Research

Survey of Frequency, Timing of Insertion, and Management of Peripheral Arterial Catheters in Acute Care Units in Japan

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ABSTRACT

Background: Arterial catheters are commonly used in acute care units for hemodynamic monitoring in conjunction with blood pressure and blood gas analysis. Complications arising from the use of arterial catheters have been reported; however, few studies have focused on standard practice of arterial catheters.

Aim: To clarify the management, particularly the insertion frequency and timing, of peripheral radial arterial catheters in acute care units in Japan.

Methods: We developed 34 questions through an interactive process based on guidelines and clinical experience to create a digital survey. This survey was conducted over a month. Participants were nurses working in acute care units in Japan who received electronically distributed surveys through nursing-specific mailing lists and social network services.

Results: A total of 451 responses were collected; 224 were used for analysis. Respondents reported 35% implemented routine insertion of arterial catheters for all newly admitted patients, while 58% would insert the arterial catheter within 24 hours of admission. Only 7% of respondents did not add heparin to the pressurized bag. Of the respondents, 51% had a rule to change the pressurized bag of fluids every 3 days. Splinting of the wrist was a routine procedure for 41% of respondents.

Conclusions: Arterial catheters were commonly used in all acute care units. Based on the results of the survey, we recommend the use of heparin as a flush fluid should be reconsidered. The high rate of unnecessary arterial catheter insertions and the routine use of splinting need to be reassessed.

Keywords: Peripheral arterial catheter, acute care, splint, Intensive Care Units

INTRODUCTION

Arterial catheters, most often cannulated into the radial artery, are commonly used for hemodynamic monitoring in acute care

units. In Japan, acute care units include Intensive Care Units (ICUs), High Care Units (HCUs), and emergency care-specific ICUs (EICUs). Patients with critical illnesses are mainly admitted to the ICU, while those with milder illnesses are admitted to the HCU. EICUs are units attached to specialized trauma departments. Patients requiring arterial catheter monitoring can be admitted to any of these acute care wards. We will collectively refer to ICUs, including EICUs, and HCUs together as acute care units (ACUs).

Arterial catheters are almost always used in conjunction with frequent blood pressure measurements and blood gas analyses. In the United States, 36% of ICU patients undergo arterial catheter insertion (Gershengorn et al., 2014). However, arterial catheter use is not without complications, such as infection (Gershengorn et al., 2014), pseudoaneurysm (Gaertner et al., 2010), median nerve damage from the wrist extension associated with the splints that are frequently used to secure the wrist during catheter insertion (Chowet et al., 2004). Furthermore, patients may experience discomfort when they do not move their wrists during the splinting. Studies that clarify the frequency of use, timing of catheter insertion, and arterial catheter management are sparse, and to our knowledge, there are few guidelines specific to arterial catheter management (O'Grady et al., 2011, 2002, Timsit et al., 2020).

It is important to clarify the frequency of use of peripheral arterial catheters and their management. Therefore, we conducted a preliminary electronically distributed survey to clarify the management of arterial catheters in acute care wards. This study aimed to examine management strategies for peripheral catheter use in adult patients and to clarify the frequency and timing of insertion. Additionally, we explored any significant difference between the different types of acute care units

METHODS

Design and setting

A cross-sectional web-based survey was used to collect the responses from acute care units in Japan. The survey was conducted from September 1, 2021, through September 30, 2021.

Participants

The participants were nurses working in acute care units in Japan. In some units, physicians were only involved in their medical department and may, therefore, not be aware of the entire process of arterial catheter insertion and management. Hence, we considered that nurses associated with such units would be more appropriate for this study. Therefore, only nurses were included in the study. The inclusion criteria were nurses working in acute care units where adult patients were admitted.

We had no exclusion criteria.

Survey methods

The survey was distributed electronically through mailing lists of the nursing departments of the Japanese Society of Education for Physicians and Trainees in Intensive Care and the Japanese Society of Certified Intensive Care Nurses. The recipients were also asked to forward the survey to other eligible nurses. In addition, social network services were also used to distribute the survey instruments. Furthermore, we asked local communities where the intensive care nurses participated in distributing the survey via e-mail or social network services to encourage wider participation.

