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Impact of Nurse-Led Interventions on Nursing Officers' Knowledge Regarding Intra-Aortic Balloon Pump Care: A True Experimental Study

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Abstract

Introduction: The intra-aortic balloon pump (IABP) is a vital circulatory support device used for critically ill patients with heart disease. Due to its extensive application, it is essential for nurses to have a thorough understanding of IABP management and patient care. This study aims to assess the impact of nurse-led interventions on improving nursing officers' knowledge and skills in the care of patients with IABPs in a tertiary care hospital setting.

Materials and Methods: A randomized controlled trial involving 64 participants was conducted employing a true experi-mental design with a Pre-test-post-test control group. Participants were randomly assigned to either the Experimental or Control group using a coin-flipping method. In the Experimental group, partici-pants received a 60-minute PowerPoint-based lecture cum discussion session specifically focused on IABP care. Pre- and post-intervention knowledge data were collected using a self-structured ques-tionnaire from both groups. Data analysis involved paired and unpaired t-tests to compare knowledge scores within and between groups.

Results: The findings reveal that out of 64 participants, 16(26.6%) had very low knowledge, 26(43.3%) had low knowledge, 18(30%) had average knowledge and none 0(0%) had high knowledge in pre-test. Post intervention, the mean knowledge score increased from 52.67 (pre-test) to 87.33 (post-test) in the Experimental group whereas the mean knowledgescore was slightly increased from 46.53 (pre-test) to 49.20 (post-test) in the Control group

Conclusion: This study provides direct evidence supporting the effectiveness of nurse-led interventions in enhancing nursing officers' knowledge regarding the care of patients with Intra-Aortic Balloon Pumps

Keywords: Intra-aortic balloon pump, Knowledge, Nursing officers, Nurse led Intervention

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INTRODUCTION

The **intra-aortic balloon pump (IABP)** remains a critical circulatory assist device for severely ill hospital patients with heart disease.[1] As a temporary mechanical support system, the IABP assists the heart in pumping blood effectively, especially during acute cardiac events. Given its widespread use, nurses play a pivotal role in managing patients on IABPs and ensuring optimal care.[2] The IABP consists of an inflatable balloon catheter inserted into the aorta, positioned just distal to the left subclavian artery. During the cardiac cycle, the balloon inflates during diastole (when the heart relaxes) and deflates during systole (when the heart contracts). This synchronized inflation and deflation augment coronary perfusion, reduce afterload, and enhance cardiac output.However, proper management of IABP patients requires comprehensive knowledge and skill.[3,4] Evidences suggest that the incidence of complications related to IABP insertion ranges from 0.94% to 31.1%.[5]These complications can occur during or after IABP treatment and include complications like thrombocytopenia(50%), Fever(40%) and other complications such as bleeding (with aorto-iliac artery injury and dissection), thromboembolism, distal leg ischemia and balloon entrapment-rupture. Diabetes, peripheral vascular disease, hypertension, and smoking are identified as risk factors for IABP complications.[6]The atherosclerotic status of the common femoral artery is linked to ischemic problems in the limbs.[7]Despite contemporary treatment with revascularization therapy, mortality remains high for patients with cardiogenic shock complicating acute myocardial infarction.[8] While IABP provides essential circulatory support, healthcare professionals must be vigilant about potential complications and risk factors.[9]

Nurses are at the forefront of patient care, monitoring vital signs, assessing complications, and providing essential interventions.[10] Their understanding of IABP principles, troubleshooting techniques, and patient education directly impacts patient outcomes.[11,12] Therefore, enhancing nursing officers' knowledge regarding IABP care is crucial. This study aims to evaluate the effectiveness of nurse-led interventions in improving nursing officers' knowledge of IABP management. By assessing the impact of targeted educational sessions, we seek to empower nurses with the necessary knowledge to optimize patient care during IABP therapy. By equipping nurses with evidence-based information, we aim to improve patient outcomes, reduce complications, and promote safe and effective IABP management.[13]

METHODS

Ethical clearance for the clinical trial was obtained from the institutional ethics committee. The trial was registered with CTRI under the registration number CTRI/2023/11/060241.

