, knowledge, and practices.

Baseline data on nurses' knowledge and practices regarding the prevention and management of IDH was collected, with participants completing questionnaires immediately to ensure high response rates and prevent peer consultation. Additionally, 25 nurses were observed three times discreetly over two weeks in each study site.

Following the pre-intervention phase, an educational intervention was implemented. This involved face-to-face teaching sessions lasting one hour, complemented by hands-on demonstrations during all work shifts. Participants received educational materials, including PowerPoint presentations, laminated leaflets, and video clips illustrating IDH prevention and management standards.

Post-intervention data was collected one month later using the same tools to assess the impact of the educational intervention on nurses' knowledge and practices. The one-month interval was informed by related studies[22,23] to evaluate the sustained effect of the intervention. This approach ensured a comprehensive assessment of the intervention's effectiveness in enhancing IDH-related care.

Quality Control

The questionnaire and checklist tools were developed based on a thorough review of relevant literature.[24–26] The tools were then reviewed by experts for content validity and pretested on nurses working in the MRRH dialysis unit. The internal consistency reliability of the knowledge questionnaire was assessed using Cronbach's alpha, yielding a coefficient of 0.8525, indicating good reliability within the study sample. Pretesting was conducted at Mbarara Regional Referral Hospital (MRRH), and adjustments were made before field data collection. To ensure standardization, all research assistants underwent training before the intervention, achieving an inter-observer reliability of 0.8. The educational sessions on the prevention and management of IDH were conducted under the supervision and oversight of a nephrologist to maintain consistency and accuracy throughout the intervention.

Data Management and Analysis

The collected questionnaires and observation checklists were reviewed for completeness immediately after data collection. Data was entered, coded, and cleaned using Microsoft Excel 2016, then exported to STATA version 17 for statistical analysis. Descriptive statistics were employed, with results presented in tables and graphs.

Knowledge and practice responses were dichotomized as "Yes" (1) for correct answers and "No" (0) for incorrect answers, and analyzed using frequencies and percentages.

Continuous variables were assessed for normality using skewness and kurtosis, with means and standard deviations (SD) or medians and interquartile ranges (IQR) reported accordingly. A paired *t*-test was used to analyze the mean scores of participants' knowledge and practice on the prevention and management of intradialytic hypotension (IDH) before and after the intervention for statistical significance.

Ethical Approval and Consent to Participate

The study protocol received ethical approval from the Mbarara University of Science and Technology Research Ethics Committee (MUST-2024-1497). Administrative clearance was secured from the management of KNRH and MNRH. Written informed consent was obtained from all participants, with the study objectives thoroughly explained to each individual. Participants provided signed consent forms during both the pre- and post-intervention phases. Confidentiality was strictly maintained, as no personally identifiable information, such as names or telephone numbers, was collected. Participants were assured that their decision to decline participation or withdraw from the study at any stage would have no adverse consequences or repercussions.

Results

Sociodemographic

The Demographic Characteristics of the Participants are Presented in Table 1 Below

In this study, 25 participants were recruited. 13 (52%) were male, while the majority, 13 (52%), were in the age bracket between 31–45 years, and 15 were from KNRH as compared to 10 who were from MNRH. The bigger number (52%) had a diploma in nursing, and 44% had experience in nursing of 1–5 years. 60% had a dialysis experience of 1–4 years, and almost all (92%) had a qualification in nephrology.

