The Incidence of Needlestick Injuries During Perineorrhaphy and Attitudes Toward Occurrence Reports Among Medical Students

Nalinee Panichyawat, M.D., Tripop Lertbunnaphong, M.D.
Department of Obstetrics and Gynaecology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand.

ABSTRACT

Background: Medical students are at risk of needlestick injuries (NSIs) while performing obstetrical procedures especially perineorrhaphy, because of their less experience. This study aims to determine the incidence and causes of NSIs during perineorrhaphy and medical students' attitudes toward occurrence reports.
Methods: A cross-sectional study was conducted. After completion of Obstetrics & Gynaecology rotation, the data from final year medical students were collected using a self-administered questionnaire.
Results: Of 390 medical students, 290 (74.4%) returned questionnaires with complete data. The annual NSIs incidence during perineorrhaphy was 26.9%. The most common site of injury was the index finger of the non-dominant hand (66.2%). Common causes of NSIs were time pressure (52.1%) and lack of surgical skills (50.7%). Nearly half of students (41%) did not report their occurrence, and 81.3% of injured students believed that NSIs were harmless.
Conclusion: The incidence of NSIs during perineorrhaphy and the non-reporting occurrence were quite high among medical students. Structural clinical supervision by medical staffs, HBV vaccination for all medical students, and instruction on standard pre-exposure precaution should be applied. We advocate a strategy plan for increasing students' awareness and having a simple occurrence reporting system for NSIs, with clear guidelines on post-exposure protocols in all medical schools and teaching hospitals.

Keywords: Medical students, needlestick injury, perineorrhaphy

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INTRODUCTION

Sharp injuries to mucocutaneous surfaces are very common in medical practice, especially during the training period. A previous study in our hospital reported a high incidence of medical accidents (51.5%) and the most common accident was needlestick injuries (NSIs).[1] Exposure to blood or body fluids from medical injuries carries risks of serious blood-borne infections, for example, hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV). Risk of infection is 6-30% for HBV, 1.8% for HCV, and 0.3% for HIV.[2] In addition, these injuries also cause adverse psychosocial effects and influence working ability.[3]

Among occupational groups, medical students have the highest risk for NSIs, and they are also at risk of exposure to blood-borne infections, because of their novice status and limited clinical practice experience. They also have less awareness of the risks involved. Several studies report the

Correspondence to: Tripop Lertbunnaphong
E-mail: tripop2520@hotmail.com
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incidence for NSIs among medical students varying from 13.8 to 65.6%.[4-12] However, many studies showed that 34-70% of medical students had less attentiveness and failed to report their NSIs occurrence.[4-6,8,11] The most common reasons were less awareness of the risk of infections, unfamiliarity with the occurrence reporting system and lack of time.[5,6,8,9,13] According to the Thai Medical Council qualification 2012, perineorrhaphy or repairing of episiotomy wound after normal vaginal delivery is one of the basic skill requirements for graduate doctors. This requires complex surgical skills and can cause NSIs. A study in Sri Lanka reported that 49% of hospital medical accidents occurred in the Obstetrics and Gynaecology department, and that 70% of medical students had experienced NSIs during perineorrhaphy.[8]

The primary objective of this study was to determine the incidence of NSIs during perineorrhaphy among final-year medical students who had responsibility to perform perineorrhaphy as their assignment. Additionally, we also evaluated the causes of NSIs during perineorrhaphy and attitudes toward occurrence reports after NSIs.

MATERIALS AND METHODS

After ethical approval from Siriraj Institutional Review Board (SIRB) (Approval number Si No. 690/2013), this cross-sectional study was conducted between January 2014 and March 2015 at Faculty of Medicine Siriraj Hospital, Mahidol University, which is both a medical school and a tertiary referral hospital. After completion of the Obstetrics and Gynaecology rotation, final-year medical students were included in the study. The questionnaire was given out to each student by an officer who was not involved in this research. Unconditionally, all participants were free to answer the questionnaire. The data were collected by self-administered questionnaire. All participants provided written informed consent independently. According to our pilot study, a quarter of medical students reported their experience of NSIs during perineorrhaphy. This study was calculated based on a type I error of 0.05 and the power of the study being 80%. The total sample size was 288.

The questionnaire consisted of four parts. The first part focused on general information including age, sex, grade point average (GPA) and the total number of perineorrhaphy procedures performed. The second part dealt with frequency, sites, and causes of NSIs. The third and fourth parts comprised questions about behavior and attitudes related to occurrence reports after NSIs. In this study, NSI was defined as any laceration, puncture, or ablation caused by a needle that occurred during procedure. These included 4 categories as following; 1) NSI during suturing episiotomy 2) NSI during lidocaine injection 3) NSI during recapping or 4) NSI in multiple steps. Each medical student had a chance of experiencing only one or multiple categories.

