Nurse Management of Radial Arterial Lines: Quality & Safety

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Received December 09, 2021; Revised January 14, 2022; Accepted January 23, 2022

Abstract Background: Radial arterial lines (RALs) are used to obtain precise measurement and provide continuous blood pressure monitoring of critically ill patients. Critical care nurses are the primary responsible clinician for maintaining the safety and effectiveness of radial arterial lines (RALs). Gaps exist in the practice literature about tools that help nurses stabilize the wrist joint for safe maintenance of RALs. Local Problem: The purpose of this study was to improve the quality and safety of RALs by establishing use, safety, and preferences of critical care nurses for tools that help them manage RALs. Methods/Intervention: A mix method approach provided in-depth qualitative and quantitative data in two phases: Phase I: Survey of critical care nurse management of RALs and Phase II: a Focus Group of Critical Care Nurse Experts exploring the use, safety, and perception of tools to manage RALs. Results: Nurses reported that visual inspection of the insertion site of an RAL (97.1%); adjustment of the wrist angle (98.5%) and stabilization of the wrist (88.2%) were critical areas for safe management. Nurses voiced concern about the lack of the availability of adequate tools to manage RAL. Conclusions: 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.

Keywords: radial arterial lines, quality improvement, nurse management

Cite This Article: Nancy P. Hanrahan, Lisa Letourneau, and Rachel Batty, “Nurse Management of Radial Arterial Lines: Quality & Safety.” American Journal of Nursing Research, vol. 10, no. 1 (2022): 7-15. doi: 10.12691/ajnr-10-1-2.

1. Background

Use of arterial cannulation in critically ill patients is a common practice for monitoring continuous blood pressure and to obtain frequent diagnostic and arterial blood gas samples. [1] Despite the frequent use of radial arterial lines (RALs), little practice evidence exists in the literature about the nursing management of RALs. Specifically, new armboard devices for stabilizing the RAL wrist have emerged but have not been reviewed by critical care nurses. Thus, the purpose of this paper is to review new evidence for improved management of radial arterial lines that can guide nursing practice.

The radial artery is one of the most widely used arteries for continuous blood pressure monitoring. [2] Insertion of a radial artery catheter is common among patients of all ages who are cared for in acute care areas such as emergency departments, critical care units and operating rooms. Blood pressure monitoring is the primary purpose for an indwelling arterial catheter. [2,3] Consistent anatomy of the radial artery across patient populations, ease of cannulation, and low risk of complication make the radial artery the preferred site for cannulation. [4,5]

Radial artery cannulation provides easy access for frequent blood sampling and continuous blood pressure monitoring and provides nurses and doctors with critical information when caring for patients who need close monitoring. [4] Although the radial artery site poses few risks for complications when compared to other potential cannulation sites, the most common complication is temporary occlusion of the artery; A study by Cousins et al [6] reported that the instance of occlusion may range from 1.5% to 35%. Temporary occlusion of the artery generally has no serious consequences as adequate collateral circulation to the hand exists, yet, permanent occlusion, although rare, can provide very serious consequences. [6] 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 have been associated
with skin deterioration, accidental removal, inaccurate readings, and failed attempts to draw blood. [7]

The optimal wrist angle for insertion is described as one that stretches the radial artery to reduce tortuosity and movement without affecting the size of the arterial lumen. [5] When the diameter of the radial artery is reduced, the risk of temporary occlusion is increased. [5] Mizukoshi et al. studied the specific dimensions of the radial artery at different angles of flexion to determine where the radial artery remained at its largest diameter. When measured with ultrasound, the wrist angle extended from 45° to 60° in healthy people. [8] When the wrist was extended further it may cause a decrease in height of the artery, thereby hypothesized to increase the difficulty of insertion. [8]

Ogle [9] describes a wrist position dorsiflexed to 30-45° and recommends avoiding hyper dorsiflexion as it may make cannulation more difficult due to compression of the radial artery. To maintain this position during insertion of a RAL, a towel or gauze is often placed on the dorsal aspect of the wrist and the hand is held by an assistant or by taping the fingers in place. [9] Further, Pandey, et al studied successful cannulation rates with the wrist position at different angles. They determined wrist extension of 45° is optimal for successful radial artery cannulation. [5] The optimal angle is one which can stretch the radial artery to reduce tortuosity and movement without affecting the size of the arterial lumen. [5]

2. Local Problem

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. [12,13,14] However, much less information is available about the maintenance of the radial arterial line which is the primary responsibility of the nurse. From a nursing perspective, the key to managing a RAL is stabilizing the wrist such that blood pressure measurements are consistent and accurate, while preventing complications such as infection, skin breakdown and annoyance alarms.