Survey development

The survey was developed through an interactive process of researchers based on their clinical experience and guidelines (O'Grady et al., 2011; Timsit JF et al., 2020). The survey was anonymous; however, the name of the facility and units with which the respondents were affiliated were required to avoid duplicate responses from the same unit. In this study, a peripheral arterial catheter was defined as one cannulated into the radial artery, the most common site for arterial monitoring (Nuttall et al., 2016).

The survey consisted of four components. The first was the characteristics of the participants and their years of experience in the ICU, HCU, or EICU. The question of physician staffing was based on the model developed by Pronovost and colleagues (Pronovost et al., 2002). The second component covered the characteristics of the institution, including the function of the hospital (i.e., university hospital), physician staffing, number of beds, and nurses' manpower. The third component in the questionnaire focused on arterial insertion (i.e., insertion frequency under echo guidance). The fourth component focused on arterial catheter management, including the frequency with which the pressurized saline solution and dressing were changed. It is important to note that questions for components 1, 3, and 4 were asked regarding standard practices at the facility, not the responder's practices. The questionnaire comprised a total of 34 questions. A pilot study to test the understanding of the 34 questions was not conducted; however, all investigators checked understandability as well evaluated the questions for content validity. To avoid arbitrary selection when duplicate responses were received from the same unit, we predetermined that only the first response from each ward would be included in our analysis.

Statistics

Continuous variables and categorical variables in the questionnaire are represented as median (interquartile range) and percentage, respectively. Fisher's exact test was used to compare categorical data. The Kruskal–Wallis test was used to compare

continuous data among more than two groups. We conducted a predefined subgroup analysis: unit type (i.e., ICU, HCU, or EICU). Statistical significance was considered $p<0.05$. All statistical analyses were performed using SPSS Statistics ver.27 (IBM Corp., Armonk, NY) and R 4.0.2 (R Foundation for Statistical Computing, TX).

Ethical considerations

This study was approved by the Institutional Review Board of Japan Red Cross Fukuoka Hospital (approval number: 563) and conducted according to the Declaration of Helsinki. Participants responded after reading the explanation of the study and provided their consent to participate.

RESULTS

Participants

In total, 451 responses were obtained. We excluded 176 interrupted responses, most lacking institutional names, and 51 duplicate responses. Consequently, 224 responses were analyzed. Considering the total number of acute care units in Japan, reported as 1742 in the 2020 government report (Ministry of Health, Labor and Welfare, 2021), the response rate was 12.9%. The characteristics of the participants, institutions, and units are shown in Table 1. The number of responses from university hospitals was 62 (27.7%). Most participants were from ICUs; however, 45 (20.1%) were from HCUs. The response rates for each region are listed in Table 2.

Frequency of peripheral arterial catheter insertion

The responses for arterial insertion (i.e., insertion frequency under echo guidance) are shown in Table 3. While 35.3% of the respondents reported routine insertion of arterial catheters for newly admitted patients, 57.6% reported inserting an arterial catheter within 24 h of admission. A subgroup analysis by type of acute care unit is shown in Table 4. The proportion of participants who responded that the arterial catheter was inserted within 24 h of admission was significantly higher in the ICU (n=56, 40.3%) and ICU, specifically in emergency medicine (n=19, 47.5%) than in the HCU (n=4, 8.9%, $p<0.01$) (Table 4).

Management of peripheral arterial catheter

Table 5 shows the management of the arterial catheter and related equipment. The highest percentage of respondents (n=115, 51.3%) reported changing the saline solution in the pressurized bag every 3 days. Most respondents (n=195, 84.3%) reported the addition of heparin to the saline solution. Most facilities used 1000–2000 units of heparin per 500 mL of normal saline. Approximately one in three respondents (n=76, 33.6%) reported that they had no rule for changing the pressure tube. Respondents who reported replacing arterial catheters regularly were rare (n=10, 4.5%). The percentage of respondents who implemented wrist splinting

routinely was 41.1% (n=92). For the management of the arterial catheter and related equipment, there were no significant differences among the acute care unit types. (Table 3).

Table 1.