In our hospital, episiotomy and perineorrhaphy are routinely performed in almost all patients. The training has been started among the 5th-year medical students. They are assigned to be observers and assistants of the final-year medical students or residents. To improve their competency, all medical students, both the 5th- and last-year medical students have been trained via a half-day workshop. The workshop involves a combination of a lecture of perineal anatomy as well as suturing technique and hands on experience in perineal repair using pig perineum. During a period of the final-year medical students, they are assigned to perform at least 13 perineorrhaphy procedures by themselves under supervision of our residents. Steps involved in perineorrhaphy are initiated by placing sutures at vaginal mucosa for reapproximation of tissue and closure of dead space in a continuous fashion and then the suture is continued to the muscular tissue of the perineal body. Finally, the skin closure is performed with subcuticular suture. The data were analyzed using IBM SPSS software version 18.0.0. Descriptive statistics such as means, standard deviations (SD), frequencies, and percentages were used to describe the characteristics of the participants, characteristics of NSIs, behaviors and attitudes of medical students on occurrence reports. Chi square statistical analysis was used for evaluating categorized factors associated with NSIs and attitudes of medical students on occurrence reports. A p-value of less than 0.05 was defined as statistically significant.

RESULTS

Two hundred and ninety out of a total of 390 students (response rate of 74.4%) returned their questionnaires with complete data. The characteristics of the participants are shown in Table 1. The numbers of male and female students were almost equal. The majority (93.1%) had complete hepatitis B vaccination. The median of perineorrhaphy was 13 cases (range 1-40 cases). The total number of perineorrhaphy procedures of all medical students was 3,902 and the number of NSIs was 142. Rate of NSIs in our study was 3.64 per 100 procedures. About one-fourth of the students (26.9%) had experienced NSIs during perineorrhaphy.

Table 2 demonstrates the characteristics of NSIs among medical students. The most common site of NSIs was the index finger of the non-dominant hand (66.2%). Students reported that major causes of NSIs were time pressure (52.1%) and lack of surgical skills (50.7%). Factors associated with NSIs were analyzed as shown in Table 3. During perineorrhaphy, students who performed more cases (≥13 cases) had more significant NSIs ($p < 0.05$), while gender and GPA were not associated with NSIs.

As shown in Table 4, of 78 medical students who experienced NSIs, nearly half of the students (41%) did not report the occurrence. The common reasons were believing that the exposures were harmless (81.3%), the occurrence reporting system was complicated (12.5%), presumption that the injury did not involve a high-risk patient (12.5%) and lack of time (12.5%).

DISCUSSION

Perineorrhaphy is a common procedure related to NSIs. It is one of the obstetrical procedures required in undergraduate training. In Thailand, this procedure is a basic requirement for qualified medical graduation. Because episiotomy wound is located in a poor visibility site and difficult to approach, it needs more surgical skills. It sometimes requires manipulation of vaginal tissue using the

TABLE 1. Characteristics of study population (N=290 medical students).

Characteristic	Means (SD)
Age (years)	23.5 (0.7)
Total cases of perineorrhaphy per medical student	13.5 (5.7)
	N (%)
Gender	
Male	139 (47.9)
Female	151 (52.1)
Hepatitis B vaccination status	
Unvaccinated	14 (4.8)
Incomplete vaccinated	6 (2.1)
Complete vaccinated	270 (93.1)
Number of cases of perineorrhaphy	
≤ 13 cases	126 (43.4)
> 13 cases	164 (56.6)
Experience of needlestick injuries (NSIs)	78 (26.9)
NSIs during suturing episiotomy	71 (24.5)
Frequency 1 time	36 (50.7)
2 times	25 (35.2)
≥ 3 times	10 (14.1)
NSIs during Lidocaine injection	10 (3.4)
NSIs during recapping	4 (1.4)
NSIs multiple procedures	7 (2.4)

TABLE 2. Characteristics of needlestick injuries (NSIs) (N=78).

