Nurse Management of Radial Arterial Lines: Evidence-Based Practice

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BACKGROUND

- Nurses reported that at least fifty percent of critical care patients have radial arterial lines (RALs) for immediate identification of changes in a patient's hemodynamic status.
- Nurses have the primary responsibility for caring for patients with RALs.
- Stabilizing RALs is essential for patient safety.
- Armboard devices for stabilizing the RAL wrist have emerged but have not been formally reviewed by critical care nurses.
- Large gaps exist in the practice literature about the nursing management of RALs.

The purpose of this paper is to review new evidence and devices for improved management of radial arterial lines that can support nursing practice in critical care.

LITERATURE

- The radial artery cannulation is one of the most widely used procedures for continuous blood pressure monitoring. [1] Blood pressure monitoring, medication titration, and arterial blood gas testing are the primary indications for an indwelling arterial catheter. [1 2]
- The most common complication is temporary occlusion of the artery; A study by Cousins et al[3] reported that the instance of occlusion may range from 1.5% to 35%. Other researchers reported complications of indwelling radial arterial catheters increased with the length of time the catheter was left in place. For instance, risk of occlusion increased at the 48–72-hour mark and instance of infection and sepsis increased after 96 hours. [2] Infection was also associated with contamination by caregivers, the monitoring system, and the flushing device. [2] Failure of radial arterial lines has been associated with skin deterioration, accidental removal, inaccurate readings, and failed attempts to draw blood.[4]
- Procedural literature on arterial catheterization is abundant with a focus on the placement of an arterial catheter, complications, and other procedures such as the setup of hemodynamic circuitry, maintaining accurate readings, monitoring blood pressure, and the waveform display.[5-7]
- From a nursing perspective, the key to managing a RAL is stabilizing the wrist and preventing occlusions that will assure blood pressure measurements are consistent and accurate as well as preventing complications such as infection, skin breakdown, and nuisance alarms.
- When managing RALs, nurses have a heightened sensitivity to factors that affect the accuracy of the artery waveform as it is portrayed on the bedside monitor, especially in the context of administering vasoactive medication to ensure appropriate dosing and patient safety.[8]
- Bedside monitors are a vital part of nursing management of critically ill patients. Nurses rely on these tools to measure and alert them to a sudden or critical change in a patient's hemodynamic status.[9-10] Mitigating the technical factors that may cause inaccurate alarms such as supporting the wrist to prevent movement are necessary in acute care.
- Best practice and tools for stabilizing the wrist with arterial cannulation are not well documented. Nurses report using tape, wrapped towels, and rigid armboards to stabilize the cannulated wrist. These methods do not adequately stabilize the patient's wrist.

METHODS

A mix method approach was used to provide in-depth, valid, reliable, credible qualitative and quantitative data using two phases: Phase I: Survey of Critical Care Nurse Management of Radial Arterial Lines and Phase II: Focus Group of Critical Care Nurse Experts (focus group data is reported in another publication).

Phase I: Survey of Management of Radial Arterial Lines. A 21-question survey was designed to obtain critical care nurses' feedback about optimal management of RALs. Likert responses at 5 levels were used to extract nurse views of RAL management. 260 surveys were sent to nurses who were self-identified as working in critical care for more than 5 years. There were 192 partially completed surveys and 68 completed surveys for a 26.2% response rate. Only completed surveys were used in this study.

Phase II: Focus Groups. Six critical care nurses were chosen under the eligibility criteria which included: 5 years or more and current employment in critical care as a registered nurse. Also, nurses had to report that they managed radial arterial lines as a part of their practice. Six nurses were selected with a mean of 15.5 years of critical care experience (range 9-23 years). Participants completed and signed consent forms for audio and video taping of the sessions. The sessions were virtual, and Zoom meeting technology was recorded, transcribed, and reviewed. Focus group participants received $200 payment for completing the focus group.

Prior to the focus group, participants received a sample rigid armboard and a sample bendable/flexible armboard. During the focus group, the nurse participants were asked general questions about the use of armboards, safety, and preference for these devices in the management of radial arterial lines. A description of each type of armboard was provided:

Make-Shift Armboard A make-shift armboard is made up of various items such as towels, tape gauze, and tongue depressors the clinician needs to gather various sources

Rigid Armboard A rigid armboard is prefabricated with a non-bendable cardboard or plastic center and usually covered with vinyl. Tape and gauze are often used to secure the rigid board to the cannulated wrist. Rolled up towels can be placed under the wrist to maintain a hyperextended position.

Pre-formed Armboard A pre-formed armboard is frequently made of plastic and bent at a 30-degree angle. The armboard cannot be reshaped. The device is lined with foam padding and can include foam straps.

