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Procedure-Specific Rates for Needlestick Injuries in Health Care Workers

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Abstract: Procedure-Specific Rates for Needlestick Injuries in Health Care Workers: Lukas Jyuhn-Hsiarn LEE, *et al.* Institute of Occupational Medicine and Industrial Hygiene, College of Public Health, National Taiwan University—To assess the rates of needlestick injuries (NSIs) from different types of injection procedures in health care workers, we conducted a prospective study in a university hospital in Taiwan. NSIs in the departments of internal medicine and surgery were prospectively monitored during July 1994–March 1995. All the injured were interviewed to identify their associated procedures. The corresponding numbers of injection procedures were collected during the study period to estimate the denominator of medical procedures. A total of 81 cases of contaminated NSIs were actively collected over a 9-month period compared with 54 NSIs from a routine self-reporting system. Procedures involving intravenous catheter stylets had the highest needlestick injury rate, 43.5/100,000, followed by blood transfusion and blood drawing, 17.7 and 13.3/100,000, respectively. These rates may aid priority setting to introduce safer needle devices when resources are limited.
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Key words: Needlestick injury (NSI), Active surveillance

Needlestick injuries (NSIs) are the most common type of occupational hazards for health care workers (HCWs)[1]. There are more than 20 pathogens transmitted through contaminated needlesticks that have been reported in medical literature[2] among which the primary agents of significant concern are hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV)[3].

Questionnaire surveys conducted retrospectively were the most common type of studies to provide descriptive statistics, including the first multi-center survey in Taiwan[4], but these data usually cannot directly be applied to estimate the risk of NSIs because of recall bias and underreporting which may result in underestimation of the true number of injury cases in retrospective studies[5]. Device-specific injury rates were prospectively documented in two prototypical studies: one in a university hospital in the United States[6], and the other through a multi-hospital surveillance database in Italy[7]. These rates were calculated by collecting the cases of NSIs from a routine self-reporting database divided by the total quantity of devices purchased, but HCWs frequently use the same type of needle device for different injection procedures. For example, disposable syringes may be used for blood drawing and intravenous introduction of medications in routine clinical practices. Therefore, the epidemiologic method first described by Jagger *et al.*[6] for measuring the device-specific injury rates may need to be refined according to specific procedures.

The recent revision of the U.S. Occupational Safety and Health Administration (OSHA) bloodborne pathogens standard has taken effect since April 18, 2001. The standard declares that it is obligatory for employers to consider and implement effective safer medical devices, and it is HCWs' right to get involved in identifying and selecting the devices[8]. It is important to characterize the injury rates from various injection procedures in health-care settings, especially in developing countries where resources are limited and a comprehensive replacement of medical devices may not be feasible. We therefore conducted this prospective study to document procedure-specific rates for NSIs.

Materials and Methods

The departments of Internal medicine and Surgery with a total of 740 beds in a tertiary care teaching hospital in

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Table 1. Frequencies of needlestick injuries and procedure-specific rates in various kinds of medical injection procedures

Category of injection procedure	Numbers of needlestick injuries	Total numbers of procedures used in medical injections	Injury rate (per 100,000)
Intravenous catheter	14	32,169	43.5
Blood transfusion	2	11,291	17.7
Blood drawing	15	113,187	13.3
Insulin injection	3	24,922	12.0
Intravenous drip	14	130,993	10.7
Hypodermic injection	1	10,965	9.1
Intramuscular injection	1	25,801	3.9
Intravenous push	13	362,096	3.6
Blood sugar test (fingerstick)	1	58,013	1.7
Intravenous nutrition	0	7,786	0
Intradermal injection	0	1,139	0
Arterial chemotherapy	0	15	0
Housekeeping	9		
Others	3		
Not available in interview	5		
Total	81		

Taiwan were recruited in the study. The population at risk of occupational exposure to NSIs included all the HCWs working in the 20 wards of these two departments. We conducted a prospective study with an active surveillance system to monitor all NSIs which occurred in the workplace from July 1, 1994 to March 31, 1995. Head nurses of these 20 wards were first instructed to actively monitor every case of NSI for the 9-month period, and one of the investigators, CT Yu, went to each ward every Monday and obtained information on NSIs from all the head nurses. Each person with NSI was interviewed face-to-face by her to gather detailed information on the associated procedures and devices used. The corresponding numbers of medical injection procedures were collected from hospital computerized billing files during the study period to estimate the denominators for medical procedures. Subsequently we calculated the rates of NSIs for different injection procedures among HCWs.

Results

Records of a total of 81 persons injured by contaminated needles were actively collected over a 9-month period. During the same period, the routine self-reporting database from the Department of Occupational Safety and Health gathered 54 self-reported cases, which accounted for only 63 percent of the study's active surveillance. Procedures involving intravenous catheter stylets had the highest needlestick injury rate (43.5/100,000 procedures), followed by blood transfusion and blood drawing, 17.7 and 13.3/100,000, respectively, as summarized in Table 1.

Discussion

To our knowledge, this is the first prospective study to estimate needlestick injury rates for conventional medical injection procedures. We found that procedures involving intravenous catheter stylets had the highest injury rate among various procedures. 7 out of 14 injuries occurred after intravenous injection with the catheter, and before disposal of the contaminated stylet. During the installation of an intravenous catheter, HCWs must carefully handle the device to minimize blood leakage from the catheter while the stylet is withdrawn. They are frequently requested to inject additional medication through the newly installed intravenous route. Stylets were often put aside on beds without immediate disposal, which resulted in a prolonged time of exposure and increased the risk of injury. 3 cases occurred during recapping of the stylets, and 2 additional cases resulted from stylets piercing the caps. We also consistently found that recapping was the major mechanism in injuries from other procedures, which accounted for 8 out of 15 injuries that occurred when drawing blood with disposal syringes, for example. Therefore, immediately disposing of used needles in safe containers and strict avoidance of recapping should be standard practices for the prevention of needlestick injuries in traditional injection procedures.

In order to have an accurate estimate of the needlestick injury rate, one must correctly measure both the numerator and the denominator, but underreporting of needlesticks is a common problem, though hospital

employees are generally requested to report all of them[9]. The extent of underestimation of injured cases in routine data can be reduced to a minimum by utilizing an active surveillance system as described in our study. Moreover, we collected the corresponding numbers of specific medical injection procedures directly from the computerized billing files for the estimation of denominators, so that our estimates of the denominators for every procedure are likely to be more accurate than studies simply counting the total number of needle devices purchased. Because different prices were billed for different procedures, our computerized data files were generally accurate to prevent any error or unnecessary cost to the hospital or patients. For example, the use of disposable syringes was consistently found to result in the lowest injury rates[6, 7], but syringe needles could be used both for blood drawing and intravenous introduction of drugs, and were found to have injury rates of 13.3 and 3.6 per 100,000 procedures, respectively in our study. Therefore, our study identified the most hazardous procedures frequently encountered in conventional injection activities. We recommend that the development of safer needle devices and standard operation procedures for safer clinical practices should be given priority according to procedure-specific rates. In addition, on the basis of these rates a health-care institute can evaluate product performance for selecting cost-effective devices with safety features[10].

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