Original Article

Prevalence and Prevention of Unplanned Removal of Tubes and Catheters among Hospitalized Patients

Mayumi Kato, PhD, RN
Professor, Division of Health Sciences, Graduate School of Medical Sciences, National University Corporation Kanazawa University, Ishikawa, Japan

Wahyuni Fauziah, MHS, RN
Doctoral student, Gerontological Rehabilitation Nursing Department, Division of Health Sciences, Graduate School of Medical Sciences, National University Corporation Kanazawa University, Ishikawa, Japan
Dr. H Koesnadi Regional Hospital, Bondowoso, East Java, Indonesia

Tomoko Yamashita, RN
Kanazawa Cardiovascular Hospital, Ishikawa, Japan

Sumiko Nishijima, RN
Medical Safety Manager, Kanazawa Cardiovascular Hospital, Ishikawa, Japan

Mitsuko Kima, RN
Kanazawa Cardiovascular Hospital, Ishikawa, Japan

Michika Iida, MHS, RN
Doctoral student, Gerontological Rehabilitation Nursing Department, Division of Health Sciences, Graduate School of Medical Sciences, National University Corporation Kanazawa University, Ishikawa, Japan

Huong Thi Thu Pham, PhD, RN
Adult Nursing Department, Nursing Faculty Haiphong University of Medicine and Pharmacy, Haiphong, Vietnam

Correspondence: Wahyuni Fauziah, MHS, RN, Doctoral student, Gerontological Rehabilitation Nursing Department, Division of Health Sciences, Graduate School of Medical Sciences, National University Corporation Kanazawa University, Ishikawa, Japan. E-mail: wahyuni.fauziah83@yahoo.com

Abstract

Objective: To identify the prevalence of unplanned removal of catheters among hospitalized patients and accumulate nurses' opinions regarding the causes of catheter removal caused by patients' activities.
Methods: A retrospective study including patients with tube and catheter was conducted for a year under the surveillance of nurses. A total of 4 wards and 1 intensive care unit reported 427 incidents. The quantitative and qualitative data were analyzed by Spearman test and text mining using KH Coder, respectively.
Results: Overall, 66.7% (40 out of 60) of incidents and accident reports of unplanned removal of tube and catheter were observed. The incident rate of unplanned removal was 0.67 per 1000 patient. However, a correlation among variables: age, cognitive decline, language disorder, and occurrence time was also observed. Additionally, variable delirium and adverse effects of anesthesia was also correlated.
Conclusions: Although various methods were already implemented, unplanned removal of tubes and catheters still prevailed. Strategies to manage delirium including declining cognitive and enhancing observation in nighttime especially in older patients who underwent surgery may reduce the incident of unplanned removal of tubes and catheters.

Keywords: unplanned removal, tubes, catheters, older patient, retrospective study

Introduction

Management of insertion tube and catheter for hospitalized patients is needed to provide effective treatment and to avoid negative complications. World Health Organization (2007) states that tubes and catheters are part of the main aspects of providing daily health care for the administration of medicines and fluids to patients. In hospital settings, approximately one-quarter of patients had a peripheral intravenous tubes and more than a half of the patients had urinary catheters and endotracheal tubes (Kuriyama et al., 2017; Metheny, Hinyard, & Mohammed, 2018; Wong, Cooper, Brown, Boyd, & Levinson, 2018).

Nosocomial infection and unplanned removal lead to complications that occur in patients who use tubes and catheters (Lorente, Huidobro, Martín, Jiménez, & Mora, 2004). Patients who undergo unplanned removal of tubes and catheters are more prone to get medical complications such as bleeding, pulmonary aspiration, tube dislodgement, and so on. However, only few studies have inspected the prevalence and prevention of unplanned removal of tubes and catheters. On the other hand, the prevalence and prevention of nosocomial infections associated with the use of tubes and catheters in hospitalized patients has been extensively studied.