Characteristics of participants, institutions, and units using peripheral arterial catheters

Characteristics of participants, institutions, and units	Results, n (%) N=224
Nursing experience (years), median (IQR)	16 (11–20)
University Hospital, n (%)	62 (27.7)
Physician staffing, n (%)	
▪ Closed, n (%)	9 (4.0)
▪ Mandatory intensivist consultation, n (%)	78 (34.8)
▪ Elective intensivist consultation, n (%)	55 (24.6)
▪ No intensivist, n (%)	82 (36.6)
Types of acute care unit, n, (%)	
▪ ICU	139 (62.1)
▪ ICU specialized in emergency medicine	40 (17.9)
▪ HCU	45 (20.1)
Number of beds, median (IQR)	10 (8–14)
Number of beds per a nurse in the night-time, median (IQR)	8 (6–11)
Number of nurses in the night-time, median (IQR)	4 (3–6)

Abbreviations: IQR, interquartile range; ICU, intensive care unit

Table 2.

Response rate by region in Japan

Region	Hokkaido	Tohoku	Kanto	Chubu	Kinki	Chugoku/ Shikoku	Kyushu
Response	36.4%	16.5%	13.3%	15.9%	8.9%	10.8%	8.9%

Response = number of valid responses per number of ICUs and HCUs in each region

Table 3.

Arterial catheter and related equipment management

Question	Response	n (%)
Inserting arterial catheter routinely?	Yes	79 (35.3)
The reported proportion of arterial catheter insertion immediately after admission	0–25%	24 (10.7)
	26–50%	20 (8.9)
	51–75%	51 (22.8)
	76–100%	129 (57.6)
Reported arterial catheter insertion under echo-guiding	0–25%	109 (48.7)
	26–50%	43 (19.2)
	51–75%	26 (11.6)
	76–100%	11 (4.9)
	Not at all	35 (15.6)
Insertion position of the arterial catheter	Wrist joint area	138 (61.6)
	From wrist joint to center	86 (38.4)

Table 4.

Subgroup analysis divided by type of acute care unit

		Type of acute care unit			p value
		ICU N=139	EICU N=40	HCU N=45	
Nursing experience (years), median [IQR]		16 (11-20)	15 (9-20)	18 (14-22)	0.004
University hospital, n (%)		40 (28.8)	12 (30.0)	10 (22.2)	0.65
Physician staffing, n (%)	Closed, n (%)	1 (0.7)	7 (17.5)	1 (2.2)	
	Mandatory intensivist consultation, n (%)	61 (43.9)	13 (32.5)	4 (8.9)	
	Elective intensivist consultation, n (%)	33 (23.7)	8 (20.0)	14 (31.1)	
	No intensivist, n (%)	44 (31.7)	12 (30.0)	26 (57.8)	0.004

Number of beds, Median [IQR]		10 (8-12)	10 (8-18)	12 (8-16)	0.08
Number of nurses in the daytime, Median [IQR]		9 (7-12)	9 (6-12)	7 (5-8)	0.002
Number of nurses in the nighttime, Median [IQR]		5 (4-6)	5 (4-7)	3 (3-4)	0.001
Inserting arterial catheter routinely?	Yes	56 (40.3)	19 (47.5)	4 (8.9)	0.001
Perceived proportion of arterial catheter insertion immediately after admission.	0-25%	2 (1.4)	0 (0.0)	22 (48.9)	0.001
	26-50%	2 (1.4)	8 (20.0)	10 (22.2)	
	51-75%	31 (22.3)	10 (25.0)	10 (22.2)	
	76-100%	104 (74.8)	22 (55.0)	3 (6.7)	
Perceived arterial catheter insertion under echo-guiding	0-25%	60 (43.2)	26 (65.0)	23 (51.1)	0.29
	26-50%	29 (20.9)	5 (12.5)	9 (20.0)	
	51-75%	20 (14.4)	4 (10.0)	2 (4.4)	
	76-100%	7 (5.0)	2 (5.0)	2 (4.4)	
	Not at all	23 (16.5)	3 (7.5)	9 (20.0)	
Insertion position of arterial catheter	Wrist joint area	87 (62.6)	24 (60.0)	27 (60.0)	0.93
	From wrist joint to center	52 (37.4)	16 (40.0)	18 (40.0)	
Fixed methods of arterial catheter	Staple	1 (0.7)	0 (0.0)	0 (0.0)	0.17
	Exclusive transparent occlusive dressing	73 (52.5)	24 (60.0)	29 (64.4)	
	A transparent occlusive dressing	62 (44.6)	12 (30.0)	14 (31.1)	
	Other	3 (2.2)	4 (10.0)	2 (4.4)	
Perceived frequency of replacement of saline solution for pressurized bags	Daily	8 (5.8)	2 (5.0)	6 (13.3)	0.06
	No rules	40 (28.8)	8 (20.0)	12 (26.7)	
	Every 3 days	74 (53.2)	20 (50.0)	21 (46.7)	
	Every 2 days	6 (4.3)	8 (20.0)	3 (6.7)	
	Every 1 week	11 (7.9)	2 (5.0)	3 (6.7)	
Frequency of replacement of 500 mL saline flush solution	0.5ml（500U）	2 (1.4)	1 (2.5)	0 (0.0)	0.37
	1ml（1000U）	41 (29.5)	9 (22.5)	19 (42.2)	
	2ml（2000U）	52 (37.4)	14 (35.0)	11 (24.4)	
	3ml（3000U）	9 (6.5)	3 (7.5)	1 (2.2)	