Radial Arterial Line cannulation insertion is generally performed by physicians. However, it is the critical care nurses in the emergency department, post-surgical unit and intensive care units who provide monitoring and management of radial arterial line patency long term. [1] 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. [6]

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 patient’s hemodynamic status. [10,11] Monitor alarms are highly sensitive and even the slightest change in vital signs can trigger an alarm. [11] Many alarms are triggered by technical factors related to the stabilization and position of the cannulated wrist. [11] Mitigating the technical factors that may cause inaccurate alarms such as supporting the wrist to prevent movement are necessary in acute care. However, the best tools for stabilizing the wrist are not well documented. Nurse’s report using tape, wrapped towels, and rigid armboards to stabilize the cannulated wrist. These tools do not adequately stabilize the patient’s wrist.

Radial arterial lines require the proper tools for nursing management that stabilize the wrist and arterial line. New armboard tools have emerged; however, little is known about critical care nurses’ perception of these devices compared with other options. The purpose of the study reported in this paper was to establish use, safety, and preferences by critical care nurses for armboard tools that help them manage and stabilize radial arterial lines.

3. Methods

A mix method approach was chosen to provide in-depth, valid, reliable, credible qualitative and quantitative data [15] 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.

Phase I: Survey of Management of Radial Arterial Lines. A 21-question survey designed to get critical care nurse feedback about optimal management of radial arterial lines and recommended steps for managing radial arterial lines. Likert responses at 3-5 levels were used to extract nurse views of RAL management. 260 surveys were sent to nurses self-identified as working in critical care; 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. At the end of the Phase I survey, nurse respondents were asked to self-select for the focus group, 25 nurses chose to participate in the focus groups. Six nurses were chosen if they fit 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). The six critical care nurses primarily worked in urban settings in the Critical Care/Trauma Intensive Care Unit, Surgical Intensive Care Unit, and Pediatric Intensive Care Unit. They estimated that 25-50% of the patients they cared for had radial arterial lines. Participants signed consent forms and completed consent forms for audio and video taping of the sessions. The sessions were virtual, used Zoom meeting technology, and were recorded. Recordings were 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 is provided in Figure 1.
**Make-Shift Armboard** A make-shift armboard is made up of various items such as towels, tape, gauze, and tongue depressors that the clinician needs to gather from 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.

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Table 1. 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              |     |      |     |     |     |
| 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                    |     |      |     |     |     |
| Urban                          | 54  | 79.4%|     |     |     |
| Rural                          | 14  | 20.6%|     |     |     |
| Patient Population:            |     |      |     |     |     |
| Adult                          | 60  | 88.2%|     |     |     |
| Child                          | 8   | 11.8%|     |     |     |
| Country                        |     |      |     |     |     |
| Canada                         | 30  | 44.1%|     |     |     |
| United States                  | 38  | 55.9%|     |     |     |
4. Results

Table 1 describes the surveyed and focus group nurses. The mean years as a registered nurse was almost 15 (SD=14.6; Range 3-42 year's experience). The group had a mean of 11.9 years working in the critical care of patients and 12.6 year's experience with management of radial arterial lines. The nurse respondents worked in hospitals with an average of 24.8 beds (SD=14.7; range 6-76). Most (75%) worked in critical care Intensive Care Units, Emergency departments (4.4%), post anesthesia care unit (4.4%), pediatric intensive care units (7.4%), and surgical care intensive care units (8.8%). Most nurse respondents worked in urban hospitals (79.4%) with adult patients (88.2%). The nurse sample resided in the United States (55.9%) or Canada (44.1%).

Survey questions about nurse management of radial arterial lines, Table 2, showed that all the nurses (100%) believed they were responsible for the patient’s safety and the majority of nurses concurred with the statement that managing RALs are the responsibility of nurses (95.6%). Nurse management of RALs include the need to be able to visually inspect the insertion site of an RAL (97.1%); adjust the wrist angle (98.5%) and noted that arterial line failure can be caused by frequent wrist movements (88.2%). Changes in wrist position are often associated with false blood pressure alarms (95.6%). Most of the nurse respondents used an armboard to stabilize the RAL (82.4%) but did not agree that an armboard should necessarily be used on all patients (51.5%). The majority of nurses reported that use of an armboard for stabilizing a RAL is not a hospital policy (70.5%). Most often the nurses use a makeshift or rigid armboard (58.8%). Fewer nurses used a preformed armboard or a flexible/bendable armboard (41.2%). However, most nurses preferred the flexible/bendable armboard (42.6%). In the focus group, the use of armboards was explored in greater depth.

