A Comparative Study of Ampoule Breaking and Resultant Injury among Registered Nurses

Natthacha Chiannilkulchai, Siranee Kejkornkaew*

Abstract : Breaking ampoules can cause serious injuries and a lack of self-confidence among nurses. These injuries can cause nurses to lose working hours and risk their exposure to blood-borne disease. To prevent injury, ampoule openers are recommended. However, such openers may not be available, so the most standard procedure is to open ampoules manually, requiring skill to do so safely. This comparative study evaluated manual methods for breaking ampoules and resultant injury, length of sharp edge, and identified risk factors for ampoule injury among 56 registered nurses. The participants broke ampoules using six methods with two ampoule sizes (2 ml and 10 ml). Each method used material such as a gauze pad, cotton ball or syringe bag and one hand breaking direction (breaking the ampoule tip in an outward or inward direction). The incidence of injuries, length of the sharp edge of the ampoule, and factors predicting injuries were measured.

In total, 73 of 672 gloves worn by participants showed damage (glove tears). Breaking an ampoule using a syringe bag and an outward direction showed the lowest incidence of injuries and the shortest length of the sharp edge. Significant predictors of ampoule injury were the breaking method, area of nursing specialty, ampoule size, breaking direction, and length of the sharp edges. These findings suggest that breaking an ampoule in an outward direction and using material wrapping entire the ampoule neck can protect against injury.

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Introduction

Breaking ampoules is the most common cause of sharps injuries that are defined as occupational injuries among healthcare workers (HCWs), especially nurses.[1-3] Ampoule injury among nurses accounts for 20.8%-32.5% of sharps injuries and is classified as a high-risk event.[4, 5] Broken edges of ampoules tend to be sharp, and often cause severe cuts on nurses' fingers that can restrict nurses in their work and lessen their self-confidence.[5, 6] These injuries may be entry points for microorganisms and represent the main factor to expose workers to blood-borne diseases.[5] The risk of infection includes hepatitis B and C viruses, and

human immunodeficiency virus.[7, 8] Although the risk of infection, is known, nurses are not paying attention to potential injury. This is because they perceive an ampoule injury as a clean injury, with a low-risk of infection, and afterward, they continue their work.[7, 9] The Centers for Disease Control and Prevention (CDC) estimate that 62%-88% of sharps injuries can be prevented by using safety devices.[10] So to prevent ampoule injury, ampoule openers are recommended for use.

In developing countries, especially Thailand, the ampoule openers are rarely used because of inadequate budgets for safety devices, and the use of such devices is limited to the protection of expensive solutions.[11, 12] Various ampoule openers do not fit different sizes of ampoules ranging from 1-30 ml, so they are perceived as not being practical and time-consuming in a clinical setting. Furthermore, there is no clear evidence available to nurses about which types of multiple ampoule openers are appropriate for breaking ampoules to prevent nurses' injuries and promote patient safety regarding glass particle contamination. These days developed countries acknowledge that advanced management and technology are not enough to promote safe behaviors in the workplace.[6] To promote safety and prevent injury is an essential issue for nurses as well as for patients, and the typical procedure for opening ampoules in developing countries requires manual skills.

In clinical settings, the diversity of nursing practice means nurses must think carefully about ways of enhancing their clinical skills.[13] Sharps injury among nurses is a result of a lack of awareness, lack of training, and outdated safety protocols.[14] Reporting ampoule injuries and factors associated with these is a crucial protocol to decrease the risk of sharps injury in the future. Although many published studies have reported that breaking ampoules presents a risk of injury among nurses, limited data are available regarding methods for breaking ampoules that minimize the risk for injury. Therefore, this study evaluated methods of breaking ampoules in comparison to the incidence of ampoule injuries and length of sharp edges, and identified risk factors influencing the occurrence of ampoule injuries in registered nurses (RNs).