Knowledge Assessment

The Knowledge of the Study Participants Before and After the Intervention Is Presented in Table 2 Below

Before the training, only 32% could correctly define IDH, and the number rose to 92% after the training. Only 24% and 20% could tell the risk factors and common signs and symptoms of IDH, respectively, before the training, as opposed to

Table 1 Participants' Demographic Characteristics (n=25)

Variable	Category	F	%
Sex	Male Female	13 12	52 48
Education level	Certificate Diploma Bachelors Masters	2 13 10 0	8 52 40 0
Dialysis experience	1–4 5–8 >10	15 7 3	60 28 12
Nephrology qualification	Yes No	23 2	92 8
	Yes No	18 7	72 28
Hospital	KNRH MNRH	15 10	60 40
Age	Mean=33.1	SD= 1.54	
Years of Nursing experience	Mean =8.5	SD=1.28	

Table 2 Nurses' Knowledge Assessment Pre and Post Training on IDH (n=25)

Knowledge Item	Pre-test		Post-test	
	Correct F (%)	Incorrect F (%)	Correct F (%)	Incorrect F (%)
Definition of IDH	8 (32)	17 (68)	23 (92)	2 (8)
Do you think routine use of proactive IDH measures can prevent IDH?	10 (40)	15 (60)	22 (88)	3 (12)
What are the risk factors for IDH?	6 (24)	19 (76)	20 (80)	5 (20)
What are the common signs and symptoms of IDH	5 (20)	20 (80)	21 (84)	4 (16)
Describe steps used to manage IDH	1 (4)	24 (96)	20 (80)	5 (20)
Rate the importance of strategies to prevent IDH	3 (12)	22 (88)	21 (84)	4 (16)

80% and 84% after training. Before training, only 1 (4%) participant would describe the steps used to manage IDH correctly, and 3 (12%) would rate the importance of strategies to prevent IDH as compared to 20 (80%) and 21 (84%) after the training, respectively.

Perceived Importance of the Four BP Measures

The Perceived Importance of the Four BP Measures Is Presented in Figure 1

Before training, systolic blood pressure measure was selected as the most important BP parameter in the assessment of IDH, while pulse pressure was chosen as the least important. After the intervention, all four BP parameters were chosen as equally important (Figure 1).

Preferred Strategies Used to Prevent Intradialytic Hypotension (IDH)

The Preferred Strategies Used to Prevent IDH are Presented in Figure 2

The majority of participants reported that they were sometimes (n=16, 64%) or nearly always (n=8, 32%) successful in preventing IDH. The remaining 1 participant indicated that they were never successful, and no one reported being always successful.

Participants were asked about their preferred strategies for effective IDH prevention. Figure 2 indicates how many participants used each of the suggested intradialytic strategies to prevent IDH in their facility before and after the intervention.

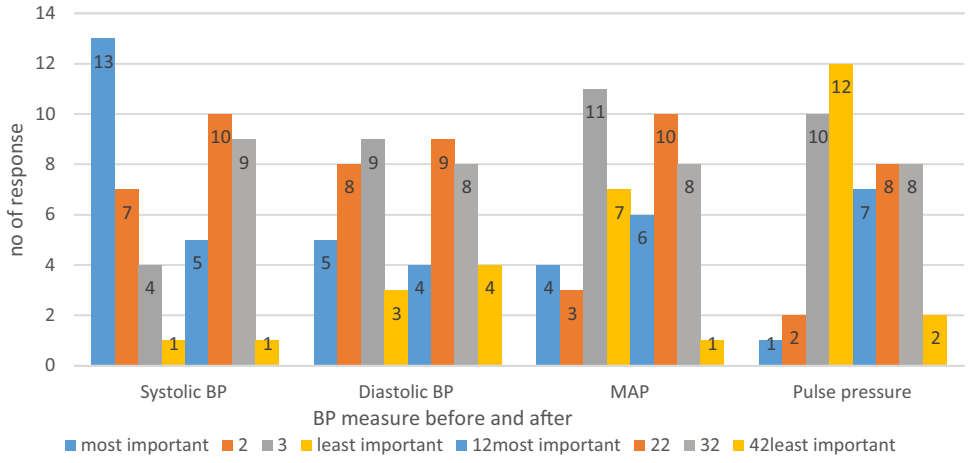


Figure 1 Perceived importance of BP parameters pre and post intervention among (n =25).