Table 3 shows nurses’ ratings of the importance of certain features of armboard use. In most of the responses, the majority of nurses reported ‘extremely important’ or ‘important’ ratings for maintaining accurate arterial line wave forms, prevention of kinked tubing, reducing false alarms, ease of application, accommodation of multiple wrist positions, provision of adequate stability, patient comfort, easier visualization of the RAL site, stability, and patient safety.

| Table 2. Survey Questions related to Nurse Management of Radial Arterial Lines (RAL) | n   | %     |
|---------------------------------------------------------------------------------|-----|-------|
| After insertion, managing RAL is the nurse’s responsibility                    | Agree | 65 | 95.6% |
|                                                                  | Disagree | 3 | 4.4%  |
| Nurse management of RAL is essential for patient safety                       | Agree | 68 | 100.0% |
|                                                                  | Disagree | 0 | 0.0%   |
| Nurses must be able to visually inspect the insertion site to safely monitor RAL | Agree | 66 | 97.1% |
|                                                                  | Disagree | 2 | 2.9%   |
| Nurse management of RAL includes adjustment of the wrist angle                | Agree | 67 | 98.5% |
|                                                                  | Disagree | 1 | 1.5%   |
| Arterial line failure can be caused by frequent wrist movements               | Agree | 60 | 88.2% |
|                                                                  | Disagree | 8 | 11.9%  |
| Changes in wrist position may cause a false blood pressure alarm              | Agree | 65 | 95.6% |
|                                                                  | Disagree | 3 | 4.4%   |
| Do you use any type of armboard to stabilize a RAL?                          | Agree | 56 | 82.4% |
|                                                                  | Disagree | 11 | 16.2%  |
|                                                                  | N/A | 1 | 1.5%   |
| Should an armboard be used on all patients?                                   | Agree | 31 | 45.6% |
|                                                                  | Disagree | 35 | 51.5%  |
|                                                                  | N/A | 2 | 2.8%   |
| 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. Nurse Rating of the importance of the following features of using an armboard to manage RAL (n=68)

| Feature of Using Armboard | 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% |

5. Focus Group Themes

Six nurses were eligible for the focus group interviews; all worked in critical care intensive care units with adults or children and had nearly 100 years of aggregate critical care experience working with patients and with radial arterial lines. The focus group critical care nurses reported that 50-75% of their patients had radial arterial lines to manage blood pressure and draw blood for essential lab studies. Three main topic areas emerged: 1) general experience working with and stabilizing radial arterial lines (RAIs). See Figure 2; 2) patient safety (rigging up RALs to secure and stabilize the site and adverse events). See Figure 3; and 3) preferences and benefits of using armboards to stabilize RALs. See Figure 4. All focus group nurses were mailed a rigid armboard and a flexible/bendable armboard for review during the interview.

General experience working with and stabilizing radial arterial lines (RAIs). The focus group nurses were asked to explain which patients need RALs stabilized with armboards.

"To keep the RAL stable, we often use rolled facecloths, tongue depressors, and tape to secure an arm because that is what is available. However, when you need to move a patient, something always gets dislodged, and you need access to that site quickly. It takes time to remove all that tape to access the site.

ICU Nurse 14 years’ experience

“The risk of pressure injuries is higher whenever you're using a homemade “rigged” device. Your patient is at greater risk for skin abrasions, breakdown from tape, and pressure injuries. Flexibility of the securement device is so important. You often need to adjust the wrist, sometimes day by day, hour by hour, because everything is going to change, just because my art line worked when my wrist was like this two hours ago doesn't mean it's going to have the same waveform as it does now. And I know we've had to put in new art lines just because of the constant flexion that then leads to failure of the line, which leads to a patient having to suffer through another procedure, and more staff and equipment costs.”

Cardiac ICU Nurse 22 years’ experience

“Some patients don’t need armboards because they don’t move much—they are comatose or immobilized for other reasons. However, many patients move around a lot because they may be agitated or delirious or for whatever reason. So, these patient populations benefit from an armboard for protecting their arterial lines.

Critical Care ICU Nurse 9 years’ experience

“Stabilizing A-lines is definitely important, especially with neuro patients; we have a lot of cranietomies. They have had clips or aneurysms and we need accurate blood pressure. I mean pinpoint, systolic BP between 140 and 160—It mean, tight parameters. It can’t be off. You depend on the A-line to always be accurate.”

