

Sharp injuries in Japanese operating theaters of HIV/AIDS referral hospitals 2009–2011

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Abstract: The aim of this study was to identify how doctors and nurses experienced sharps injuries in operating rooms and the risks for these injuries by analyzing data from 78 Japanese hospitals participating in the nationwide EPINet surveillance system. The years of professional experience of the cases were classified into tertiles separately for doctors and nurses. Suture needles accounted for 54.9% of injuries in doctors and 48.3% of injuries in nurses. Among doctors, injuries occurred most frequently during the use of an item (range: 58.1–64.3%), while among nurses, injuries occurred most frequently (range: 24.7–29.0%) between steps of a multi-step procedure. The frequency of injury by a suture needle held by someone else was 41.1–47.3% (range) among doctors, and 27.0–48.1% (range) among nurses. In conclusion, sharps injuries in the operating room need to address the circumstances of injury and holder of devices based on the specific risk for doctors and nurses to decrease the number of injuries.

Key words: Needlestick injuries, Operating room, Blood-borne pathogens, Suture needle, Japan

Introduction

Sharps injuries in an operating room pose a risk of infection for staff^{1, 2)} and patients and may also affect the opera-

tion itself because of loss of a staff member, even if only temporarily, to take care of these injuries³⁾. However, sharps injuries are common in operating rooms⁴⁾, and have higher rates than in general wards where injuries have declined as a result of improved access to sharps disposal containers at the point of use^{5, 6)}. Specific measures to reduce injuries in operating rooms are still necessary.

The Exposure Prevention Information Network (EPINet)

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is a tool for collecting the standardized information for needle stick injuries and body fluid exposures^{7,8}. The EPINet has already adopted as the nationwide surveillance in Canada⁹.

The characteristics of sharps injuries in operating rooms have been reported to vary according to the professional role of the staff member during surgery. While surgeons are likely to be injured during suturing, scrub nurses are injured during counting or sorting instruments². Closer scrutiny of operating room injuries can help to identify and minimize risks for health professionals during surgery. The aim of this study was to identify how doctors and nurses sustained sharps injuries in operating rooms by analyzing data obtained from hospitals participating in the nationwide EPINet surveillance system in Japan.

Methods

Data collection

Data from 78 HIV/AIDS referral hospitals were analyzed because these hospitals are designated as secondary or tertiary care hospitals in their regions and are distributed geographically throughout Japan¹⁰. These hospitals are also expected to have better precautions against sharps injuries. In 2008, participation agreement forms were sent to the directors of all 364 HIV/AIDS referral hospitals in Japan^{10,11}. Agreement for participation in the study was obtained from 117 institutions. The infection control team at each hospital required all workers to report any sharps injuries and record each case using the EPINet-Japan form⁷. In July 2011, we asked all 117 institutions to provide individualized data on needlestick and sharps injuries that had occurred between April 2009 and March 2011. We received individualized data from 78 of the 117 institutions (the response rate was 66.7%).

We extracted all the cases of injuries occurred in operation rooms. We, then, partially used the data as follows for the analysis; the time of each injury (before use of the item, during use of the item, between steps of a multi-step procedure, while disassembling devices or equipment, and other after use-before disposal procedures), along with the devices causing the injuries (suture needle, scalpel, and disposable syringe), the original users of the sharp items (someone else or him/herself), and whether a doctor or nurse was injured.

Statistical analysis

We classified the number of years of professional experience into tertiles separately for doctors and nurses considering the number of years of experienced an important

determinant. The 95% confidence interval for each proportion was also calculated. We analyzed data using Stata version 11 (Stata Corp, College Station, TX, USA).

Ethics

The Human Research Committee at the Institute for Science of Labour approved the research methods and processes prior to study commencement (No. 2009-01). In this study, patient records and information were anonymized and de-identified prior to analysis.

Results

The 78 participating hospitals were evenly distributed by location throughout the country. The number of cases of sharps injuries in operating rooms was 1,542 (26.7%) out of a total of 5,756 sharps injuries. Based on occupation, 94.2% of sharps injuries in operating rooms occurred among doctors and nurses. After excluding data from doctors and nurses with incomplete information on their injuries, 1,298 cases were available for analysis in this study.

Table 1 shows the characteristics of sharps injuries in the operating room. The boundaries of the middle tertiles of the number of years of professional experience were 4 and 12 years for doctors and 1 and 5 years for nurses. Among surgical instruments and other sharp items, suture needles accounted for 54.9% of injuries in doctors and 48.3% of injuries in nurses. Regarding the circumstances of the injury, sharps injuries occurred most frequently during use of the item among doctors (62.2%) and between steps of a multi-step procedure among nurses (27.9%). Sharps injuries occurred in 43.6% of doctors and in 31.5% of nurses while the device was held by someone other than the injured person.