Literature Review

The literature describes different methods used for breaking ampoules, including various ampoule breaking devices and manual methods. Several ampoule openers have been developed to promote safety for HCWs, including an ampoule snapper[15], an ampoule opener[16], the barrel of a syringe[17], and an ampoule breaker.[18] These devices have benefits and limitations depending upon their designs and user requirements. However, there is no consensus about recommending which types of ampoule openers are appropriate to prevent sharp injury among nurses and protect patients from glass particle contamination.

For manual methods, HCWs try to protect themselves from ampoule injuries by wrapping a piece of material (cotton ball, gauze pad, or syringe bag) around the neck when breaking a glass ampoule.[19] Although most glass ampoules are either pre-scored around the neck or dotted at the neck with markers to indicate where they should be broken, it is difficult to break an ampoule cleanly. The general directions for breaking ampoules in both laboratory and clinical settings indicate that the ampoule tip can be broken inwardly or outwardly.[20, 21] For the inward direction, one hand holds the bottom part below the pre-scored or dotted marker in the back, and the other hand holds the tip above the marker. Then, both thumbs are pressed against the narrow tip to break it inwardly.[20] For the outward direction, on the dotted marker in the front, one thumb is pressed against the narrow tip to break it away from the body.[21] Ampoules used in clinical settings include 1, 2, 5, 10, and 20 ml sizes; however, 2 and 10 ml are the most common sizes.[22] Various studies have indicated that breaking ampoules can cause injury.[14, 23, 24] The main cause of most

injuries was reported to be behavioural, including practical skills and improper force to crush glass ampoule.[1, 25] A few studies evaluated methods of open ampoules between hand and ampoule opener devices, the result showed that ampoule opener reduced the injury.[25] However, breaking ampoule by hand is a practical method in a clinical setting and there are limited studies evaluating which hand methods are appropriate for HCWs to break ampoules safely.

Among occupational injuries, in nursing staffs with lower working experience have more sharps injury.[26] A previous study found that different areas of working practice had a different incidence of sharps injuries; for example, nurses working in emergency departments have to work fast and may have increased errors and mistakes.[6] A risk factor for sharps injury includes breaking a glass ampoule that then has spikes.[27] Limited studies are evaluating the time taken to break an ampoule and causing a sharps injury. However, Zhu indicated that breaking an ampoule with a free hand in a quick and harmful manner easily causes iatrogenic injury.[28] Other studies also reported that time constraint was a risk factor that increases the incidence of sharps and needle injuries.[7, 29] Therefore, in this study the researchers included the time taken to break an ampoule as a factor associated with the occurrence of ampoule injury. Included also was the RN's work experience, area of nursing specialty, break direction, and length of sharp edges from the review as the risk factors to predict the occurrence of ampoule injury.

Methods

Design:

This study employed a comparative research design.

Sample and setting:

Participants were RNs at a university hospital, Thailand. The sample size was analyzed based on the correlation sample size described by Browner, Newman, and Hulley.[30] Entering all values into their formula indicated a sample size of 47 was needed, but given an expected attrition rate of 10%, the required sample size was then deemed to be 52 participants. The principal researcher informed the head nurses to gain their cooperation in recruiting volunteer nurses for the project. Fifty-eight nurses were purposive contacted. The inclusion criteria were working at the hospital and having the prior clinical experience of at least two years. Two nurses who had less than two years of experience were excluded. Therefore, 56 RNs participated in this study. It was more than estimated sample size; however, the study for testing the association between risk factors and the dichotomous outcome may include the possibility of refusal up to 20% (56.4).[31]

Ethical considerations:

The research was approved by the Committee on Human Rights Related to Research Involving Human Subjects, Mahidol University (IRB no. MURA2016/444). Each participant received essential information about the study purpose, research activities, study outcomes, and the option to withdraw from the study at any time without affecting their work. All participants provided written informed consent. A principal concern for the researchers was participant safety. First aid care was available to all participants in case of injury. The researchers closely observed ampoule breaking methods and results.