Flexible/bendable Armboard The flexible/bendable armboard can be custom shaped or reshaped to any desired position. Easily adjustable elastic straps with hook and loop tabs secure the board to the cannulated wrist. The bendable armboard is covered with a soft foam padding.

RESULTS

Table 1.0. Nurse Sample Description

	n	Mean	SD	Min	Max
Years as a Registered Nurse	68	14.6	9.6	3	42
Years as an Intensive Care Nurse	68	11.9	8.5	3	35
Years' experience with Radial Arterial Lines	68	12.6	8.8	3	38
Critical Care Beds in Hospital	68	24.8	14.7	6	76
Primary work unit	n	%			
Critical Care ICU	51	75.0%			
Emergency Department	3	4.4%			
Post Anesthesia Care Unit	3	4.4%			
Pediatric ICU	5	7.4%			
Surgical ICU	6	8.8%			
Urban/rural	n	%			
Urban	54	79.4%			
Rural	14	20.6%			
Patient Population:	n	%			
Adult	60	88.2%			
Child	8	11.8%			
Country	n	%			
Canada	30	44.1%			
United States	38	55.9%			

Table 2.0. Survey Questions related to Nurse Management of Radial Arterial Lines (RALs)

		n	%
After insertion, managing RAL is the nurse's responsibility	Agree	65	96%
	Disagree	3	4%
Nurse management of RAL is essential for patient safety	Agree	68	100%
	Disagree	0	0%
Nurses must be able to visually inspect the insertion site to safely monitor RAL	Agree	66	97%
	Disagree	2	3%
Nurse management of RAL includes adjustment of the wrist angle	Agree	67	99%
	Disagree	1	2%
Arterial line failure can be caused by frequent wrist movements	Agree	60	88%
	Disagree	8	12%
Changes in wrist position may cause a false blood pressure alarm	Agree	65	96%
	Disagree	3	4%
Do you use any type of armboard to stabilize a RAL?	Agree	56	82%
	Disagree	11	16%
	N/A	1	2%
Should an armboard be used on all patients?	Agree	31	46%
	Disagree	35	52%
	N/A	2	3%
Is the use of an armboard for a RAL a hospital policy?	Agree	14	20.6%
	Disagree	48	70.6%
	N/A	6	8.8%
What types of armboard do you most often use to manage a RAL?	Make-Shift	9	13.2%
	Rigid	31	45.6%
	Preformed	21	30.9%
	Flexible	7	10.3%
Which armboard do you prefer?	Make-Shift	4	5.9%
	Rigid	4	5.9%
	Preformed	12	17.6%
	Flexible	29	42.6%
	N/A	14	20.6%

Table 3.0. Nurse Rating of the importance of the following features of using an armboard to manage RAL (n=68)

	Extremely Important	Important	Neutral	Not Important	Extremely Not Important
	%	%	%	%	%
Maintains accurate arterial line waveforms	63.2%	27.9%	8.8%	0.0%	0.0%
Prevents temporary RAL occlusions from kinked tubing	55.9%	35.3%	7.4%	1.5%	0.0%
Reduces the triggering of false alarms	48.5%	41.2%	7.4%	1.5%	0.0%
Easy to apply	35.3%	48.5%	16.2%	0.0%	0.0%
Accommodates multiple wrist positions	55.9%	38.2%	5.9%	0.0%	0.0%
Provides adequate stability	54.4%	36.8%	5.9%	0.0%	0.0%
Increases patient's comfort	50.0%	41.2%	5.9%	0.0%	0.0%
Allows me to easily visualize and monitor the RAL site	55.9%	38.2%	4.4%	0.0%	0.0%
Stabilizes the RAL and provides accurate measures of B/P	63.2%	27.9%	1.5%	0.0%	0.0%
Increases patient safety	61.8%	38.2%	1.5%	0.0%	0.0%

PRACTICE IMPLICATIONS

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- 100% of the Critical Care Nurses reported that maintenance of patient safety with RALs is the responsibility of nurses.
- Wrist stabilization of the cannulated artery, continuous visualization of the RAL site, monitoring for skin breakdown and infection, and accurate blood pressure measurement were declared priorities for critical care nurses.
- Critically ill patients who were agitated, anxious, and moved frequently were most eligible for use of an armboard to stabilize the RAL.
- Nurses voiced concern about the lack of the availability of tools to manage RALs.
- Too often the nurses jury rig devices to stabilize a patient's wrist and the nurses reported frequent adverse events such as infections, skin breakdown, and inaccurate blood pressure measurements. These outcomes are costly for hospitals and patients.
- Nurses reported preference for flexible/bendable armboards, but they were reported often not available.
- Nurses need up-to-date tools to perform best practices that keep patients safe.

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