Sample Size and Participant Selection

The sample size was estimated using Wall Street Mojo software, with a confidence interval of 95%.[14] The calculated sample size estimated was 59. 64 Participants were chosen based on specific inclusion and exclusion criteria. Nursing officers who were available and willing to participate during the data collection period were included. Those who were absent during this period were excluded. The study encompassed nursing officers working in various departments of the hospital, including the CTVS ward, CTVS ICU, cardiology ward, and medical ICU. Participants were randomly assigned to either the experimental group (32 participants) or the control group (32 participants) using a coin flipping method.

Participants were randomly selected from the CTVS ward, CTVS ICU, Cardiology ward, and MICU. They were assigned to the control group if "TAILS" appeared during the coin flip, and to the experimental group if "HEADS" appeared.

Data collection procedure

Participants self-reported their demographic characteristics (age, gender, educational status, years of work experience, previous experience of caring for patients with an Intra-Aortic Balloon Pump, and previous knowledge regarding the Intra-Aortic Balloon Pump)through a researcher-developed questionnaire. A self-structured questionnaires with 25 items was utilized for assessing the knowledge about the Intra-Aortic Balloon Pump. The validity (SVCI =0.92 and reliability of these tools were established using the test-retest method (r=0.956) and split-half method (r=0.825)

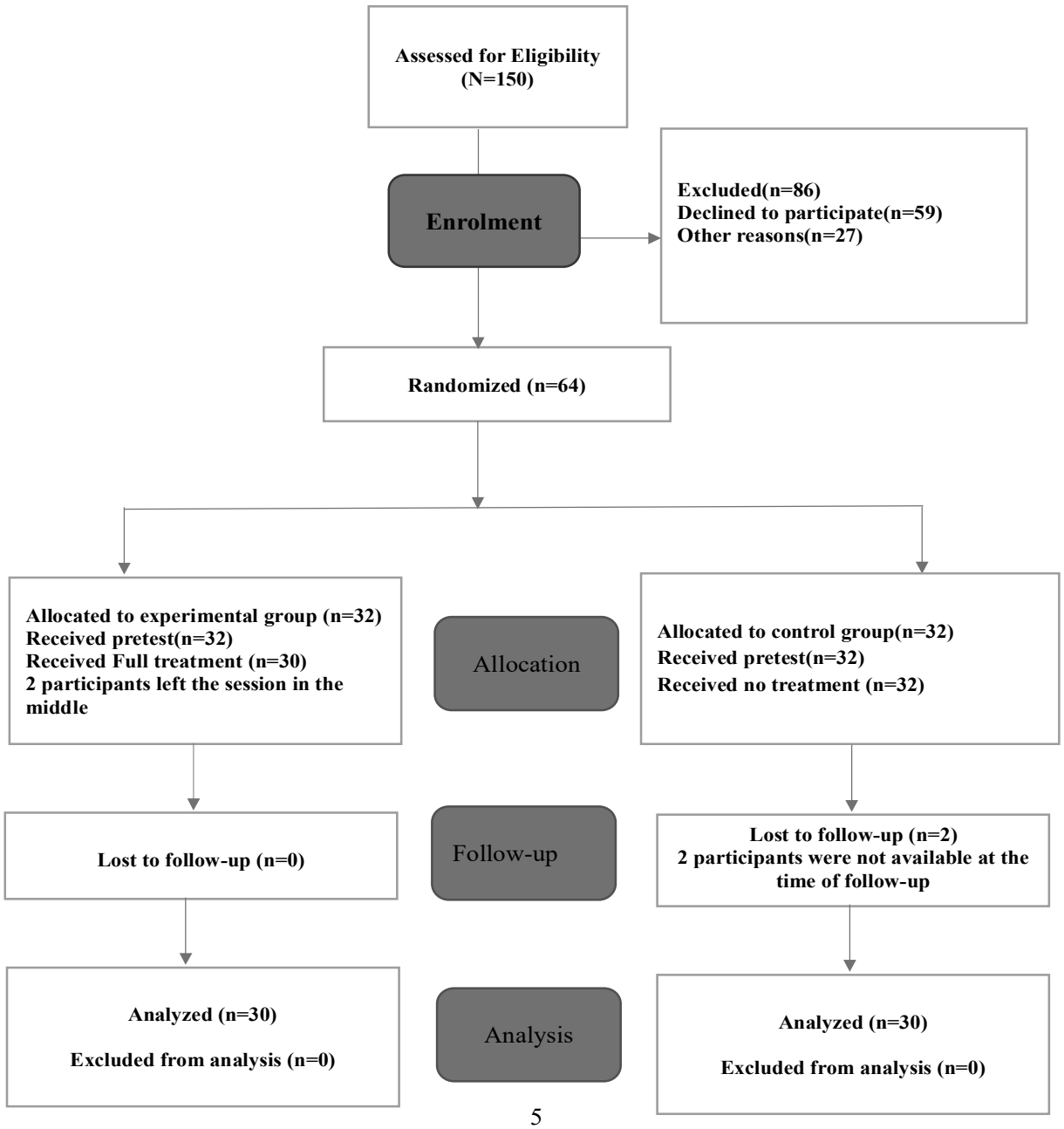
The intervention, led by a nurse, consisted of a 60-minute PowerPoint-based lecture and discussion session on the Intra-Aortic Balloon Pump (IABP). This session was conducted for the experimental group's nursing officers in the CTVS ward on November 23, 2023. The session covered various aspects of IABP, including its introduction, components, indications, contraindications,