Instrument:

Instrument design was performed in two steps. The first step was determining the items of content identified by a literature review on the topic of factors associated with ampoule breaking injury. The second step was the validation of the content by the three experts who had experience in clinical practice. The developed instrument, the Ampoule Breaking Record, consists of three sections:

Section A contains five questions and collects participants' information on age, education, work

experience (time working as a nurse), area of nursing specialty (current working area), and skill in terms of breaking direction (outward direction refers to dot marker in the front of the ampoule and breaking the ampoule tip away from the body and inward direction refers to dot marker at the back of the ampoule and breaking the tip towards the body)

Section B contains two questions designed to collect factors associated with the occurrence of ampoule injury. This part consists of six items about breaking methods for a 2 ml ampoule and six items of breaking methods for a 10 ml ampoule. Methods 1 and 2 use a gauze pad; methods 3 and 4 a cotton ball; and methods 5 and 6 a syringe bag. An outward hand breaking direction is employed for methods 1, 3, and 5, and an inward direction for methods 2, 4, and 6. Each item of each method contains two questions 1) the time taken to break the ampoule (the time record by one of the researchers, starts from cleaning the ampoule with alcohol to finish with ampoule tip snipping off, scoring in second) and 2) the length of the sharp edge (recorded by two scientists, measures from flat edge to the highest point of a sharp edge scoring in millimeter; mm).

Section C is composed of two questions and focuses on the occurrence of ampoule injury. Each item of each method contains the position of glove tearing and the number of glass particle contaminations. The position of glove tearing divided to the left side and right side. The injury scoring is done by counting the torn glove at the left side or right side or both sides and scored as one occurrence of ampoule injury (occur/none occur). The number of glass particle contaminations are recorded for further analysis.

The Ampoule Breaking Record was sent to three experts to validate the content. The instrument was considered appropriate and one expert suggested divided Section B and Section C for 2 ml and 10 ml ampoules so the researchers did this. After validation, the instrument was then used in the study.

Data collection:

The data were collected from the participants outside of work hours in the nursing laboratory room from October to December 2016. After informed consent was obtained, the researchers explained the data collection procedure to all participants and requested them to complete Section A of the instrument. The process started with a random selection of breaking methods. Ampoule breaking methods were numbered from 1 to 6. Participants chose a number six times; those six numbers specified the order in which participants were to perform the ampoule breaking methods. Participants were reminded to select and put a pair of gloves (Latex glove, nonsterile) which fitted for their hands before starting to break ampoules for each method. This study followed a safety policy that recommended the use of gloves because they resulted in a significant reduction in the incidence of percutaneous injuries and lower incidence of blood-borne contamination.[32] However, in reality, nurses in our hospital clinical settings usually do not use gloves for preparing medications from glass ampoules, except for preparing chemotherapy medication, similar to what happens in developing countries.[19]

Before starting to break ampoule, the participants were assigned to read the procedure of each breaking method. In each breaking method, one researcher recorded the time taken to break the ampoule, while the other researcher prepared materials for the process of breaking ampoule to each participant. The data were collected from participants one by one. Each participant completed six different methods in two ampoule sizes (2 ml and 10 ml sterile water ampoule). After breaking an ampoule in each method, participants rested for 5 minutes. The time to complete the assignment for each participant used 1.5-2 hours. Broken ampoules and all gloves were sent to be examined and measured by two scientists. Broken ampoules were sealed in plastic containers

and used to measure the length of a sharp edge in millimeters (mm) and the scientists completed in Section B of the instrument. The gloves from each breaking method were collected in plastic bags (left side and right side) and also sent to scientists to examine for glove tearing and to complete Section C. If a participant had an injury from breaking an ampoule, the process was stopped and not restarted until they had received first aid. After the administration of first aid, the participant was instructed to rest for 30 minutes, or data collection for that sample was stopped.