	5ml（5000U）	16 (11.5)	4 (10.0)	7 (15.6)	
	No heparin used	8 (5.8)	7 (17.5)	4 (8.9)	
	Other	11 (7.9)	2 (5.0)	3 (6.7)	
Frequency of dressing change on the insertion site	Daily	3 (2.2)	4 (10.0)	0 (0.0)	0.20
	No rules	79 (56.8)	23 (57.5)	27 (60.0)	
	Every 3 days	12 (8.6)	3 (7.5)	6 (13.3)	
	Every 2 days	1 (0.7)	0 (0.0)	1 (2.2)	
	Every 1 week	44 (31.7)	10 (25.0)	11 (24.4)	
Frequency of pressure tubing replacement	Every 1 week	29 (20.9)	7 (17.5)	11 (24.4)	0.09
	Every 2 days	0 (0.0)	1 (2.5)	0 (0.0)	
	Every 3 days	35 (25.2)	12 (30.0)	10 (22.2)	
	None	20 (14.4)	10 (25.0)	13 (28.9)	
	No particular rule	55 (39.6)	10 (25.0)	11 (24.4)	
Routine replacement of arterial catheter?	Yes	7 (5.0)	2 (5.0)	1 (2.2)	0.72
Frequency of replacing the arterial catheter	1 to 2 weeks	27 (19.4)	3 (7.5)	4 (8.9)	0.07
	3 to 4 weeks	5 (3.6)	0 (0.0)	0 (0.0)	
	Within 3 days	0 (0.0)	1 (2.5)	1 (2.2)	
	4 to 7 days	4 (2.9)	4 (10.0)	4 (8.9)	
	No rules	89 (64.0)	25 (62.5)	28 (62.2)	
	None	14 (10.1)	7 (17.5)	8 (17.8)	
Wrist spline fixation used routinely?	Yes	59 (42.4)	17 (42.5)	16 (35.6)	0.70
Frequency of spline fixation for wrist	0-25%	31 (22.3)	8 (20.0)	10 (22.2)	0.50
	26-50%	24 (17.3)	5 (12.5)	6 (13.3)	
	51-75%	25 (18.0)	7 (17.5)	9 (20.0)	
	76-100%	57 (41.0)	16 (40.0)	18 (40.0)	
	None	2 (1.4)	4 (10.0)	2 (4.4)	
Judgment of using spline fixation.	Physician's orders	2 (1.4)	2 (5.0)	1 (2.2)	0.23
	Based on nursing service standards	12 (8.6)	6 (15.0)	3 (6.7)	
	Decided in conference	6 (4.3)	2 (5.0)	4 (8.9)	

	Decided by individual nurse	92 (66.2)	24 (60.0)	22 (48.9)	
	No rule	27 (19.4)	6 (15.0)	15 (33.3)	
Type of splint	Special splints available on the market	110 (79.1)	28 (70.0)	35 (77.8)	0.28
	Not in use	5 (3.6)	5 (12.5)	2 (4.4)	
	Homemade splint	24 (17.3)	7 (17.5)	8 (17.8)	

Abbreviations: IQR, interquartile range

Table 5.