Unplanned removal of tubes and catheters is life-threatening; this is because unexpected removal will not only interrupt treatment and lessen physical ability but also lengthen hospitalization. The median rate of unplanned medical device removal in critical care units in North West England between 2011 and 2016 was 0.7 (interquartile range, 0.4-2.2) per 1000 patient days per unit (Balmforth & Thomas, 2019). Improper positioning and self-retraction caused by patients' activities are one of the causes of unplanned removal of catheters. Hayashi & Nakano (2012) reported 11,819 cases related to tube and catheter accidents in 550 hospitals. Amongst 743 (52.7%) were unplanned removal of tubes and catheters. Diverse patient conditions that used catheters in acute or chronic phases raised a challenge for nursing care. The effectiveness and efficiency of the nurse's intervention may get influenced by the unplanned removal of tubes and catheters.

Various methods are used by nurses to prevent unplanned removal of catheters, such as catheter placement according to standard safety guidelines, intensive observation of the patient and the use of additional preventive measure including restraints (Leslie, Sajjad, & Sharma. 2020). Nurses often face dilemma such as decision to carry out restraints, which generally used to ensure the safety of patients. Restraints do not ensure safety, some reports suggest that "restraints may increase patient agitation and result in significant side effects including serious injury and even death" (Langley, Schmollgruber, & Egan, 2011). However, even after applying those methods, unplanned removal of catheters incidents are still operative.

In the intensive care units (ICU) of three European countries, unplanned Central Venous Catheters (CVC) removal in two study groups were 2% and 6%, respectively (Karpanen, T.J., Casey, A.L., Whitehouse, T. et al., 2019). Nurses' clinical judgment plays a crucial role in early identification of risk on unplanned removal of tubes and catheters. Daniels & Nicoll (2011) described that the nurse has more access as the first person to recognize the fact that a patient needs particular attention for early treatment.

Objective: This study aimed to identify the prevalence of unplanned removal of catheters among hospitalized patients and to investigate nurses' clinical judgment about the causes of catheter removal caused due to patients' activities.

Methods

Study design: Retrospective design study was performed for a year from September 2014 to October 2015.

Participants and procedure: The study was conducted at a hospital that has heart surgery specifications in central western, Japan with a capacity of 200 beds. The patients with tube and catheter were recruited and observed by nurses. A total of 4 wards and 1 intensive care unit reported 427 incidents for one year. Sixty cases were related to tubes and catheters and then forty cases were inspected as unplanned removal.

The study data were collected from incident and accident records of the patients from the electronic clinical documentation. Patients demographic characteristics such as use of preventive measures, characteristics of tubes and catheter including the level of impact, incidents, and identification of the cause by the nurses related to unplanned removal were examined.

Data analysis: Quantitative data was analyzed by Spearman test, which was performed on IBM SPSS Statistics version 23 to obtain the strength and direction of monotonic association between variables. The Qualitative data was analyzed by text mining using KH Coder, a free and open source software program created by Koichi Higuchi at Ritsumeikan University, Kyoto, Japan (Higuchi, 2012). Text mining is a computerized process of extracting information from collected discussions and has been widely used in health science research to improve the consistency of qualitative data analysis (Goto et al., 2014).

Ethical consideration: This study was approved by the Kanazawa University Medical ethics committee (permission number: 706).

Results

Prevalence: A total of 427 incident reports were reviewed. Overall, 66.7% (40 out of 60) of incidents and accidents reports were related to unexpected removal of tube and catheter. The incident rate of unplanned removal was 0.67 per 1000 patient days.

Patients characteristics: The patient's characteristics are shown in Table 1, from which it can be perceived that there were 36 (90%) patients above 60 age years old and 26 (65%) male patients. Patients were hospitalized with various conditions; 11 (27.5%) patients were post operation and 14 (35%) patients experience cognitive decline including dementia. Furthermore, there were 13 (32.5%) patients used of additional preventive measures including restraint.

Characteristics of tubes and catheters: Table 2 described removed catheters including 19 (47.5%) intravenous tubes, 6 (15%) nasogastric tubes, and 4 (10%) atrial tubes. Categories of causes of removal were presented in Table 3, as follows: 1) unadapted to environmental change 2) agitation linked with physical distress, 3) emotional distress associated with limited activities, 4) delirium linked with treatments, and 5) uncontrolled physical movements.