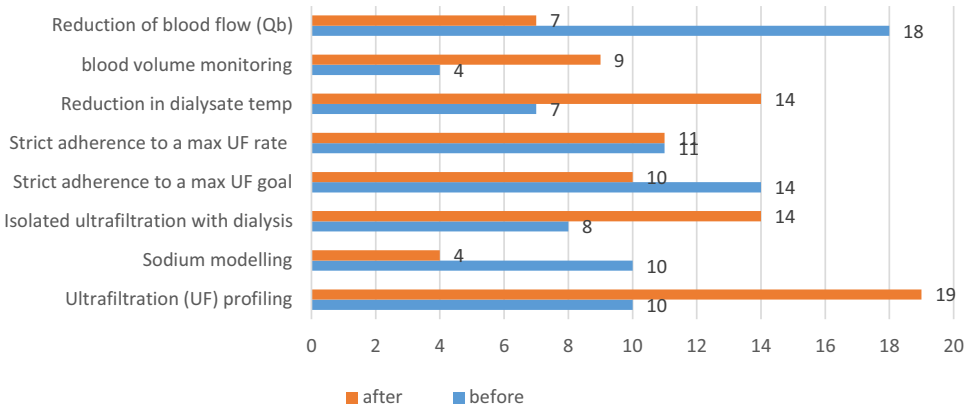


Figure 2 Strategies used to prevent IDH (25).

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Reduction of blood volume and strict adherence to the ultrafiltration goal were the most used strategies before the education. Ultrafiltration profiling, reduction in dialysate temperature, and isolated ultrafiltration with dialysis became the most used strategies after the intervention.

Comparison Between Nurses' Knowledge Before and After the Intervention

Before the intervention, the mean score of knowledge of nurses on IDH was 5.3 (SD=2.13) and 13.1 (SD=1.02) after. A paired *t*-test was run to ascertain whether the difference in the mean scores of knowledge was significant. The difference was statistically significant at 95% confidence interval ($t=16.1$, $p<0.001$).

Assessment of Nurses' Practice Towards IDH Pre- and Post-Intervention

The Nurses' Practice Towards IDH Pre- and Post-Intervention Is Presented in Table 3 Below

During assessment of practice, the following was observed before and after the intervention; Checking patient's medical history increased from 80% to 96%, assessing the patient's baseline vital signs increased from 68% to 92%, evaluating the patient's fluid status increased from 56% to 80% documenting the patient's weight increased from 64% to 88%. Patient being adequately hydrated increased from 46% to 88% reviewing the patient's prescribed medications increased

Table 3 Practice Assessment Before and After the Intervention (n=25 @ Observed 3 Times)

Aspect	Before		After	
	Yes F (%)	No F (%)	Yes F (%)	No F (%)
Patient assessment				
Check patient's medical history	60 (80)	15 (20)	72 (96)	3 (4)
Assess the patient's baseline vital signs	51 (68)	24 (32)	69 (92)	6 (8)
Evaluate the patient's fluid status	42 (56)	33 (44)	60 (80)	15 (20)
Document the patient's weight	48 (64)	27 (36)	66 (88)	9 (12)
Prevention measures				
Patient is adequately hydrated	36 (46)	39 (54)	66 (88)	9 (12)
Review the patient's prescribed medications	57 (76)	18 (24)	69 (92)	6 (8)
Set appropriate dialysis prescription parameters	60 (80)	15 (20)	75 (100)	0 (0)
Monitor the patient's vital signs	63 (84)	12 (16)	75 (100)	0 (0)
Stable and comfortable treatment environment	42 (66)	33 (44)	69 (92)	6 (8)
Immediate Response to IDH				
Monitor the vital every 15 minutes	27 (36)	48 (64)	60 (80)	15 (20)
Decrease UF rate or temporarily stop UF	30 (40)	45 (60)	66 (88)	9 (12)
Administer a normal saline bolus	39 (54)	36 (46)	60 (80)	15 (20)
Elevate the patient's legs if feasible.	21 (28)	54 (72)	57 (76)	18 (24)
Address the patient's symptoms and comfort	54 (72)	21 (28)	72 (96)	3 (4)
Document all interventions and response	51 (68)	24 (32)	66 (88)	9 (12)
Communicate with the nephrologist	60 (80)	15 (20)	75 (100)	0 (0)

(*Continued*)

Table 3 (Continued).