Data analysis:

Data were analyzed with SPSS version 21. Descriptive statistics (including frequency, percentage, mean, and standard deviation) used to describe demographic data, the incidence of injuries, and length of sharp edges. Univariate analysis was employed to find the associations between the predicting factors (age, education, breaking method, area of nursing specialty, ampoule size, breaking direction, working experience, length of sharp edge and time taken to break an ampoule) and ampoule injury (injury or no injury). Factors with p-values < .25 were used to analyze a logistic regression model.[33] Binary logistic regression was performed to examine factors associated with the risk of ampoule injury using Stata version 13. The reference in each group of predicting factors used the lowest percentage of ampoule injury or chose categories with the same relationship to the event of interest.[34]

Results

Participants' characteristics

Participants were aged 23-44 years, with a mean age of 28.80 ± 4.65 years. About 89.3% of participants had undergraduate degrees, and 42.9% had work experience of more than five years. The majority of participants listed their specialty as medical nursing (25.0%), and 10.7% worked in the emergency department. Participants were equally skillful in terms of ampoule breaking direction (inward and outward), as shown in **Table 1**.

Breaking methods

In total, there were 73 injuries (glove tears), giving an incidence rate of 10.9%. Three of 73 participants had minor injuries (superficial skin injury with bleeding) during breaking the ampoules and took a rest for 30 minutes. After receiving first aid, they insisted on continuing to break ampoules as usual, which they do in a clinical setting. Method 4 had the highest percentage of injuries (20.5%) and method 5 had the lowest percentage of injuries (3.6%). Breaking ampoules with methods 2 (14.3%), 4 (20.5%), and 6 (8%) showed higher percentages of injuries than methods 1 (5.4%), 3 (13.4%), and 5 (3.6%), as presented in **Table 2**.

The mean length of sharp edges after breaking an ampoule using method 4 was the longest (1.99 ± 1.36 mm), whereas method 5 had the shortest length of the sharp edge (1.10 ± 0.89 mm). Breaking ampoules with methods 2, 4, and 6 showed longer sharp edges than methods 1, 3, and 5 **(Table 2)**. The length of sharp edges from breaking ampoules using all six methods is presented in **Figure 1**.

Ampoule size

The incidence of injuries using 10 ml ampoules (15.5%) was higher than that for 2 ml ampoules (6.3%). The mean length of sharp edges in 10 ml ampoules was longer (1.89 ± 1.29 mm) than those in 2 ml ampoules (1.17 ± 0.94 mm), as shown in **Table 2**.

Factors associated with injury

From univariate analysis, the occurrence of injury was significantly associated with breaking method, ampoule size, breaking direction, and length of sharp edge (p-value < 0.05), whereas no significance was associated with age, education, work experience, area of nursing specialty, and time taken to break an

Table 1. Characteristics of participants (N = 56)

Characteristics	M ± SD	n	%
Age group, years	28.80 ± 4.65		
≤30		42	75.0
>30		14	25.0
Educational status			
Undergraduate degree		50	89.3
Graduate degree		6	10.7
Working experience, years	6.33 ± 4.33		
≤5 (2-5 years)	3.42 ± 1.09	32	57.1
>5 (6-21 years)	10.21± 3.97	24	42.9
Area of nursing specialty			
Medicine nursing		14	25.0
Surgery nursing		12	21.4
Pediatrics nursing		9	16.1
Obstetrics nursing		8	14.3
Emergency nursing		6	10.7
Other		7	12.5
Skill in term breaking direction			
Inward direction		28	50.0
Outward direction		28	50.0

M, mean; SD, standard deviation.

Table 2. Incidence of ampoule injuries and mean length of sharp edge affected by breaking method and ampoule size

Breaking method	Incidence of ampoule injuries			Length of sharp edge (N=672)		
	2 ml	10 ml	Total	2 ml	10 ml	Total
	n (%)	n (%)	n (%)	M ± SD	M ± SD	M ± SD
Method 1 (n=56)	1 (1.8)	5 (8.9)	6 (5.4)	0.92 ± 0.95	1.79 ± 1.18	1.35 ± 1.15
Method 2 (n=56)	5 (8.9)	11 (19.6)	16 (14.3)	1.44 ± 0.99	2.04 ± 1.16	1.74 ± 1.11
Method 3 (n=56)	4 (7.1)	11 (19.6)	15 (13.4)	1.20 ± 0.95	1.67 ± 1.29	1.43 ± 1.15
Method 4 (n=56)	8 (14.3)	15 (26.8)	23 (20.5)	1.62 ± 1.07	2.36 ± 1.52	1.99 ± 1.36
Method 5 (n=56)	1 (1.8)	3 (5.4)	4 (3.6)	0.75 ± 0.59	1.46 ± 0.99	1.10 ± 0.89
Method 6 (n=56)	2 (3.6)	7 (12.5)	9 (8.0)	1.08 ± 0.74	2.03 ± 1.40	1.55 ± 1.21
Total	21 (6.3)	52 (15.5)	73 (10.9)	1.17 ± 0.94	1.89 ± 1.29	1.53 ± 1.18