Nursing interventions: Two major interventions that have been carried out by nurses after unplanned tube and catheter removal. First, tube and catheter were inserted at sites where the tube and catheter route shall not be seen by the patient. Second, the patients were observed and assisted at frequent interval such as toileting assistance, changing diapers, and other needs. In addition, most of the nurses had a work experience of 5 years to 26 years.

Correlation among variables related unplanned removal of tubes and catheters: Table 4 shows that there was a correlation between age (r_s= .347), cognitive decline (r_s= .444), language disorder (r_s= .271), and occurrence time. Furthermore, delirium and adverse effects of anesthesia were also correlated (r_s= .348).

Table 1 Patient characteristics

Variables			Number (n)	Percentage (%)
Age	50-59		4	10.0
	60-69		4	10.0
	70-79		8	20.0
	80-89		17	42.5
	≥90		7	17.5
Gender	Male		26	65.0
	Female		14	35.0
Disease	Heart disease		29	72.5
	Cerebrovascular accident		5	12.5
	Pneumonia		3	7.5
	Atherosclerosis		2	5.0
	Stomach ulcers		1	2.5
Condition	Post-operation including delirium			
		Yes	11	27.5
		No	29	72.5

	Cognitive decline including dementia			
		Yes	14	35.0
		No	26	65.0
	Bedrest			
		Yes	18	45.0
		No	22	55.0
Use of additional preventive measures including restraint		Yes	13	32.5
		No	27	67.5
	Type of additional preventive measures:			
	Cover for protect the insertion of intravenous catheter		2	5.0
	Cover for protect the insertion of intravenous catheter and restraint		2	5.0
	Restraint		8	20.0
	Other		1	2.5

Table 2 Characteristics of tubes and catheters in relation to unplanned removal

Variables		Number (n)	Percentage (%)
Type of tubes and catheters	Intravenous tubes	19	47.5
	Nasogastric tubes	6	15.0
	Atrial tubes	4	10.0
	Negative pressure tubes	4	10.0
	Central venous catheters	3	7.5
	Endotracheal tubes	2	5.0
	Urinary catheters	2	5.0
Occurrence time	Midnight	16	40.0
	Day shift	10	25.0
	Evening	14	35.0
Level of impact on patients	Temporary treatment is required due to an accident	14	35.0
	Temporary observation or test is required to confirm safety, but no treatment is required	6	15.0
	No continuous observation and treatment are required due to accident	20	50.0

Table 3 Categories of causes of unplanned tubes and catheters removal identified by nurses

Name of categories	Causes
Unadapted to environmental change	Being transferred to a new ward or in the darkness of night
Agitation associated with physical distress	Wound pain, uncomfortable feelings after excretion in a diaper
Emotional distress associated with limited activities	Distress by physical restraint or limitation of activities on the bed for treatment
Delirium associated with treatments	Having serenity agents and or as peripheral symptoms of dementia
Uncontrolled physical movement	Due to contracture in the upper extremities, tremor, or continuing cough

Table 4 Correlation among variables related unplanned removal of tubes and catheters

	Occurrence time	Age	Walking disorder	Cognitive decline including dementia	Bedrest	Language disorder	Delirium	Adverse effect of medication	Adverse effect of anesthesia
Occurrence time	1.000	.347†	-.023	.444††	.095	.271†	-.066	-.230	-.167
Age		1.000	-.318†	.224	-.114	.083	.046	-.321†	-.056
Walking disorder			1.000	.266†	-.277†	-.061	-.174	-.108	-.061
Cognitive decline including dementia				1.000	-.348†	-.145	-.152	-.258	-.145
Bedrest					1.000	.218	-.062	.388††	.218
Language disorder						1.000	-.074	-.046	-.026
Delirium							1.000	.119	.348†
Adverse effect of medication								1.000	.562††
Adverse effect of anesthesia									1.000

Notes: A spearman test was used to analyzed the data; †=p< .05; ††=p< .01

Discussion

The incidence rate of unplanned removal of tubes and catheters was 0.67 per 1000 patients' days. This study finding is quite similar with other findings (0.7 per 1000 patients' days) in the intensive care units (Balmforth & Thomas, 2019). Our study was conducted in 4 wards and 1 ICU; this indicated that unplanned removal tubes and catheters are still occurring even in non-ICU setting. We found many causes of unplanned removal tubes and catheters based on nurse identification. Unadapted to environmental change, agitations related with physical distress, emotional distress associated with limited activities, delirium associated with treatments, and uncontrolled physical movement were the main causes for the unintentional removal of tubes and catheters.