Aspect	Before		After	
	Yes F (%)	No F (%)	Yes F (%)	No F (%)
Post-IDH management				
Continue monitoring vital signs closely	51 (68)	24 (32)	72 (96)	3 (4)
Document the post-IDH care provided	60 (80)	15 (20)	75 (100)	0 (0)
Adjust the dialysis prescription	34 (46)	41 (54)	60 (80)	15 (20)
Educate patient on signs and symptoms of IDH	42 (56)	33 (44)	63 (84)	12 (16)
Medical chart contains records of all IDH events and actions	54 (72)	21 (28)	66 (88)	9 (12)
Communication and documentation				
Communicate with the patient and their family about any changes in the treatment	48 (64)	27 (36)	66 (88)	15 (12)
Maintain clear and detailed documentation of the patient's condition and interventions	57 (76)	18 (24)	69 (92)	6 (8)
Report any recurrent or severe IDH events to the healthcare team	45 (60)	30 (40)	69 (92)	6 (8)
Infection control				
Ensure that proper infection control measures are in place	60 (80)	15 (20)	75 (100)	0 (0)

from 76% to 92%, monitoring the vital signs every 15 minutes increased from 36% to 80% decreasing UF rate or temporarily stop UF increased from 40% to 88% while continuing monitoring vital signs closely increased from 68% to 96%.

Comparison of Mean Scores of Practices Pre- and Post-Intervention

The mean score of practice before the training was 12 (SD=3.71) and 20 (SD=0.53) after the training. A paired *t*-test was conducted to determine whether the difference in means was statistically significant. The difference was found to be statistically significant, $t=18.53$ $p<0.001$.

Discussion

Nurses' Baseline Knowledge on Prevention and Management of IDH

This study revealed that only a few nurses could correctly define IDH before training. The majority chose "A drop in blood pressure which may or may not be accompanied by adverse symptoms" and "A drop in systolic blood pressure greater than 20 mmHg" as the most common definitions. They emphasized the importance of the systolic blood pressure in defining IDH. However, IDH is defined as a sudden, unexpected, and symptomatic drop in BP requiring intervention, irrespective of metric value.[16] This could be due to a lack of nursing-focused in-service training or ward rounds aimed at improving nursing knowledge regarding the prevention and management of IDH. Nurses did not have printed guidelines for reference in their care for patients with IDH in their dialysis units. The possible explanation could be the fact that the nurse-to-patient ratio was high, which may have limited time for learning and conceptualizing information about the care of patients undergoing hemodialysis. This is similar to a study conducted by Yousef, Elashir, Mahmoud, Maghraby[27] about the effect of nursing educational program on knowledge and practice of nurses regarding infection control measures for children under hemodialysis in Egypt, which reported poor scores of knowledge before the intervention.

It was observed that before the education intervention, only 24% of the nurses could identify the risk factors for IDH. IDH has numerous risk factors, such as rapid fluid removal High UFR, diminished cardiac reserve and intake of medications that alter cardiovascular stability, use of low-sodium dialysate, warm dialysate and eating of a meal

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immediately before or during dialysis diabetes mellitus; cardiovascular disease including systolic and diastolic dysfunction, ischemic heart disease, arrhythmias and vascular calcification, autonomic dysfunction; poor nutritional status; hypoalbuminemia, age >65 years; pre-dialysis SBP <100 mmHg; high body mass index and severe anemia.[28,29]