Critical Care ICU Nurse 18 years’ experience

Figure 2.
**Patient Safety:** Nurses reported that assessment of the RAL is frequent and ensuring the stability of the RAL site is key to safe practice. Tools, such as armboards, for securing RALs are often not available for nurses in practice environments. The nurses reported often “rigging-up” ways to stabilize the wrist for an arterial line. The focus group nurses were asked to describe a case where there was a failure such as an occlusion of the arterial line and what was helpful to prevent these failures. Examples of their responses are below:

“No, I’ve seen many cases where the arterial line has failed due to occlusion from kinked tubing. Either they are not securely positioned, or the patient moves around and dislocates the arterial line. Yeah, there is many times where I think that the life of the art line would have lasted longer if an armboard was then used, essentially the flexible armboard. I think the flexible armboard is more functional because it is adjustable without removing the entire device. It’s soft on the exterior and it is bendable. So, I think there’s some adjustment you can make with it”

**Critical Care ICU Nurse 15 years’ experience**

“We watch our RALs hour by hour depending on if you are titrating some sort of medication. You are looking at your arterial line often, but infiltrates can happen very quickly. Swelling can occur with tape and cause pressure sores if they are taped down tight. However, we often must move the wrist to get the waveform accurate. I like the bendable/flexible armboard because you can quickly adjust the wrist using the hook and loop, view the site, and reestablish the site security.”

**Pediatric ICU Nurse 14 years’ experience**

“In critical care we instruct and do skin assessments with RALs every hour. Dressing changes need to happen every 96 hours or as needed if there is leakage. Full precautionary measures are used when changing dressings.”

**Surgical ICU Nurse 12 years’ experience**

“I think when we have extra movement and the staff are constantly trying to adjust wrists and things without the board, we definitely lose our art lines a lot quicker than probably we would with an armboard. So, I do think there would be a benefit in longevity of the arterial line with a flexible armboard. The other safety issue I see is people going back and forth between using a manual blood pressure reading and a waveform reading. So, I think the longevity factor would be a huge benefit with using an armboard to stabilize the arterial line. And then for patient comfort, I think it ergonomically looks like the flexible armboard would do a better job for wrist comfort. And then just protecting the skin, too, with all, like I said, the tape that we use. So, I think there have been skin tears that I have seen with attachment attempts when we are making up something, trying to keep it in a certain position. So, I think there is a lot of benefit from a flexible armboard that has hook and loop positioning instead of tape.”

**Surgical ICU Nurse 12 years’ experience**

“Sometimes we have our patients that have been there for quite some time, and they have an A-line. One example, our COVID population, majority of patients had a-lines. They became so edematous from fluid overloaded that it was hard to keep the A-line even in because of the fluid, it was just horrible for them. And these patients were with us for a while—not three days, four days, we are talking weeks, some of them and you were changing out the A-line, getting rid of the A-line, putting a new A-line in, trying all kinds of things to keep it from coming out and protecting their skin because they had so many other things going on”

**Critical Care ICU Nurse 15 years’ experience**

Figure 3.
Figure 4.

6. Discussion

This study gathered critical care nurses to review factors influencing the management of RALs. Three quarters of the nurses worked fulltime in adult intensive care units in hospitals with 6-76 critical care beds (M=24.8; SD=8.8). The sample was drawn from Canada (44.1%) and the United States (55.9%) who worked mostly in urban hospitals (79.4%). Other participants worked in the emergency department, post anesthesia care unit, pediatric ICU or surgical ICU. It is notable that these nurses were extremely experienced as critical care nurses (M=11.9; SD=8.5; Range 3-35 years’ experience) and they had on average, 12.6 years’ experience working with RALs.

Wrist stabilization of the cannulated artery, continuous visualization of the RAL site, monitoring for skin sores and infection, and accurate blood pressure measurement

Preferences and benefits of stabilizing a radial arterial line. The focus group nurses were asked to discuss their preferences for stabilizing the radial arterial line. These quotes illustrate their replies:

“A flexible/bendable armboard would be much safer with quicker access to the patient and allow a lot more flexibility. Also, the cushioning of the flexible armboard would allow for better skin care versus the tape that is holding our MacGyvered rig.”

ICU Nurse 14 years’ experience

“I think the hook and loop strap with the flexible/bendable armboard is a preferred option to me rather than tape. I think people will automatically tape tighter than necessary just to try to keep it on. And you always want to tape the tape to itself, so you are doing some hardcore circumferential squeezing. And almost all our patients are going to get edema during their stay, so having something that's quick and easy to adjust rather than a nurse thinking they must take all these rolls of tape and then put all this back on. I think it's going to be much safer for the patient.”