	NSIs during suturing episiotomy (N=71), N (%)	NSIs during Lidocaine injection (N=10), N (%)	NSIs during recapping (N=4), N (%)
Site of injury of non-dominant hand*			
Index finger	47 (66.2)	6 (60)	2 (50)
Middle finger	19 (26.8)	4 (40)	1 (25)
Thumb	6 (8.5)	0 (0)	1 (25)
Hand or wrist	1 (1.4)	1 (10)	0 (0)
Did not remember	4 (5.6)	0 (0)	0 (0)
Perceived cause of injury*			
Time pressure	37 (52.1)	6 (60)	0 (0)
Lack of surgical skills	36 (50.7)	3 (30)	0 (0)
Incorporate patient	15 (21.1)	2 (20)	0 (0)
Inappropriate environment (e.g. light sources and exposure)	13 (18.3)	2 (20)	1 (25)
Fatigue/sleepy	6 (8.5)	0 (0)	1 (25)
Complicated perineal wound	1 (1.41)	0 (0)	0 (0)

*The participant can select more than one site and cause of injury

TABLE 3. Factors associated needlestick injuries (NSIs)

Factors	NSIs during perineorrhaphy N (%)		P value
	No	Yes	
Sex (N=290)			
Male (N=139)	98 (70.5)	41 (29.5)	0.06
Female (N=151)	121 (80.1)	30 (19.9)	
Grade point average (N=254)			
< 3.25 (2nd class honor) (N=78)	57 (73.1)	21 (26.9)	0.54
≥ 3.25 (N=176)	135 (53.1)	41 (23.3)	
Experience of perineorrhaphy procedure (N=290)			
< 13 cases (N=120)	100 (83.3)	119 (70)	0.01*
≥ 13 cases (N=170)	20 (16.67)	51 (30)	

*Statistically significant (P value <0.05)

fingers. Thus, perineorrhaphy is a situation that can lead to NSIs proven by the data of glove perforation during obstetrical laceration repair.[14,15] Although the incidence of NSIs during perineorrhaphy in the final year of medical course in our study was 26.9%, this is much lower than in a Sri Lankan study showing that 70% of students experienced NSIs during perineorrhaphy in the clinical years of medical course. Our study also reported the low rate of NSIs per 100 procedures (3.64/100) which did not show in previous studies. This low incidence of NSIs could be a beneficence of our constructed training program including steps of clinical exposure from observer to assistant and, finally, preparing for the real experience via a simulation course. Simulation education can improve medical safety and increases self-efficacy. Perineorrhaphy training using simulation, such as sponge model[16] or an animal model,[17-20] improves students' competency and shortens their learning curve. Hands-on training experience can also reduce the incidence of NSIs during medical procedures.[21,22]

It should be better if we can reduce more cases of NSIs among medical students who are novices in surgical procedures. The missing part of our training system may be structural clinical supervision when performing their first few procedures. Direct supervision of training leads to improve care process and does not diminish the subsequent ability to function independently.[23] A systematic review concluded that enhanced clinical supervision of graduate medical education trainees was associated with improved patient and educational outcomes.[24] We suggest that not only simulation education is necessary for perineorrhaphy training, but clinical supervision is also an add-on educational tool to reduce NSIs.

NSIs increase risk for contracting blood-borne infections. HBV has the highest transmission rate via NSIs and medical students can easily protect themselves against this infection through vaccination. Similar to previous studies, this study found that some medical students had incomplete HBV vaccinations.[8-10,13,25] This may provide convincing evidence that medical school policy should support HBV vaccination for all medical students. However, HBV vaccination by itself does not prevent other blood-borne infections that can be acquired from NSIs.

This study focused on the specific details of injury during perineorrhaphy. We found that the most common site of NSIs during perineor-

TABLE 4. Behavior and attitude of medical students toward occurrence reporting system (N=78).

Occurrence report			**N (%)**
Never report			32 (41)
Sometimes report			18 (23.1)
Always report			28 (35.9)
Behavior		**Sometimes report (N=18) N (%)**	**Always report (N=28) N (%)**
Immediately report		8 (44.4)	23 (82.1)
Report within 24 hours		7 (38.9)	5 (17.9)
Report after 24 hours		3 (16.7)	0
Attitude*	**Never report (N=32) N (%)**	**Sometimes report (N=18) N (%)**	**Always report (N=28) N (%)**
Believe that it had no risk or their exposures were not dangerous	26 (81.3)	12 (66.7)	0 (0)
The occurrence reporting system was complicated	4 (12.5)	2 (11.1)	0 (0)
Presumption that the injury did not involve a high-risk patient or previous negative patient's result blood test	4 (12.5)	3 (16.7)	0 (0)
Lack of time or busy	4 (12.5)	4 (22.2)	0 (0)
The occurrence reporting system was not useful	1 (3.1)	1 (5.6)	0 (0)
Feeling ashamed to report	1 (3.1)	0 (0)	0 (0)
Perception that they used clean needle	2 (6.3)	5 (27.8)	0 (0)
Do not want to have a blood test	2 (6.3)	0 (0)	0 (0)
Do not want to take prophylactic medication	3 (9.4)	1 (5.6)	0 (0)
Do not know about the reporting system	1 (3.1)	0 (0)	0 (0)
Forget to report	0	2 (11.1)	0 (0)
Fear for HIV infection	0	1 (5.6)	27 (96.4)
Fear for hepatitis B infection	0	0	16 (57.1)