Frequency and procedure of arterial catheter insertion

Questions	Responses	n (%)
Fixation methods for arterial catheter	Staple	1 (0.4)
	Exclusive transparent occlusive dressing[a]	126 (56.3)
	A transparent occlusive dressing	88 (39.3)
	Other	9 (4.0)
Frequency of replacement of saline solution for pressurized bags	Daily	16 (7.1)
	No rules	60 (26.8)
	Every 3 days	115 (51.3)
	Every 2 days	17 (7.6)
	Every 1 week	16 (7.1)
Do you add heparin to the saline in the pressurized bag? If so, what is the dosage per 500 mL of normal saline?	0.5 mL（500 U）	3 (1.3)
	1 mL（1000 U）	69 (30.8)
	2 mL（2000 U）	77 (34.4)
	3 mL（3000 U）	13 (5.8)
	5 mL（5000 U）	27 (12.1)
	No heparin used	19 (8.5)

	Other	16 (7.1)
Frequency of dressing change on the insertion site	Daily	7 (3.1)
	No rules	129 (57.6)
	Every 3 days	21 (9.4)
	Every 2 days	2 (0.9)
	Every 1 week	65 (29.0)
Frequency of pressure tubbing replacement	Every 1 week	47 (21.0)
	Every 2 days	1 (0.4)
	Every 3 days	57 (25.4)
	None	43 (19.2)
	No rule	76 (33.6)
Routine replacement of the arterial catheter	Yes	10 (4.5)
Frequency of replace the arterial catheter	1 to 2 weeks	34 (15.2)
	3 to 4 weeks	5 (2.2)
	Within 3 days	2 (0.9)
	4 to 7 days	12 (5.4)
	No rules	142 (63.4)
	None	29 (12.9)
Splint fixation routinely used?	Yes	92 (41.1)
Frequency of splint fixation for wrist	0-25%	49 (21.9)
	26-50%	35 (15.6)
	51-75%	41 (18.3)
	76-100%	91 (40.6)
	None	8 (3.6)
	Physician's orders	5 (2.2)

Judgment of using splint fixation	Based on nursing service standards	21 (9.4)
	Decided in conference	12 (5.4)
	Decided by individual nurse	138 (61.6)
	No rule	48 (21.4)
Type of splint	Special splints available on the market	173 (77.2)
	Not in use	12 (5.4)
	Homemade splint	39 (17.4)

Abbreviations: Arterial catheter inserted in the radial artery

Note[a]: the exclusive transparent occlusive dressing is an all-in-one dressing designed to minimize the risk of catheter migration and dislodgement commonly used in Japanese acute care units.

DISCUSSION

In this study, we investigated the frequency, timing of insertion, and management of peripheral arterial catheters in acute care units. In summary, approximately three of the four responders reported that arterial catheter insertion was not routinely performed; however, respondents carried out insertion of the arterial catheter within 24 h in most patients. Approximately half of the respondents did not change the pressurized saline solution routinely, and most units did not routinely replace the arterial line. Many respondents reported adding heparin to the arterial catheterization in a pressurized bag. The heparin dose varied. Approximately two of the five units routinely use wrist splints. The actual practice has not been well investigated; however, arterial catheters were routinely used in acute care units. Thus, this study highlights the actual routine technique used in acute care units.

Based on our findings, arterial lines may be common in the ICU. According to the Japanese Intensive Care Patient Database, from 2016 to 2019, 89.7% of patients had an arterial catheter in the ICU (Irie et al., 2020). In contrast, in a U.S. survey conducted in 2006, 36.4% of ICU patients received an arterial catheter (Gershengorn et al., 2014). This difference may be explained by several factors. Firstly, many patients in Japan enter the ICU for monitoring purposes after surgery in Japan (Sirio et al., 2002) and may have already undergone arterial catheter insertion.

Secondly, in Japan, the criterion for reimbursement of ICU costs is not the severity of the patient's illness, but the various types of patient monitoring

performed. Monitoring includes arterial pressure monitoring, and invasive arterial pressure monitoring is important for receiving ICU cost reimbursement. This specific policy was initiated in 2014 (Ohbe et al., 2021). According to a study that examined the rate of invasive blood pressure monitoring before and after the policy, invasive blood pressure monitoring with an arterial catheter was increased (Ohbe et al., 2021). Thus, we assumed that invasive blood pressure monitoring via arterial catheters tends to be unnecessary under this policy.