Also, high Interdialytic Weight gain (IDWG) of above 4.0 4.0% may also be a predisposing factor, as it may require higher UFR (of >13 mL/kg/h), which is associated with IDH.[30–32]

In this regard, identifying risk factors of intradialytic hypotension is critical and beneficial for the nurse to achieve optimal patient outcomes. Therefore, the nephrology nurse plays a vital and important role in accurately assessing, caring, teaching, and counseling kidney disease patients.[33–35] Many nurses had a diploma in nursing, which may not empower them to actively participate in discussions with the physicians and nephrologists. This could be the reason why many of them could not identify the risk factors of IDH. These findings are in line with the study done in Australia, which revealed that over 64% of the nurses failed to identify the risk factors of IDH.[36,37]

Only 20% of the nurses could list the signs and symptoms of IDH pre-training. It is very important for the nurses to recognise early signs of IDH and intervene because they are at the forefront of dialysis care.[16] Common intradialytic symptoms include muscle cramps, pruritus, headaches, nausea, vomiting, and fatigue. The majority of the nurses had less than four years of experience in dialysis, which explains the inadequate knowledge regarding early signs and symptoms of IDH. This is similar to a study done by[36,37] about the same study, which revealed that nurses with 5–10 years of experience are more likely to be more knowledgeable.

This study also sought to assess knowledge about strategies routinely used for IDH minimization and management. Only one nurse could correctly describe the steps used in the management of IDH before training. This could be because nurses did not have printed guidelines for reference in their care for patients with IDH in their dialysis units. This is in agreement with the study done by Wills, Carrico,[16] which revealed that nurses still ranked reduction of blood flows, which is regarded as old literature.

Reducing blood flow may be an example of unit-based practice being handed down from nurse to nurse because there is no evidence to suggest this strategy has any effect on IDH.

Additionally, 32% of nurses in this study highlighted the importance of isolated ultrafiltration; this number is lower than the number reported in Australian nurses, which reported 52%.

Within restrictions based on maximum UF rate, the limit is ascribed as an hourly rate rather than an overall goal per treatment well as Dialysate temperature reduction has been shown to decrease IDH incidence, chiefly through reduction of core body temperature and subsequent maintenance of vascular tone.[38] Cool dialysis solution increases blood pressure owing to increased total peripheral resistance, increased cardiac contractility, and mobilization of pooled venous blood to the central circulation.[38] However, with such recognized benefits in protection against IDH, it is not clear why this intervention is not used in all facilities. It may be that many facilities already have lowered dialysate temperatures pre-set in the dialysis machine, which may be unknown to some nurses.

Post-Intervention Changes in Nurses' Knowledge on Prevention and Management

In the current study, there was a general improvement in all knowledge test items after the educational intervention. Findings of the paired sample *t* test further indicated that nurses' knowledge in the post-test was statistically significantly improved from that in the pre-test after the education intervention. This is consistent with studies that reported that the nurses' knowledge improved with a p value < 0.0001 after an educational intervention.[27,39]

After training, the majority (90%) of the nurses defined IDH as a drop in blood pressure accompanied by adverse symptoms that require intervention. Many studies examining IDH adopt the international guideline definition: "A decrease in systolic blood pressure by greater than 20 mmHg or a decrease in mean arterial pressure (MAP) by greater than 10 mmHg with symptoms".[40]

However, this definition fails to recognize individual BP variation; to take relative, asymptomatic hypotension into account; or to consider the significance of the diastolic value during ultrafiltration (UF). These factors are important because the first physical response to UF in hemodialysis is a compensatory increase in stroke volume and heart rate (as cardiac output) and a rise in peripheral resistance through vasoconstriction.[41] During initial fluid removal, the diastolic BP value may rise correspondingly when the systolic BP value falls, meaning that a BP may appear lower according to