mechanisms, nursing care before, during, and after insertion, balloon weaning, and potential complications.

Pre-test data was collected from both the control and experimental groups using the self-structured questionnaire to assess knowledge regarding the Intra-Aortic Balloon Pump before the intervention. Post-intervention data was collected from the nursing officers in both groups after one week.

STATISTICAL ANALYSIS

Data analysis was performed using IBM SPSS Version 22.[15] The Kolmogorov–Smirnov test was used to check for normality(>0.05).[16] As the data were normally distributed, Unpaired and Paired t-tests were used to compare pre and post test scores between and within group. The chi-square test was used to determine associations, and a P value ≤0.05 was considered statistically significant.



5

Fig. 1: CONSORT flow diagram for the randomized controlled trial

Participant characteristics (Table 1):

The majority of participants in this study were between the ages of 26 and 30. Only five participants had an M.Sc. in nursing, while the majority of participants had a B.Sc. in nursing. Most of the participants were male. majority of them had worked for two to five years prior in hospitals. The majority of participants lacked prior IABP knowledge and expertise.

Table 1: Frequency and percentage distribution of sociodemographic variables in experimental v/s control group.

Demographic variables		Association						
		Experimental	Control	Chi test	P value	Df	Table value	Result
Age	Upto 25 years	4 (13.3%)	12 (40.0%)					
	26-30 years	15 (50.0%)	17 (56.7%)	12.458	0.002	2	5.991	significant
	31-35 years	11 (36.7%)	1 (3.3%)					
Gender	Male	20 (66.7%)	20 (66.7%)	0.000	1.000	1	3.841	Not significant
	Female	10 (33.3%)	10 (33.3%)					
Education status	GNM	6 (20.0%)	7 (23.3%)					
	B.Sc Nursing	19 (63.3%)	17 (56.7%)	1.055	0.788	3	7.815	Not significant
	Post Basic B.Sc nursing	2 (6.7%)	4 (13.3%)					
	M.Sc. Nursing	3 10.0%)	2 (6.7%)					
Year of Work Experience	Upto 1 year	10 (33.3%)	9 (30%)					
	2-5 years	12 (40.0%)	18 (60.0%)	3.525	0.172	2	5.991	Not Significant
	6-10 years	8 (26.7%)	3 (10.0%)					
Any Previous experience of IABP	yes	6 (20.0%)	10 (33.3%)	1.364	0.243	1	3.841	Not significant
	No	24 (80.0%)	20 (66.7%)					
Any previous Knowledge of IABP	Yes	13 (43.3%)	12 (40.0%)	0.069	0.793	1	3.841	Not significant
	No	17 (56.7%)	18 (60%)					