Methods: Method 1 = gauze pad and outward direction, Method 2 = gauze pad and inward direction, Method 3 = cotton ball and outward direction, Method 4 = cotton ball and inward direction, Method 5 = syringe bag and outward direction, Method 6 = syringe bag and inward direction.

Length of sharp edge: each method calculated from 56 broken ampoule in 2 ml ampoule, and 56 broken ampoule in 10 ml ampoule

M, mean; SD, standard deviation.

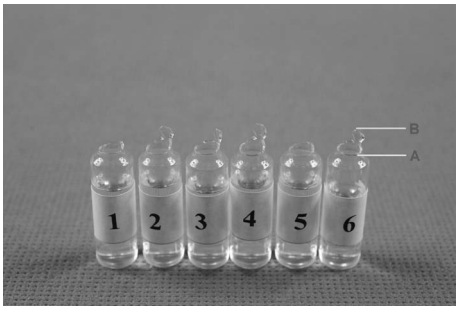

Figure 1. Length of sharp edge refers to the distance from the flat edge (A) to the highest point of sharp edge (B)

ampoule (p-value > 0.05). However, work experience and area of nursing specialty had p-values <0.25 and were retained in the logistic regression model.[29] When all predictors were considered together, they showed both significant and non-significant odds ratios (OR) for injury (LR χ^2 (15) = 152.65; p (>χ^2) < .001). The exposure variables (breaking method, ampoule size, breaking direction, area of nursing specialty, and length of sharp edge) showed a significant risk for ampoule injury (**Table 3**). Participants who broke an ampoule using method 4 had 3.34 times more injuries compared with participants who broke an ampoule using method 6. Also, participants who specialized in surgery and obstetrics nursing showed the incidence of injury 4.47 times and 5.90 times higher than those who specialized in pediatric nursing, respectively. Participants who had skillfully broken ampoules in an outward direction, and then broke an ampoule in an inward direction experienced ampoule injuries 22.35 times (46.78-24.43) more than those who had skillfully broken an ampoule using an inward direction and then in an outward direction. The result indicated that breaking an ampoule using an inward direction caused more ampoule injuries than an outward direction. The OR for the length of sharp edge indicated that for every 1 mm increased in sharp length, the risk for injury increased by approximately 1.41 times. The working experience was not significantly related to an OR for injury (p > .05).

Discussion

In our study, the breaking of 672 ampoules resulted in a torn glove 10.9% of the time. The occurrence of ampoule injuries in our study was lower than those in earlier studies that reported injuries in 43.3%-90.3% of nurses.[23, 25] The low incidence in this study might be related to the use of torn gloves as a proxy for injury and real-time collection that differed from the previous studies using self-report at least 6 months to collect data,[23, 25] they may not allow actual conclusion.[12] In developing countries, including Thailand, some medical centers lack the safety equipment and the incidence of sharp injuries remains increased.[29] However, although some medical centers have access to adequate safety equipment, sharps injuries still occur.[1] This situation reflects nurses' lack of awareness of the potential for sharps injury and ways to protect themselves the same as in other countries[9, 35] Therefore, appropriate organization of training that enhances safe practice is a more practical goal than supplying expensive equipment.[32]

In our study, the most common cause of ampoule injury was breaking ampoules using a cotton ball and in an inward direction (20.5%). In contrast breaking ampoule with using a syringe bag and in an outward direction (3.6%) had the lowest incidence of ampoule injuries. Therefore, the method of breaking an ampoule affected the incidence of ampoule injuries and the length of sharp edges.