Table 2 shows the characteristics of sharps injuries among doctors and nurses according to years of experience. Injuries caused by a suture needle accounted for 50.0–58.0% (range) of injuries in doctors and 44.0–52.8% (range) of injuries in nurses. Sharps injuries in doctors occurred most frequently (58.1–64.3% (range)) during use of an item, followed by between steps of a multi-step procedure (15.1–22.9% (range)). Among nurses, sharps injuries occurred most frequently between steps of a multi-step procedure, accounting for 24.7–29.0% (range). The proportion of injuries from another person was approximately 40% (41.1–47.3% (range)) for doctors across the tertiles. In contrast, there was an increasing trend in the proportion of injury from someone else among nurses (27.0% for < 1 year's experience and 48.1% for ≥ 5 years' experience).

Table 3 shows cases classified by type of instrument,

Table 1. Characteristics of sharps injuries in the operating room

	Doctors (<i>n</i> = 704)		Nurses (<i>n</i> = 594)	
	<i>n</i>	(%)	<i>n</i>	(%)
Years of experience				
Lower tertile (<4 yrs for doctors, <1 yrs for nurses)	201	(28.6)	89	(15.0)
Middle tertile (4–<12 yrs for doctors, 1–<5 yrs for nurses)	258	(36.6)	293	(49.3)
Upper tertile (12+ for doctors, 5+ for nurses)	245	(34.8)	212	(35.7)
Types of sharps				
Suture needle	386	(54.9)	287	(48.3)
Scalpel	60	(8.5)	61	(10.3)
Disposable syringe	63	(8.9)	62	(10.4)
Others	195	(27.7)	184	(31.0)
Circumstances of injury				
Before use of item	31	(4.4)	68	(11.4)
During use of item	438	(62.2)	74	(12.5)
Between steps of a multi-step procedure	123	(17.5)	166	(27.9)
Disassembling device or equipment	7	(1.0)	65	(10.9)
Other after use-before disposal	11	(1.6)	51	(8.6)
Others	94	(13.4)	170	(28.7)
Holder of devices				
Someone else	307	(43.6)	187	(31.5)
Him/herself	397	(56.4)	407	(68.5)

Table 2. Sharp injuries among doctors and nurses by years of experiences among doctors and nurses (*n* = 1,298), % (95% Confidence Interval)

	Doctors			Nurses		
	<4 yrs <i>n</i> = 201	4–<12 yrs <i>n</i> = 258	12+ yrs <i>n</i> = 245	<1 yrs <i>n</i> = 89	1–<5 yrs <i>n</i> = 293	5+ yrs <i>n</i> = 212
Types of sharps						
Suture needle	57.2 (50.4–64.4)	50.0 (44.0–56.0)	58.0 (52.0–64.0)	49.4 (39.2–58.6)	44.0 (38.1–50.1)	52.8 (45.3–60.3)
Scalpel	7.0 (3.0–11.0)	10.1 (5.8–13.8)	9.0 (5.0–13.0)	11.2 (4.0–18.4)	13.0 (9.0–17.0)	6.1 (2.9–9.2)
Disposable syringe	10.0 (6.0–14.0)	10.1 (6.1–14.1)	6.9 (4.0–9.9)	9.0 (3.0–15.0)	11.9 (7.7–16.1)	9.0 (5.0–13.0)
Others	25.8 (21.3–31.3)	29.8 (24.4–36.2)	26.1 (21.8–29.6)	30.4 (23.1–38.7)	31.1 (25.1–37.1)	32.1 (26.0–38.2)
Circumstances of injury						
Before use of item	3.0 (1.0–5.0)	5.0 (2.0–8.0)	4.9 (1.8–7.8)	16.9 (8.9–24.9)	11.9 (8.0–15.8)	9.0 (5.0–13.0)
During use of item	58.1 (50.9–65.3)	63.2 (58.1–70.3)	64.3 (58.2–69.7)	11.2 (4.2–18.2)	11.9 (8.0–15.8)	14.2 (9.1–19.3)
Between steps of a multi-step procedure	22.9 (17.2–29.4)	15.5 (12.2–20.4)	15.1 (11.0–19.2)	24.7 (16.1–34.3)	29.0 (24.0–34.0)	27.8 (21.6–34.2)
Disassembling device or equipment	2.0 (0–4.0)	1.2 (0–2.3)	0.8 (0–1.6)	9.0 (3.0–15.0)	13.1 (9.2–17.2)	9.0 (5.0–13.0)
Other after use-before disposal	3.0 (1.0–5.0)	1.9 (0–4.0)	0.8 (0–1.6)	5.6 (1.3–10.9)	9.2 (6.1–12.3)	9.0 (5.0–13.0)
Others	11.0 (9.0–13.0)	13.2 (9.1–17.3)	13.9 (10.7–18.1)	32.6 (22.3–41.9)	24.9 (20.7–30.1)	31.0 (24.0–38.0)
Holder of devices						
Someone else	47.3 (39.5–54.1)	41.1 (35.0–47.2)	44.1 (38.1–50.1)	27.0 (18.0–36.0)	32.1 (27.1–37.1)	48.1 (40.8–55.4)
Him/herself	52.7 (46.2–60.2)	58.9 (52.9–64.9)	55.9 (49.6–62.2)	73.0 (64.2–82.2)	67.9 (62.7–73.1)	51.9 (44.8–59.1)