Critical Care ICU Nurse 22 years’ experience

“I think especially in our pediatric population where we can have infiltrates that occur so quickly, that having the hook and loop on the flexible/bendable armboard or having something that you can adjust, you can easily remove and put back on so that you can do your hourly assessment on your either PIV or on your arterial site. So, I think just different ways that you can move and adjust this would be more ideal than using a stiff-armboard. And then the fact, yes, that it can bend is an added benefit of not having to use something else. You can just use the product itself and use it for your advantage on how you want it to go. And the patient's anatomy with some of our CP kids, that maybe they bend a different way. And without having to bend their extremity a certain way, you can use this to actually bend it.”

Pediatric ICU Nurse 14 years’ experience

“I just feel like it will actually position the extremity so that is at a better angle to be able to keep the wrist flexed so that you do get a better waveform and everything on the monitor. As opposed to a stiff-armboard, which doesn't allow you to bend the wrist as often or at all. Yeah, I definitely feel it would be a better benefit for the patient.”

Surgical ICU Nurse 12 years’ experience

“I personally feel, like I said with the flexible/bendable armboard, I think that it does its job. But I think the flexible armboard is softer against the skin and the actual hook and loop adjuster, the fact that it has that adjustment straps on it makes me never want to use tape on a patient's skin. Things being on the patient's skin, cause skin tears and problems. Sometimes you're using lots of gauze, then is necessary. So, I think, the flexible/bendable armboard is the ideal product.”

Skin Care Critical Care Nurse 18 years’ experience
were declared priorities for critical care nurses. Most of the nurses agree they used an armboard to stabilize a RAL (82.4%). But more than half of the nurses (51.5%) disagreed that armboards should be used on all patients. While not all patients with RAL need special tools such as armboards to stabilize the wrist, nurses in this study reported about 50% of their patients do require armboards to stabilize the RALs. Critically ill patients who were agitated, anxious, and moved frequently were most eligible for use of an armboard to stabilize the RAL. Involuntary and voluntary movement place a higher risk that the RAL will move out of position, result in kinked tubing, trigger false alarms, causes skin irritation or site infection, or may result in inaccurate blood pressure measurements. They reported that they most often use rigid armboards (45.6%) or preformed armboards (30.9%) because these are the tools available to them.

Because the best tools for stabilizing the wrist are not always made available, nurses are forced to use tape, wrapped towels, tongue depressors and rigid armboards. The use of make-shift stabilization devices and especially the use of wooden tongue depressors are not recommended due to the increase in risk to patient safety. [16,17]

Although they may appear cost effective, the use of tongue depressors as stabilization devices are not without an increased risk of development of opportunistic fungal infections in critically ill and immunocompromised patients. [16,18] However, as alarms are frequently set off due to a lack of stability thereby jeopardizing accurate hemodynamic measurement and leading to an increase in alarm fatigue, nurses will often turn to the make-shift resources on-hand to stabilize the wrist.

The nurses’ preference, however, was for the flexible/bendable armboard because it allowed them to a) adjust the armboard position or reshape it without removing it, b) maintain skin integrity with a soft comfortable product, c) eliminate tape which does not accommodate edema and can lead to skin breakdown, d) quickly and easily visualize the RAL site to monitor for infection and skin breakdown, e) easily adjust the wide elastic straps with hook and loop closures, giving nurses the best options for repositioning the wrist on the armboard.

7. Limitations

A mix method approach was chosen to provide in-depth, valid, reliable, credible qualitative and quantitative data for rigorous results using focus groups and survey questions. [15] Although the nurse sample was a convenience sample, they were highly experienced critical care nurses. [19] While there is risk for bias, the nurse participants provided a deep reach into the practice management of RALs.

8. Conclusion

Nurses need tools to perform best practices to keep patients safe. Jury rigging to stabilize a patient’s wrist for a radial arterial line is common practice. Nurses reported adverse events such as infections, skin breakdown, and inaccurate blood pressure measurements when proper tools are not available. These outcomes are costly for hospitals and patients. Nurses also voiced concern about the lack of availability of tools to manage RAL. They reported having few alternatives for wrist support and reach for inadequate resources such as tongue depressors and excessive use of tape. Nurses reported preference for flexible/bendable armboards, but they are not available. This study explored new devices that are tools that help nurses to keep patients safe. Hospital administrators need to pay attention to upgrading the tools nurse's use.

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