Table 3. Main factors retained in the model to predict the occurrence of ampoule injury (N = 672 ampoule)

Factors	Injuries		OR (95% CI)	p-value
	Yes n (%)	No n (%)		
Methods				
Method 6 (n = 112)	9 (8.0)	103 (92.0)	Reference	-
Method 1 (n = 112)	6 (5.4)	106 (94.6)	0.95 (0.07-13.96)	.972
Method 2 (n = 112)	16 (14.3)	96 (85.7)	2.00 (0.76-5.26)	.161
Method 3 (n = 112)	15 (13.4)	97 (86.6)	3.19 (0.24-42.39)	.379
Method 4 (n = 112)	23 (20.5)	89 (79.5)	3.34 (1.29-8.66)	.013
Method 5 (n = 112)	4 (3.6)	108 (96.4)	0.68 (0.04-10.67)	.784
Ampoule sizes				
2 ml (n = 336)	21 (6.3)	315 (93.8)	Reference	-
10 ml (n = 336)	52 (15.5)	284 (84.5)	2.57 (1.35-4.87)	.004
Working experience, years				
>5 (n = 347)	31 (10.8)	257 (89.2)	Reference	-
≤5 (n = 325)	42 (10.9)	342 (89.1)	0.80 (0.44-1.45)	.465
Areas of nursing specialty				
Pediatric nursing (n = 108)	5 (4.6)	103 (95.4)	Reference	-
Surgery nursing (n = 144)	21 (14.6)	123 (85.4)	4.47 (1.44-13.88)	.010
Medicine nursing (n = 168)	22 (13.1)	146 (86.9)	2.88 (0.93-8.94)	.065
Obstetric nursing (n = 96)	13 (13.5)	83 (86.5)	5.90 (1.67-20.84)	.006
Emergency nursing (n = 72)	6 (8.3)	66 (91.7)	1.78 (0.45-7.06)	.411
Other (n = 84)	6 (7.1)	78 (92.9)	1.71 (0.44-6.65)	.438
Breaking directions				
Skillful outward, then broke outward (n = 168)	1 (0.6)	167 (99.4)	Reference	-
Skillful outward, then broke inward (n = 168)	46 (27.4)	122 (72.6)	46.78 (10.24-213.53)	.000
Skillful inward then broke outward (n = 168)	24 (14.3)	144 (85.7)	24.43 (3.14-190.00)	.002
Skillful inward, then broke inward (n = 168)	2 (1.2)	166 (98.8)	1 (omitted)	
Length of sharp edge, mean ± SD	2.29 ± 1.56	1.40 ± 1.18	1.41 (1.11-1.80)	.006

Methods: Method 1 = gauze pad and outward direction, Method 2 = gauze pad and inward direction, Method 3 = cotton ball and outward direction, Method 4 = cotton ball and inward direction, Method 5 = syringe bag and outward direction, Method 6 = syringe bag and inward direction.
CI, confidence interval; OR, odds ratio; SD, standard deviation.

Logistic regression analysis confirmed that breaking methods are associated with ampoule injury. A possible explanation is that the material used to cover the ampoule neck affects ampoule injuries. In methods 3 and 4, using of a cotton ball only covered the ampoule neck on one side; however, methods 1 and 2 (gauze pad) and methods 5 and 6 (syringe bag) entirely covered the ampoule neck. This suggests that covering the ampoule neck partially or entirely affected the occurrence of injury, and completely wrapping the ampoule neck can protect against injury. This result is consistent with a study conducted in Taiwan that reported the number of nurses injuries by breaking glass ampoule with the free hand (43.0%) was more than those with the alcohol pad (40.3%).[25] In line with a Nepalese study, one half

of HCWs (40) broke ampoules with a free hand, two cases having injuries compared to using a cotton ball and syringe wrapping.[19] However, in the present study the same materials (cotton ball in methods 3 and 4, gauze pad in methods 1 and 2, and syringe bag in methods 5 and 6) used with different breaking directions affected the incidence of ampoule injuries and length of sharp edges. **Table 2** shows that ampoules are broken in an outward direction (methods 1, 3, and 5) were associated with a lower incidence of ampoule injuries and shorter mean length of sharp edges compared with ampoules broken in an inward direction (methods 2, 4, and 6).