Df* degree of freedom

Level of Knowledge (*Table 2*):

Table 2 presents the frequency and percentage distribution of pre-test and post-test knowledge scores.In the pre-test, the experimental group, made up of 30 participants, had 53.33% with low knowledge levels, none in the high knowledge category, 36.67% in the average knowledge category, and 10% in the very low knowledge category. The control group, also with 30 participants, had 6.67% scoring high, 16.67% average, 33.33% low, and 43.33% very low. In the post-test, the experimental group showed significant improvement, with 90% scoring in the high knowledge category, 6.67% in the average category, 3.33% in the low category, and none in the very low category. The control group had a slight improvement in the post-test compared to the pre-test, with 16.66% scoring high, 26.66% average, 26.66% low, and 30% very low.

Effectiveness of Nurse-Led Intervention (*Tables 4*):

Table 4 presents the comparison of knowledge score between and within the experimental and control groups after implementation of the intervention using unpaired t-test and paired t-test, respectively.In the pre-test, the mean knowledge

Table 2: Frequency & Percentage distribution of Pre-test and post-test knowledge scores in experimental group v/s control group **N=60**

Knowledge score	(Pre-Test)		(Post-test)	
	Experimental group	Control group	Experimental group	Control group
High knowledge (>80%)	0(0%)	2(6.7%)	27(90%)	5(16.7%)
Average Knowledge (60-79%)	11 (36.7%)	5(16.7%)	2 (6.7%)	8 (26.7%)
Low Knowledge (40-59%)	16 (53.3%)	10 (33.3%)	1(3.3%)	8(26.7%)
Very Low Knowledge (<40%)	3(10%)	13 (43.3%)	0(0%)	9(30%)

Table 3: Kolmogorov-Smirnov test for data distribution of experimental and control group

	Group	Statistic	Df	Significance
PRE	Exp	0.095	30	0.200
	Control	0.138	30	0.153
POST	Exp	0.274	30	0.000
	control	0.101	30	0.200

Exp*experimental group, Cncontrolontrol group

Table 4: Comparison of knowledge score between experimental and control group after implementation of the intervention using unpaired t-test and Comparison within experimental and control group after implementation of the intervention using paired t-test

Knowledge score between groups unpaired t test						
Test	Experimental group N=30		Control group N=30		T	Result
	Mean	SD	Mean	SD		
Pre-test	13.17	3.29	11.63	5.02	1.39	P=0.168, NS
Post-test	22.13	1.43	13.73	5.23	8.47	P=<0.001, significant
Knowledge score within group paired t test						
Group	Pre-test		Post-test		T	Result
	Mean	SD	Mean	SD		
Exp group, N=30	13.17	3.29	22.13	1.43	13.76	P=<0.001, significant
Control group N=30	11.63	5.02	13.73	5.23	2.52	P=0.067, NS

SD*standard deviation, NS*Not significant, T*table value

score for the experimental group (N=30) was 13.17 with a standard deviation (SD) of 3.29, while the control group (N=30) had a mean score of 11.63 with a standard deviation of 5.02. The unpaired t-test results show a t-value of 1.39 with a p-value of 0.168. Since the p-value is greater than 0.05, this indicates that the difference in pre-test knowledge scores between the experimental and control groups was not statistically significant.In the post-test, the mean knowledge score for the experimental group (N=30) significantly increased to 22.13 with an SD of 1.43. In contrast, the control group (N=30) had a mean score of 13.73 with an SD of 5.23. The unpaired t-test results show a t-value of 8.47 with a p-value of less than 0.001. This p-value is highly significant, indicating that the difference in post-test knowledge scores between the experimental and control groups is statistically significant.