its systolic value, when in fact, the physiological compensation of rising vascular resistance (as reflected in the diastolic BP) in response to reduced cardiac output (the lower systolic value) works to adjust the MAP.[12] The improvement in nurses' knowledge could have been due to the multiple education interventions phase. This is in line with the findings and methodology of a study by Portela Dos Santos, Melly, Hilfiker, Giacomino, Perruchoud, Verloo, Pereira,[42] which used face-to-face interactive teaching methods, an instructional booklet, and videos related to the prevention and management of IDH. Oikarainen, Mikkonen, Kenny, Tomietto, Tuomikoski, Meriläinen, Miettunen, Kääriäinen[43] also supported the use of multiple methods when carrying out education interventions to cause significant improvement in nurses' knowledge in the care of patients. The extended time could have given the nurses quality time to conceptualize the information taught. The nurses also showed interest and appreciation for the training that most of them had never received.

The ultrafiltration profiling increased to 76% after training. This finding is clinically significant because it suggests acknowledgment of the importance of staggered fluid removal in its principled allowance for vascular refill, as may be tailored to a patient's specific tolerance.[44,45]

The current study revealed that 56% after the training utilized isolated ultrafiltration. It may be speculated that this practice requires additional knowledge and confidence gained through clinical and theoretical experience, although its utility is still debated.[45] However, the European Best Practice Guidelines (EBPG) on hemodynamic instability propose that "isolated ultrafiltration followed by isovolemic dialysis may increase the risk for IDH because of the high ultrafiltration rates".[40] There was a balance between the ultrafiltration rate and the goal before and after the training in this study. This is similar to nurses from Australia and New Zealand who tend to use both maximum UF rate (47%) and maximum UF goal, in particular was shown to be more common in larger hemodialysis facilities.[36,37]

Nurses' Baseline Practice on Prevention and Management of IDH

Findings generally showed poor performance of nurses in the prevention and management of IDH. There were 75 observations on practices of 25 nurses without their knowledge regarding patient assessment, prevention measures, immediate response to IDH, post-IDH management, communication and documentation, and infection control.

Comprehensive patient assessment should be done pre-, during, and post each dialysis session.[46] It is essential to identify patients' status and, based on significant findings, establish the nursing care plan using SMART patient outcomes.[47]

In this present study, all aspects of the comprehensive physical assessment scored above 50% before the training. This is because 92% of the nurses had a certificate in dialysis, which emphasizes patient assessment as it guides in the calculation of the UF. Although the nurses were taking baseline vital signs, they were not monitoring these patients. This could be because of the high nurse-to-patient ratio, making it difficult for them.

This is similar to the study done in Australia, which revealed that nurses did not monitor patients during dialysis.[36,37]

Nephrology nurses have the primary responsibility to prevent, detect, and provide emergency interventions for IDH.[16] However, in this study, before training, the immediate response to IDH was poorly done. Decreasing or pausing UF was practiced at 40%, administering fluids was at 54%, and positioning the patient in Trendelenburg was at 28%. Intravascular volume may be replaced by intravenous infusion of normal saline (0.9%, 10%), glucose (10–40%), mannitol, or, more seldom, albumin (5–20%).[28] It was noticed that the dialysis units have un-adjustable beds, which makes it very difficult to position the patients in case of IDH. Also, glucose is not readily available, but instead, administer normal saline.

The period immediately following IDH is very crucial because its management determines the outcome of the IDH episode.[28,48] Studies have shown that with training and experience, this immediate response improves greatly.[16]

Post IDH management practices, such as frequent assessment of weight, patient education, continued monitoring of vitals, and adjusting dialysis prescription, were poorly done before the training. The possible explanation for this could be due to the work overload of the nurses.