Table 3. Holder of devices and types of sharps by doctors and nurses and the year of experiences, %

Types of sharps	Doctors						Nurses					
	<4 yrs		4- <12 yrs		12+ yrs		<1 yrs		1- <5 yrs		5+ yrs	
	Someone else	Him/herself										
Suture needle	51.3 (42.1-60.4)	48.7 (40.4-57.8)	47.7 (39.2-56.9)	52.3 (43.1-61.4)	44.7 (37.4-53.0)	55.3 (47.2-63.4)	22.7 (11.1-35.3)	77.3 (65.1-88.7)	32.3 (24.2-39.8)	67.7 (59.8-78.1)	31.0 (22.4-40.2)	69.0 (60.0-78.0)
Scalpel	84.4 (64.2-100)	15.6 (0-36.1)	48.0 (28.0-68.0)	52.0 (32.0-72.0)	63.6 (44.4-83.8)	36.4 (8.0-44.2)	30.0 (2.0-58.0)	70.0 (42.0-98.0)	23.1 (10.1-36.2)	76.9 (63.9-90.2)	25.0 (1.1-50.1)	75.0 (50.5-100)
Disposable syringe	15.0 (0-30.0)	85.0 (69.0-100)	16.0 (2.0-30.0)	84.0 (70.0-98.0)	44.4 (21.2-66.8)	55.6 (33.2-79.1)	37.5 (4.3-71.8)	62.5 (29.5-95.5)	11.1 (1.3-21.3)	88.9 (79.1-98.9)	44.4 (20.8-67.2)	55.6 (33.2-78.8)

Table 4. Association of the holder of devices with circumstances caused by suture needles for doctors and nurses by years of experiences, % (95% Confidence Interval)

Circumstances of injury	Doctors						Nurses					
	<4 yrs		4- <12 yrs		12+ yrs		<1 yrs		1- <5 yrs		5+ yrs	
	Someone else	Him/herself										
Before use of item	69.5 (58.2-81.7)	75.0 (64.0-86.0)	72.6 (62.2-84.8)	80.9 (72.2-90.1)	73.0 (62.0-84.0)	78.2 (69.2-86.8)	25.6 (13.1-38.9)	4.8 (1.2-8.6)	29.6 (12.8-47.2)	11.9 (4.1-19.4)	33.3 (10.5-54.6)	3.7 (0-11.1)
During use of item	5.4 (0-11.2)	8.1 (1.1-15.1)	8.1 (1.1-15.1)	2.9 (0-6.7)	3.2 (0-7.0)	2.6 (0-6.7)	7.0 (0-12.0)	11.4 (5.2-16.8)	11.1 (0-21.8)	11.9 (3.4-19.6)	14.8 (2.2-28.2)	14.8 (2.2-28.2)
Between steps of a multi-step procedure	23.7 (13.1-33.9)	14.1 (5.1-23.4)	16.1 (7.4-24.7)	8.8 (1.9-15.6)	12.7 (5.1-21.3)	10.2 (3.1-17.3)	44.1 (28.7-58.7)	28.6 (20.2-37.8)	33.3 (15.3-51.3)	29.9 (19.1-40.9)	27.8 (7.2-48.8)	33.3 (15.3-51.3)
Disassembling device or equipment				1.4 (0-3.8)				20.0 (11.5-27.5)		10.4 (2.9-15.7)	5.6 (0-16.7)	14.9 (2.2-27.6)
Other after use-before disposal						1.3 (0-3.1)		11.4 (5.2-17.2)	3.8 (0-11.4)	12.0 (3.7-19.9)	11.1 (0-24.5)	7.4 (0-17.2)
Others	6.8 (3.1-8.9)	5.5 (3.1-8.7)	3.2 (0-6.2)	6.0 (4.1-8.2)	11.1 (7.1-15.1)	7.7 (5.2-11.9)	23.3 (10.8-33.2)	23.8 (16.7-30.9)	22.2 (12.0-31.8)	23.9 (12.1-35.9)	22.2 (3.2-40.8)	25.9 (11.2-40.7)

