

Effectiveness of Radial Artery Positioning Board (RAPB) on Radial Artery Access and Prevention of Access Site Complications among Patients Admitted in Critical Care Units at Tertiary Care Hospital, Puducherry

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Abstract:-

➤ Background:

Radial artery access is a fundamental procedure in critical care settings, yet achieving optimal wrist extension poses challenges. This study investigates the efficacy of a novel intervention, the radial artery positioning board (RAPB), in enhancing radial artery access success rates and preventing access site complications among critically ill patients.

➤ Methods:

Employing a randomized controlled trial with a two-group post-tests only control design, 160 patients were enrolled using a block random sampling method. The study, conducted at a tertiary care hospital in Puducherry, utilized both descriptive and inferential statistical analyses to assess the outcomes.

➤ Results:

Analysis revealed a significant improvement in the success rates of radial artery access ($z = -11.125$, $p < 0.05$) and a notable reduction in access site complications ($z = 7.938$, $p < 0.05$) in the RAPB group compared to the control group. Furthermore, a positive correlation was established between successful radial artery access using RAPB and the prevention of access site complications ($r = 0.504$, $p < 0.05$).

➤ Conclusion:

The findings underscore the effectiveness of RAPB in facilitating early radial artery access with heightened success rates and diminished access site complications among critically ill patients. Additionally, body mass index and comorbidities exhibited statistically significant associations with radial artery access ($p < 0.05$), emphasizing the need for tailored interventions in this population.

Keywords:- Radial Artery Access, Access Site Complications, Critical Care, Procedural Success, Intervention Efficacy.

I. INTRODUCTION

Radial artery access is a widely accepted method for various invasive procedures such as hemodynamic monitoring, blood sampling for blood gas analysis, and diagnostic and interventional cardiology procedures¹. It is favored among healthcare professionals due to its lower complication rates compared to other arterial access sites, making it a safer alternative for cardiac catheterization².

Despite its advantages, radial artery access can be challenging and may require multiple attempts. Studies have shown that more than two arterial punctures are needed in 15–27% of patients undergoing general anesthesia before successful catheter insertion into the radial artery can be achieved³ (3). Furthermore, radial artery access failure occurs in 1–5% of patients undergoing percutaneous coronary interventions, representing a higher failure rate compared to other arterial sites⁴.

Wrist extension is commonly taught as part of the radial artery access technique, as it brings the radial artery closer to the surface and reduces vessel mobility, thereby increasing the success rate of access⁵. However, complications may arise with each attempt, and the position and size of the radial artery may be affected by the wrist position during the procedure⁶.

Recognizing the importance of providing optimal wrist support during radial artery access to improve access success rates and reduce access site complications, the investigator initiated this study to evaluate the effect of the Radial Artery Positioning Board (RAPB) a novel invention

on radial artery access and prevention of access site complications.

A. Problem Statement:

This study evaluates the effectiveness of the Radial Artery Positioning Board (RAPB) in facilitating radial artery access and preventing complications among critical care unit patients at a tertiary care hospital in Puducherry.

B. Objectives:

- To assess the effect of the RAPB on radial artery access and preventing complications among critical care unit patients.
- To correlate the success rate of radial artery access using the RAPB with complications prevention in critical care unit patients.
- To determine the association between the RAPB's effect on radial artery access, complications prevention, and selected demographic variables in critical care unit patients.

C. Hypotheses:

- H1: Significant improvement occurs in radial artery access and complications prevention among critical care unit patients after RAPB deployment.
- H2: A relationship exists between radial artery access using the RAPB and complications prevention.
- H3: Association exists between radial artery access, complications prevention using the RAPB, and selected demographic variables.

II. METHODOLOGY

- Study Design: A true experimental randomized control trial employing a two-group post-test only control group design was conducted.
- Study Setting: The study was conducted at Mahatma Gandhi Medical College and Research Institute, Puducherry.
- Sampling Technique: A block random sampling technique was utilized to select 160 patients requiring radial artery access.
- Study Groups: Group I (Control group): Consisted of 80 subjects who underwent the routine technique of radial artery access. Group II (Experimental group):

Comprised 80 subjects who received the Radial Artery Positioning Board (RAPB) for radial artery access.