In paired t-test, Mean knowledgescore of experimental groups is 13.73 (SD=3.29) in pre-test and 22.13 (SD=1.43) in post-test Statistically. The paired t-test results show a t-value of 13.76 with

Table 5: Association between pre-test knowledge score with selected socio-demographic variable

Demographic variables		Pre-test knowledge score of experimental and control group								(Chi statistics)						
		High knowledge		Average Knowledge		Low Knowledge		Very Low Knowledge		Chi test		P value		Df		Result
		E	C	E	C	E	C	E	C	E	C	E	C	E	C	
Age	Upto 25 years	0	0	0	2	4	6	0	6							
	25-30 years	0	2	7	3	7	5	1	7	5.06	3.32	0.28	0.71	4	6	NS
	31-35 years	0	0	4	0	5	1	2	0							
Gender	Male	0	2	10	5	9	7	1	7	5.19	2.93	0.07	0.19	2	3	NS
	Female	0	0	1	0	7	5	2	6							
Education status	GNM	0	0	1	1	5	2	0	4							
	B.Sc. nursing	0	1	7	2	10	8	2	8	6.54	7.90	0.36	0.50	6	9	NS
	Post Basic B.Sc. nursing	0	1	1	2	1	1	0	0							
	M.Sc. nursing	0	0	2	0	0	1	1	1							
Year of work experience	Upto 1 year	0	0	4	2	6	3	0	4							
	2-5 year	0	1	5	3	6	8	1	8	3.36	1.29	0.49	0.59	4	6	NS
	6-10 year	0	1	2	0	4	1	2	1							
Any previous experience of IABP	Yes	0	2	1	2	3	3	2	3	4.91	3.87	0.08	0.19	2	3	NS
	No	0	0	10	3	13	9	1	10							
Any previous Knowledge of IABP	Yes	0	2	3	2	7	3	3	5	5.08	3.03	0.07	0.33	2	3	NS
	No	0	0	8	3	9	9	0	8							

a p-value of less than 0.05. This indicates, there is significant difference between pre-test score and post test score within experimental group (p=<0.001).

Mean knowledge score of control group is 11.63 (SD=5.02) in pre-test and 13.73 (SD=5.23) in post-test statistically. The paired t-test results show a t-value of 13.76 with a p-value of more than 0.05 This indicates, there is no significant difference between pre-test score and post test score within control group (p=0.067).

The analysis demonstrates that while there was no significant difference in knowledge scores between the experimental and control groups before the intervention, the intervention led to a significant improvement in the knowledge scores of the experimental group compared to the control group. This suggests that the intervention was effective in enhancing the participants' knowledge.

Association of pre-test knowledge score with selected sociodemographic variable

Table 6 shows the association between pre-test knowledge scores of participants and various sociodemographic variables using a chi-square test. Across all socio-demographic variables examined (age, gender, education status, years of work experience, previous experience of IABP, and previous knowledge of IABP), there were no significant associations with the pre-test knowledge scores in both the experimental and control groups (P >0.05). This indicates that these socio-demographic factors did not significantly influence the baseline knowledge levels of the participants

DISCUSSION

In this study, most nursing officers were aged 26 to 30, accounting for 50% of participants, while earlier studies indicated that the majority of nurses were aged 21 to 25. Additionally, 66.7% of nursing officers in the current study were male, contrasting with previous research where most were female. Over half of the nursing officers here reported having no prior experience with IABP, whereas other studies showed that most had experience caring for IABP patients.[10,12,14,15,17]

The findings of this study underscore the importance of targeted educational interventions in improving the knowledge of nursing officers regarding the management of the intra-aortic balloon pump (IABP). Before the intervention, the knowledge levels in both the experimental and control groups were generally low, Additionally, the study explored the sociodemographic characteristics of the participants and its association with pre-test knowledge score with no significant difference found between both the groups. This baseline similarity highlights the need for educational initiatives to enhance the competency of nursing officers in managing IABP patients.