In this current study, the prevention measures were done by 46% of the nurses, which indicated low performance, and this could have been due to a knowledge deficit regarding the prevention and management of IDH. This was evident on the knowledge assessment item on the prevention of IDH in the pre-test. The common strategies of long-term treatment

and prevention of IDH include accurate calculating and frequent assessment of "dry weight", patient education to avoid excessive interdialytic weight gain (IDWG) and no heavy meals during or just before the dialysis, adequate hypertension management – sometimes it is necessary to skip or reduce drug dose on the day of dialysis session, use of bicarbonate dialysate buffer and biocompatible membranes.[29,49] Several prevention measures should be put in place to prevent or at least lower the occurrence of IDH. Patients should be adequately hydrated, a review of patients' medications, a comfortable working environment, and setting appropriate dialysis parameters.[50] The use of sodium modelling profiles, higher sodium concentration in dialysate, especially at the beginning of the procedure, and lower dialysis temperature are the first therapeutic options for hypotension-prone patients.[51] Additionally, IDH can also be treated and prevented with certain pharmacological agents such as L-carnitine and midodrine hydrochloride.[28,52] A well-known and generally accepted drug used for the acute and persistent form of IDH management is midodrine.[28] This is because the drug is well tolerated, safe, and has very few adverse side effects.[53]

This study revealed that Patient education parameters and documentation scored 64% and 76% respectively. The possible explanation could be that nurses that most nurses in the government hospitals have a heavy workload of patients, which their nursing care activities leaving patient education and documentation. There were no formal forms for nurses' notes in the dialysis units. This is in agreement with a study done at MNRH about nursing documentation dilemma in Uganda by Nakate, Dahl, Petrucka, Drake[54] that reported nurses having work overload, inappropriate attitude, doctor's failure to trust the quality of the nurses' notes and thus nobody read them, lack of nursing documentation process, less value attached and shortage of staff. However, Patient education provided by nurses remains an essential and instrumental component in health care that influences patient outcomes.[55,56]

It also helps patients and families to adequately prepare themselves psychologically and know that IDH can happen at any time.[57] They should be educated to avoid gaining excessive weight, take their medications accurately as prescribed, control blood sugars in the diabetic patients, avoid eating heavy meals before dialysis sessions, and report any unfamiliar occurrences to the medical team as recommended by.[28] Nurses educate, motivate, and inspire patients to adhere to treatment programs to achieve better health.[58,59]

Furthermore, literature emphasizes the need for nurses to work in collaboration with the nephrologists, nutritionists, social workers, patients, and family in order to ensure safety and optimization of treatment outcomes.[60–64]

Post-Intervention Changes in Nurses' Practice on Prevention and Management

Following the education intervention, and repeat observations during the post-intervention phase, the paired *t*-test showed that all aspects of practices improved after the training, with the mean score increasing from 12 before training to 20 after training, and the difference was statistically significant ($t=18.53$, $p<0.001$). The results agree with a quasi-experiment study done in Bahrain to assess the effect of implementing an evidence-based action on knowledge and practice of managing IDH, which revealed that education and training programs on IDH significantly improve nursing knowledge and practices in the management and prevention of IDH.[65] Another study revealed that nurses felt more confident when treating patients with IDH and reducing the number of consultations to doctors after undergoing a training program on IDH.[16]

The possible explanation for the statistical improvement could have been due to the use of face-to-face teaching, demonstrations, supervised hands-on practice, videos, and self-study materials as recommended from reviewed literature.[66]

Indeed, after training, the study results revealed that there was a great improvement in the immediate and long-term management response. The rate of putting patients in the Trendelenburg position increased to 76%, administering fluid bolus increased to 80% while decreasing or pausing UF increased to 88%. However, midodrine was not used because it is very expensive and not readily available in the government hospitals. This is contrary to the study, which recommended its relevance and effect regarding the prevention and management of IDH.[53]

The nurses decreased or paused ultrafiltration (UF) in response to IDH by 88%, reflecting a direct application of knowledge gained about timely interventions. Nurses were able to recognize the importance of adjusting UF rates to manage IDH effectively, which aligns with the training's emphasis on individualized patient responses.