Most units used heparin for flush fluids. The participants reported that most facilities used 1000–2000 units of heparin per 500 mL of normal saline. Heparin sodium is a blood coagulation inhibitor that increases the risk of bleeding. It also increases the risk of heparin-induced thrombocytopenia (HIT). In a study of 748 patients admitted to the ICU, 32 patients (0.39%) had possible HIT; of these, 19 patients (7%) also had possible HIT, even if the dose was less than 1000 units/day (Verma et al., 2003). Importantly, it is not always necessary to add heparin to prevent obstruction of the arterial catheter. Further, evidence has shown that heparinized solutions do not decrease obstruction of the arterial catheter in RCTs (Del Cotillo et al., 2008; Tamura et al., 2021).

The guidelines (O'Grady et al., 2011) recommend changing pressure tubes every 96 h, but we found that about half of the units had no replacement policy or no regular change schedule. One possible reason may be that most patients (e.g., patients who underwent elective surgery) used the arterial line continuously for a few days. The literature (O'Grady et al., 2011, Luskin et al., 1986; Mermel et al., 1991), reported an increased contamination rate by fluid through the transducer when the transducer and tubing were used continuously for more than 8 days. This was compared to a routine where the transducer was changed every 2 and 4 days. The system used in the above-mentioned study was likely to be more susceptible to contamination than the current device system, in which the transducer is closer to the blood collection port, and the transducer and blood sampling port are farther apart. In addition, the old system was an open system with three-way stopcocks, which would be more susceptible to contamination than the currently available closed system (Oto et al., 2012). The non-inferiority trial suggested that changing the arterial catheter infusion sets every 4 days is not inferior to changing them every 7 days for the incidence of catheter-related bloodstream infections (Rickard et al., 2021). It is expected that these recommendations will change in the future.

More than 40% of the respondents reported routinely using splints to fix the wrist. This finding did not indicate that most units never used the splint; however, nurses often made the judgment to use it on a case-by-case basis. In the subgroup analysis, the frequency of ICU admission without routine splint use varied. Some units tended to use splints, and some tended to avoid them. However, this variance

could not be explained. It is unlikely that physicians' preferences were associated with splint use. The historical culture regarding the use of splints or availability of splints may be associated with the variance reported. In this study, we did not determine whether a splint should be used to fix the wrist. Some complications, including nervous system injury, have already been reported in case studies (Chowet et al., 2004; Watanabe et al., 2017). Therefore, further studies are required.

To the best of our knowledge, this is the first survey to describe the practice of arterial catheter management in Japanese acute care settings. However, the present study has some limitations. First, as our survey was conducted via the web, a selection bias may exist. However, considering the proportion of university hospitals and the wide variety of areas in Japan, this bias did not significantly affect our results. Second, most responses that were reported in the questionnaire were participants' perceptions about their unit's practice. Third, we included the earliest response in our analysis for duplicate responses from the same facility, however, it is unclear if this is the most appropriate respondent or not.

Our findings suggest a high probability of arterial catheter use in Japanese acute care wards, which may imply a large number of cases of unnecessary use of an arterial catheter. It is inappropriate to determine the need for ICU admission based on the presence or absence of monitoring. We believe that the decision to insert the arterial catheter should be based solely on clinical indications. Additionally, it may be time to rethink whether heparin should be added during arterial catheterization because a systematic review suggested that there was not sufficient evidence that heparin facilitated arterial catheter patency (Robertson-Malt et al., 2014) and may increase the likelihood of HIT (East et al., 2018). The routine use of splints requires careful observation to avoid complications such as median nerve damage (Chowet et al., 2004), the efficacy of splinting does not seem to be well supported.

This study was a survey of nurses who reported their observations, which is not necessarily what occurs in actual practice, nor necessarily in-line with the latest practice guidelines. In particular, the frequency of arterial catheter insertion and splints was influenced by the participant's subjectivity. To avoid information bias, a one-point prevalence study is required. Additionally, the effectiveness of splints should be examined using a randomized controlled trial methodology or by comparing acute care units that routinely use splints with those that do not.

CONCLUSIONS

In this study, we examined the commonly used radial arterial peripheral catheter in acute care wards in Japan. Upon analysis of the survey responses, we recommend that the use of heparin be reconsidered as a flush fluid. A closer look at current

policy and the implementation of unnecessary arterial catheters should be undertaken. Finally, the routine use of splints requires careful observation to avoid complications, and the efficacy of wrist splints for catheter administration does not appear to be widely supported.

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