who was holding the device at the time of injury, and the number of years of experience. The proportion of injuries from a suture needle held by someone else was 44.7–51.3% (range) among doctors, and 22.7–32.3% (range) among nurses. Although the number of cases was limited, scalpel injuries in doctors from another person were most frequent in those with less than 4 years' experience (84.4%).

Table 4 shows the circumstances of suture needle injuries according to whether the device was held by the injured person him/herself or by someone else. Among doctors, 69.5–73.0% (range) of the injuries occurred during use of a suture needle, with similar proportions of cases in which the needle was by the doctor him/herself or by someone else. Among nurses with less than 1 year's experience, injuries occurred most frequently between steps of a multi-step procedure, with 44.1% sustained while the needle was held by someone else and 28.6% when the needle was held by the injured person.

Discussion

About 50% of sharps injuries in operating rooms were caused by suture needles. For nurses, over 60% of sharps injuries occurred within the first 5 years of their career. More than half of injuries in operating rooms in doctors occurred during use of the item, whereas such injuries in nurses occurred most frequently between steps of a multi-step procedure. A characteristic of the injuries occurring in operating rooms was that sharp instruments held by others were responsible for a substantial proportion of injury cases.

Suturing is the procedure associated with the highest risk of injuries in the operating room². Blunt-tip suture needles, which are not as sharp as standard suture needles, can substantially decrease the risk of injury while suturing muscle and fascia^{12, 13}, as the Food and Drug Administration, the National Institute for Occupational Safety and Health, and the Occupational Safety and Health Administration Joint Safety Commission in the United States have recommended¹⁴. Regulatory requirements for safety devices have reduced the number of injuries¹⁵, despite the compliance of surgeons remaining low¹⁶. In Japan, there are no regulatory requirements pertaining to safety devices, and information on how often blunt-tip suture needles are used in operating rooms remains scarce.

Injuries sustained by doctors, especially those receiving training, are frequently reported¹⁷. However, in this study, a substantial number of injuries were reported in even experienced doctors. Doctors in the surgical field usually take an assistive role in carrying out surgical procedures or have a primary role in relatively easy operations in their

early career¹⁸, then proceed to more difficult operations when they have several years of experience. For injuries occurring during the use of sharp instruments, persons holding such instruments should exercise due caution not only for their own safety but also for that of other personnel, always bearing in mind injury prevention.

Scrub nurses sustain the highest proportion of injuries between steps of a multi-step procedure, possibly as a result of their role in handing over sharp devices, as demonstrated in a previous study². Systems-based strategies such as a hands-free zone in the operative field could minimize the risk of such injuries^{13, 19}. In addition, injuries just prior to disposal of the sharp instrument are preventable, and measures to allow immediate disposal are necessary with setting up the safety containers.

Scalpels were involved in 9–10% of operating room injuries. Doctors with many years of experience had a higher risk of injury from a scalpel held by someone else. Although safety scalpels have been developed, there is insufficient evidence to support regulations for use of these scalpels²⁰. Double-gloving and education on operative procedures could minimize the risk of injury²¹.

This study has some limitations. Even though we actively encourage healthcare workers to report all injuries, injuries are still under-reported, with a certain number of cases being lost to surveillance^{4, 17, 22, 23}. Nagao *et al.* reported that only 22% of staff members who had sustained an operating room injury reported the incident². Supplemental surveys are necessary to obtain more accurate data. We did not obtain information on the surgical procedures during which the injured persons sustained their injuries, and what prevention strategies were implemented. Further studies are needed to determine which procedures are of high risk and which preventive measures can effectively minimize sharps injuries. In addition, the generalizability of this study was limited to HIV/AIDS referral hospitals, which may have higher standards for minimizing risk of occupational infection.

In conclusion, the characteristic features of sharps injuries in the operating room varied according to whether the injured person was a doctor or a nurse and to the number of years of professional experience. Sharps injuries in the operating room may potentially be decreased by taking countermeasures suited to each medical professional. A characteristic feature of sharps injuries in the operating room was the substantial proportion occurring when the instrument was held by another person. Staff who hold a sharp instrument during surgery should pay particular attention not only to their own safety but that of their colleagues as well.

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Conflict of Interest

None

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