The significant improvement in the post-test knowledge scores of the experimental group compared to the control group demonstrates the effectiveness of the nurse-led intervention. The control group showed an increase in knowledge score in the post-test compared to the pretest, likely due to their increased awareness of the content. This aligns with previous studies indicating that structured educational programs can substantially enhance the clinical knowledge and skills of healthcare professionals.[18-20] For instance, a study by Xue *et al*. reported that targeted training significantly improved nurses' knowledge and handling of cardiovascular assistive devices, which in turn improved patient outcomes.[21] Analogous to a pre-experimental study in India to evaluate the impact of a capacity building program on nurses' knowledge and practice regarding the care of patients with IABP. It depicted a significant difference between the pre-test (M=17, SD=3.99) and post-test practice scores (M=28.36, SD=3.8) with a t-value of 20.06, significant at p <0.001.[22] Similarly, a quasi-experimental study in Egypt assessed the effect of educational guidelines on nurses' performance in caring for patients with an IABP. Initially, 62.5% of nurses lacked sufficient knowledge to care for these patients. Following the implementation of the guidelines, knowledge levels significantly improved, with 89.1% and 81.2% showing sufficient knowledge at the first two-month follow-ups. Practice competence also improved from 67.2% lacking sufficient practice initially to 92.2% and 79.7% showing sufficient practice in subsequent follow-ups. There was a statistically significant positive correlation between overall knowledge and practice after implementing the guidelines.[23] The findings of present study were also consistent with study conducted in Pakistan which showed that most nurses' understanding and practice of intra-aortic balloon pumps were lacking before the educational program, but it improved following the session.[24] These studies support the finding that targeted educational interventions can significantly enhance nurses' knowledge and practice, thereby improving patient care outcomes.

Despite the intervention's success in enhancing knowledge, the analysis of socio-demographic variables such as age, gender, education status, years of work experience, and previous exposure to IABP care showed no significant association with the pre-test knowledge scores. This lack of association suggests that baseline knowledge deficiencies are widespread across different demographic groups, emphasizing that educational interventions should be uniformly implemented across all demographics to ensure comprehensive competency development.

The findings also echo the evidence regarding the complications and risk factors associated with IABP usage. Proper management and vigilant monitoring by well-informed nursing staff are crucial in mitigating these risks.[25,26] Complications such as thrombocytopenia, fever, bleeding, thromboembolism, distal leg ischemia, and balloon rupture are serious concerns that require proficient handling by nursing officers.[27-30] The study's intervention aimed at equipping nurses

with the knowledge to manage these complications effectively, thereby potentially reducing the incidence of such adverse events.

The nurse-led intervention proved to be a significant tool in enhancing knowledge, which is crucial for optimizing patient care and outcomes. However, a limitation of this study is that it included only 60 nursing officers from a single hospital. Therefore, larger-scale studies that can evaluate a more diverse and extensive sample are needed for better generalizability of the results.

Recommendations

Future research should focus on long-term retention of knowledge and skills acquired through such interventions and explore the direct impact on patient outcomes. Studies conducted in different settings, such as multicentric hospitals, to enhance the generalizability of the findings. Additionally, expanding educational programs to include practical, hands-on training could further improve the proficiency and confidence of nursing officers in managing IABP patients.

CONCLUSION

This study reinforces the critical role of continuous education and training for nursing officers in the effective management of IABP. The findings support the idea that specialized training can significantly enhance knowledge. Increased knowledge among nursing officers can contribute to better patient outcomes by preventing complications related to IABP.

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