Majority of the patients (90%) who experienced unplanned removal of tubes and catheters in this study belonged to an older age group of which one-third of them had reduced cognition including dementia. Most patients with dementia experience behavioral and psychological symptoms of dementia (BPSD) such as, anxiety, delusions, hallucinations, sleep cycle disorders, aggression, and agitation (Tible, Riese, Savaskan, & Von Gunten, 2017).

Older people with decline cognition who were admitted in hospital were more prone to negative outcomes such as delirium (Fogg, Griffiths, Meredith, & Bridges, 2018). In addition, we found that the older adult patients have language disorders making it difficult for them to communicate for their needs. This indicated that we should provide more attention to the older ones with dementia as they are more vulnerable to face unplanned removal of tubes and catheters. They need continuous support from healthcare professionals including nurse during admission to the hospital (Dyrstad, Laugaland, & Storm, 2015). Nurses could assist older patients in their first-time admission hospital to adapt with their transitional care from home or community setting to the hospital setting.

More than a quarter of patients who underwent surgery and delirium experienced an unplanned removal of tubes and catheters. Delirium caused by the side effects of anesthesia after surgery often occurs and cannot be avoided particularly for older adult patients. Delirium is commonly experienced by older patients in the hospital and patients with long-term care facilities particularly for those in ICU or undergoing surgery (Collier, 2012; Kalish, Gillham, & Unwin, 2014). The side effect of anesthesia may occur shortly or take longer. However, older patients are more likely to experience long-term side effects (Strøm, Rasmussen, & Sieber, 2014). In Japan, most patients undergoing surgery in the morning and afternoon (Ishiyama et al., 2019), the side effect of anesthesia such as delirium may remain among older patients in the evening and night shift. Approximately 75% of the unplanned removal of tubes and catheters occurred in evening and midnight. Enhancing observation in night shift and strategies to manage delirium on patients after they underwent surgery may reduce the incidents of unplanned removal of tubes and catheters.

In this study, we measured the level of impact related to unplanned removal of tubes and catheters. We found that one third of patients (35%) required temporary treatment due to unplanned removal of tubes and catheters. More than a half of intravenous tube and nasogastric tubes were removed accidentally. Whereas a quarter patient removed accidentally the atrial tube, negative pressure tube, and endotracheal tube. The consequences depended on the type of tubes and catheter that were removed. Leslie et al (2020) reported that unplanned removal of foley catheter can cause urologic complications such as urethral strictures, incomplete bladder emptying and hematuria. Furthermore, some incidents of unplanned removal device: tracheostomy tube (2 episodes) or endotracheal tube (6 episodes) and central catheter (3 episodes), were related to severe consequence of cardiac arrest (Balmforth & Thomas, 2019).

Preventing unplanned removal of tubes and catheters is not only to increase the effectiveness treatment but also to prevent life-threatening incident among patients. In this study various preventive interventions were implemented by nurses depending on the patient's condition. However, unplanned removal of tube and catheter are still happening. The development of additional preventive measures based on types of tubes and catheters particularly insertion of intravenous and nasogastric tube should be considered.

Limitations: The limitations of this study are it is a single centered, retrospective study, therefore; the possibility of selection bias could not be fully excluded.

Conclusion: The incidence rate of unplanned removal of tubes and catheters was 0.67 per 1000 patients' days. Majority of the patients belonged to the old-age group. Even though, various methods were already implemented to prevent it, unplanned removal of tubes and catheters still prevailed. Strategies to manage delirium and enhance observation in nighttime especially in older adult patient with decline cognition may reduce the incident of unplanned removal of tubes and catheters. Further clinical studies are needed to evaluate and develop additional preventive measures on preventing unplanned removal of tubes and catheters including minimal use of restraint.

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