The practice of nurses positioning patients in the Trendelenburg position during IDH episodes increased to 76%. The training likely provided nurses with the rationale behind this positioning and its physiological benefits, reinforcing its importance in managing hypotension.

Pre-test administration of fluid boluses was practiced by 80% of nurses. The educational sessions highlighted the significance of intravenous fluid therapy in restoring intravascular volume, thus equipping nurses with the confidence to implement this critical intervention during IDH episodes.

Pre-test, only one nurse could articulate the steps for managing IDH, and in Post-test, 56% of nurses began utilizing isolated ultrafiltration, demonstrating an understanding of its role in managing fluid removal strategies. This shift indicates that nurses not only learned about but also felt empowered to apply advanced techniques in their practice.

The educational intervention also emphasized the importance of evidence-based practices and protocols. As nurses became more familiar with guidelines on managing IDH, they incorporated these into their daily routines. For instance, the training introduced protocols for monitoring patients' vital signs more rigorously, leading to better early detection of IDH symptoms.

A notable outcome of the intervention was an increase in nurses' confidence to manage IDH independently. Many reported feeling less dependent on physician consultations for immediate decision-making related to IDH. This shift suggests that the training not only enhanced their knowledge but also fostered a sense of ownership over patient care.

Therefore, educational intervention had a profound impact on both knowledge and practice among nurses regarding the prevention and management of IDH. The explicit link between increased knowledge and improved practical applications demonstrates the efficacy of targeted educational programs in enhancing nursing competencies in critical care settings. Continued professional development and reinforcement of these practices will be essential in sustaining improvements and optimizing patient outcomes in dialysis care.

Study Limitations

The researcher was unable to perform a time series analysis to assess long-term effects; however, this limitation was mitigated by employing descriptive statistics and variability to analyze trends and patterns in the data over time.

The study's reliance on direct observations introduced the potential for the Hawthorne effect, which could limit the representativeness of the observed practices. To mitigate this, the researchers implemented prolonged observation periods and employed data triangulation, combining multiple data sources to enhance the validity and reliability of the findings.

The study's use of a one-group pretest-posttest design limited the ability to attribute causation solely to the intervention conclusively. However, the researchers implemented rigorous procedures and analytical methods to control for potential threats to internal validity.

Conclusion

The implementation of educational interventions significantly enhanced nurses' knowledge and practices in the prevention and management of IDH among patients with kidney disease, demonstrating their effectiveness in improving clinical care and patient outcomes. These findings underscore the importance of continuous professional development not only for nurses but for all members of the multidisciplinary healthcare team. Ongoing education, collaborative practice, and routine retraining are vital in ensuring high-quality, patient-centered care and in mitigating complications, such as IDH, in dialysis settings.

Recommendations

Continuous training for nurses on the prevention, identification, and management of intradialytic hypotension (IDH) is essential to enhance their knowledge and improve clinical practices. Additionally, integrating IDH prevention and management guidelines into the Uganda Clinical Guidelines is recommended to standardize care and increase awareness among healthcare providers. This will ensure that all healthcare professionals are well-informed and equipped to effectively manage dialysis patients, ultimately improving patient outcomes.

Abbreviations

CKD, Chronic kidney disease; CRRT, Continuous Renal Replacement Therapy; EBPGs, European Best Practice Guidelines; FRC, Faculty Research Committee; IDH, Intradialytic Hypotension; IDWG, Interdialytic Weight Gain; KNRH, Kiruddu National Referral Hospital; MAP, Mean arterial pressure; MNRH, Mulago National Referral

Hospital; MOH, Ministry of Health; MRRH, Mbarara Regional Referral Hospital; MUST, Mbarara University of Science and Technology; NCDs, Non-communicable diseases; PD, Peritoneal Dialysis; REC, Research Ethical Committee; RNs, Registered Nurses; SBP, Systolic blood pressure; UF, Ultrafiltration.

Disclosure

The authors report no conflicts of interest in this work.

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