The logistic regression analysis confirmed that breaking an ampoule in an inward direction caused injuries more often than breaking an ampoule in an outward direction. To date, there is no available evidence that clearly describes standard guidelines on the ampoule breaking direction. The only available recommendation is that snapping the neck of an ampoule away from the body or applying pressure and snapping the top from the ampoule body can protect nurses' fingers from broken glass[21]; this implies ampoules should be broken in an outward direction. This is a crucial finding that may enhance nurses' awareness and help to change their habits to break ampoules in an outward direction to protect against the risk of injury. The main risk factors leading to ampoule injuries are reported to be mistakes or deficiency in knowledge about breaking ampoules, and lack of proper training.[20, 36]

Analysis of ampoule size affects the incidence of ampoule injuries and length of sharp edges. The logistic regression analysis confirmed that ampoule size and length of sharp edge significantly predicted the risk for ampoule injury. A possible explanation is that longer sharp edges cause more injuries than shorter edges. A similar previous study found that breaking a glass ampoule left glass spikes 51.7% of the time, which increased the probability of potential injury.[37] A review of the literature found no studies that evaluated how ampoule size affected the incidence of injuries. However, one study[38] reported that larger ampoules had larger orifices, and was more likely to produce longer sharp edges than small ampoules. Also, the study by Stoker[18] indicated that breaking an ampoule tended to generate sharp edges that increased the risk for injury; therefore, a larger ampoule possible generated a longer sharp edge that may lead to a higher risk for ampoule injury.

The area of nursing specialty was significantly associated with risk for ampoule injury. Those who were from the surgical unit and obstetrics unit sustained ampoule injuries more than nurses from the pediatric unit. Similarly, previous studies reported that nurses working in a surgical unit were more likely to present with sharps injuries than those working in pediatrics.[5, 23] The explanation may be because the area of nursing specialty influences the type of nurse and affects their usual skills in breaking ampoule technique.[1] The higher number of injuries in the surgical units and emergency units may be the relatively higher regularity of parenteral applications.[39] However, in this study nurses from the emergency unit did not have a significant association with ampoule injury. Also, the working experience was not significantly associated with risk for ampoule injury as confirmed with a previous study.[12] However, the majority of previous studies showed that the incidence of ampoule injury in nurses who had work experience <5 years was higher than nurses who had work experience >5 years.[7, 35, 40] A possible explanation is that injuries from breaking an ampoule do not depend on work experience, but do require a practical technique and safe handing procedure. This is consistent with an earlier study that reported the lack of practical guidelines/operation manuals was a significant factor related to a high incidence of sharps injuries.[35] Therefore, a standard practical guideline and manual for ampoule breakage should be developed in a future study.

Limitations

The situation used to collect data limited in the artificial situation that may not represent a real clinical setting. Therefore, in the future, the area of nursing specialty as a factor related to ampoule injury needs to be concerned about in studies about emergency and regular situations. Further, this research was conducted in a single hospital, which limits the generalizability of the findings. However, the researchers believe that findings from this study have relevance to nurses' work in Thailand.

Conclusions and Implications for Nursing Practice

There is a lack of evidence regarding which methods of breaking an ampoule are the safest. This lack of information means that nurses suffer from injuries in their healthcare work environments. Even though there are many ampoule openers in the market designed to protect HCWs from this understated sharps injury, and gloves are a simple device to reduce the risk of injuries from breaking ampoules, they are rarely used by nurses in a clinical setting in Thailand. This may be because of a lack of hospital policies regarding safe ampoule breakage or lack of emphasis on safe ampoule breaking. This situation is preventable in developing countries. Therefore, health departments and hospital administrators need to provide budgets for the use of such safety devices, as well as arrange for training on the use of safety devices in practice.