- Data Collection: Post-tests were administered to both groups using an observational checklist on radial artery access to assess the success rate of radial artery access. Another checklist was employed to evaluate the occurrence of access site complications.
- Ethical Consideration: Approval was obtained from the Institutional Ethical Committee. Informed consent was secured from participants, who retained the right to withdraw.
- Data Collection: Post-tests utilized an interview schedule for demographic data and an observational checklist for radial artery access and site complication assessment. Group II received the Radial Artery Positioning Board (RAPB), while Group I followed routine technique.
- Tool Reliability: Reliability, assessed via Cronbach's alpha test during a pilot study, yielded scores of $r = 0.897$ and $r = 0.912$ for the radial artery access and complication checklists, respectively. No tool modifications were made post-pilot.
- Statistical Analysis: Data analysis was performed using the SPSS software. Descriptive and inferential statistics were employed to analyze the collected data, ensuring rigorous examination of the study outcomes.

III. RESULTS

In the control group, 51.2% of patients were aged 65 and above, compared to 30.0% in the experimental group aged 55-64 years. Male patients comprised 67.5% in the control group and 60.0% in the experimental group. Regarding BMI, 41.4% of control group patients and 57.5% of experimental group patients had a BMI of $25 < \text{BMI} < 30 \text{ kg/m}^2$. The majority of control group patients (56.5%) had cardiac diseases, while hypertension was prevalent in 48.8% of experimental group patients. Conversely, 27.5% of experimental group patients had cardiac diseases, and 15% of control group patients had hypertension. Diabetes mellitus affected 21.2% of control group patients and 16.2% of experimental group patients. Only 6.2% of control group patients and 7.5% of experimental group patients had no comorbidities.

Table 1: Efficacy of Radial Artery Positioning Board (RAPB) on Radial Artery Access
N = 160

Radial Artery Access	Mean	Standard deviation	Median	Mann-Whitney test	p-value
Control group	3.638	1.009	4	-11.125	p=0.001
Experimental group	5	0	5		

$p = 0.001$, HSS – Highly Statistically Significant

Table 1: This table presents the effectiveness of the RAPB in facilitating radial artery access among patients admitted to critical care units. The post-test mean value for the control group was 3.638, whereas for the experimental

group it was 5. The Mann-Whitney Test revealed a statistically significant result ($p < 0.001$), indicating that the RAPB significantly enhances the success rate of radial artery access.

Table 2: Effectiveness of Radial Artery Positioning Board on Radial Artery Access Site Complications
N = 160

Radial access site complications	Mean	Standard Deviation	Median	Mann-Whitney Test	p-value
Control group	6.513	1.543	7	7.938	p = 0.000
Experimental group	7.950	0.271	8		

Table 2: This table illustrates the impact of the radial artery positioning board (RAPB) on the prevention of radial artery access site complications in both the control and experimental groups during the posttest. The Mann-Whitney Test yielded a statistically significant result ($p <$

0.001), demonstrating a notable difference in complication rates between the control and experimental groups. Overall, the findings suggest that the RAPB effectively reduces radial access site complication.

Table 3: Correlation Between Success Rate of Radial Artery Access Using RAPB and Prevention of Access Site Complications
N = 160

CORRELATION	RADIAL ARTERY ACCESS LEVEL				Spearman's Rank Correlation Coefficient
	Successful and Probably Successful Rate		Unsuccessful Radial Access		
ACCESS SITE FOR COMPLICATION	(n)	%	(n)	%	r = 0.504 p = 0.001
High-level prevention	5	83.70%	49	31.8%	
Low-level prevention	1	16.30%	105	68.2%	

Table 3: This table presents the correlation between the success rate of radial artery access using the Radial Artery Positioning Board (RAPB) and the prevention of access site complications. The Spearman's rank correlation coefficient ($r = 0.504$) indicates a positive correlation, with a highly significant p-value of 0.001, supporting the acceptance of Hypothesis H2.

IV. DISCUSSION

The findings of our study align with those of previous research, particularly the investigation conducted by Melhuish and White, which also emphasized the importance of a 45-degree wrist extension during radial artery cannulation⁷. Our study supports the notion that optimal wrist positioning, specifically at a 45-degree angle, offers advantages in terms of access time and first attempt success rate during radial artery access procedures.

V. CONCLUSION

In conclusion, our study demonstrates the effectiveness of the Radial Artery Positioning Board (RAPB) in facilitating radial artery access and preventing access site complications among patients admitted to critical care units. The use of RAPB significantly improves the success rate of radial artery access and reduces the incidence of access site complications. These findings underscore the importance of optimal wrist positioning, particularly at a 45-degree angle, in enhancing the overall outcomes of radial artery access procedures.

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