*The participant can select more than one reason

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies* ☑

		Item No.	Recommendation
☑	**Title and abstract**	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
	Introduction		
☑	Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
☑	Objectives	3	State specific objectives, including any prespecified hypotheses
	Methods		
☑	Study design	4	Present key elements of study design early in the paper
☑	Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
☑	Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants
☑	Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
☑	Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
☑	Bias	9	Describe any efforts to address potential sources of bias
☑	Study size	10	Explain how the study size was arrived at
☑	Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
☑	Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding (*b*) Describe any methods used to examine subgroups and interactions (*c*) Explain how missing data were addressed (d) If applicable, describe analytical methods taking account of sampling strategy (*e*) Describe any sensitivity analyses
	Results		
☑	Participants	13*	(*a*) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (*b*) Give reasons for non-participation at each stage (*c*) Consider use of a flow diagram
☑	Descriptive data	14*	(*a*) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (*b*) Indicate number of participants with missing data for each variable of interest
☑	Outcome data	15*	Report numbers of outcome events or summary measures
☑	Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included

		Item No.	Recommendation
			(*b*) Report category boundaries when continuous variables were categorized
			(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
☑	Other analyses	17	Report other analyses done—e.g. analyses of subgroups and interactions, and sensitivity analyses
	Discussion		
☑	Key results	18	Summarize key results with reference to study objectives
☑	Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
☑	Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
☑	Generalizability	21	Discuss the generalizability (external validity) of the study results
	Other information		
	Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for exposed and unexposed groups.

rhaphy was the index finger of the non-dominant hand (66.2%). This may indicate that medical students had inappropriate surgical techniques such as grasping the needle or retracting the tissue with fingers of the non-dominant hand without caution. The use of forceps for grasping a needle or the use of Gelpi retractor should be introduced during the training program for the beginners. Therefore, it could be suggested that, although performing a large number of perineorrhaphies is a good strategy to increase experience of medical students, prevention strategy for NSIs is needed during their learning process, for example, using double gloving or blunt suture needles.[26,27] Presently, we promote the use of a finger cot on index and middle fingers of non-dominant hand to prevent and reduce the incidence of NSIs. The data is still in the collecting process.

According to hospital accreditation requirements, a standard protocol for management of post-exposure to NSIs is essential and there should also be an adequate incident reporting system. Prompt reporting of NSIs should be encouraged as it would lead to timely consideration of appropriate post-exposure prophylaxis. Previous studies had reported varying rates of reporting of NSIs among medical students - from 10 to 66%.[5,8,10,13] In this study, only one-third of medical students (37.2%) reported NSIs. Fear of HIV infection (96.4%) was given as a major reason for reporting. Most of them still ignored this safety system by neglecting or delaying their reports. The reasons for not reporting NSIs were similar to that found in other studies. The most common reason was a belief that exposures were harmless,[5,6,8,13] and the existence of complicated reporting systems.[10] Medical students must be educated about standard precautions and post-exposure management, including the system for incidents reporting. A simplified reporting system is advocated, as it could improve reporting rates.

The strengths of this study include a focus on NSIs during a specific clinical procedure, perineorrhaphy. We are not only focusing on what percentage of medical students experience NSIs, but also calculating deeply to determine the rate of NSIs per 100 procedures which could reflect out training system. The results were concentrated

on a specific level of medical students with a high response rate. The study focused in depth on the details of NSIs including site of injuries, reasons for injury and students' attitudes on an occurrence reporting system. These findings can help improve medical safety in medical school. The limitations of this study include results based on a questionnaire, which may underestimate the true incidence of NSIs. Although conducting the survey at the end of the Obstetrics and Gynaecology rotation confirmed that all medical students had completed their training process, students may have trouble in recalling their experience of NSIs. Moreover, we did not focus on students' learning curve whether more experience of perineorrhaphy reduced an incidence of NSI. In addition, the questionnaire did not include questions to assess the level of knowledge on the risk of blood-borne infection via NSIs or on post-exposure management. Further research regarding the efficacy of safer instruments for perineorrhaphy should be conducted.

CONCLUSION

The incidence of NSIs during perineorrhaphy and non-reporting of occurrences were quite high among medical students. Structural clinical supervision by medical staffs, HBV vaccination for all medical students, and instruction on standard pre-exposure precaution should be applied. We advocate a strategy plan for increasing students' awareness and having a simple incident reporting system for NSIs, with clear guidelines on post-exposure protocols in all medical schools and teaching hospitals.

Declaration of Conflicting Interests

The authors declare that there is no potential conflict of interest.

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