The main result of this study was that using a material (e.g., a syringe bag) to entirely cover the ampoule neck and breaking the ampoule in an outward direction reduced the incidence of injuries and length of a sharp edge. This information can be used to develop a further standard protocol for breaking ampoules and information needs to be included in educational programs for nursing students, and in continuing education programs for practicing nurses. Therefore, the development of clinical guidelines for breaking ampoules is a crucial topic for further study.

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การศึกษาเปรียบเทียบผลของการหักหลอดแก้วยากับการบาดเจ็บในพยาบาลวิชาชีพ

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บทคัดย่อ: การหักหลอดแก้วยาเป็นสาเหตุให้เกิดการบาดเจ็บที่รุนแรงและทำให้พยาบาลขาดความมั่นใจในการทำงาน บาดแผลที่เกิดขึ้นส่งผลให้พยาบาลต้องขาดงานอีกทั้งเป็นปัจจัยเสี่ยงทำให้เกิดโรคจากการสัมผัสเลือดได้ ในการป้องกันการบาดเจ็บมีข้อเสนอแนะให้นำอุปกรณ์สำหรับช่วยในการเปิดหลอดแก้วยามาใช้ในการหักหลอดแก้วยา แต่อย่างไรก็ตามการนำอุปกรณ์มาใช้ยังไม่แพร่หลายในคลินิก ดังนั้นมาตรฐานในการหักหลอดแก้วยาในคลินิกยังคงใช้วิธีการหักหลอดแก้วยาด้วยมือและยังต้องการทักษะในการหักหลอดแก้วยาเพื่อให้เกิดความปลอดภัย

การศึกษาครั้งนี้เป็นการเปรียบเทียบการหักหลอดแก้วยากับอัตราการเกิดการบาดเจ็บและความยาวของขอบคมที่เกิดขึ้น และศึกษาปัจจัยอื่นๆที่มีผลต่อการบาดเจ็บในพยาบาลวิชาชีพ จำนวน 56 ราย ทำการศึกษาโดยให้ผู้ร่วมวิจัยหักหลอดแก้วยาสองขนาด คือ ขนาด 2 มิลลิลิตร และ 10 มิลลิลิตร หักโดยใช้วัสดุในการพันรอบคอขวดหลอดแก้วยาที่แตกต่างกันและหักในทิศทางที่แตกต่างกันสองทิศทาง คือ การหักให้ส่วนปลายหลอดแก้วเข้าหาตัวผู้หักเอง และหักให้ส่วนปลายหลอดแก้วออกนอกตัวผู้หัก

ผลการศึกษา การหักหลอดแก้วยาจำนวน 672 หลอด พบว่า มีหลอดแก้วยา 73 หลอดทำให้ถุงมือขาด และ พบว่า การหักหลอดแก้วยาที่ใช้ปลอกพลาสติกที่หุ้มกระบอกฉีดยาพันรอบคอขวดและหักในทิศทางปลายหลอดแก้วยาหันออกนอกตัวผู้หัก ทำให้เกิดการบาดเจ็บน้อยที่สุด และทำให้ความยาวของขอบคมมีขนาดสั้นที่สุด นอกจากนี้ในการศึกษานี้ยังพบว่า ปัจจัยที่ทำให้เกิดการบาดเจ็บจากการหักหลอดแก้วยาอย่างมีนัยสำคัญ คือ วิธีการหักหลอดแก้วยา ความชำนาญของพยาบาลในแต่ละพื้นที่ ขนาดของหลอดแก้วยา ทิศทางในการหักหลอดแก้วยา รวมถึงความยาวของขอบคมที่เกิดขึ้น ผลการศึกษาที่เกิดขึ้นทำให้สรุปได้ว่า การหักหลอดแก้วยาในทิศทางที่หักออกนอกตัวพยาบาลและลักษณะการพันด้วยวัสดุรอบคอขวด สามารถป้องกันการบาดเจ็บจากการหักหลอดแก้วยาได้

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