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ORIGINAL ARTICLE

Study of sharp injuries and blood splash exposures among health care workers in a tertiary hospital in Bangalore

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Abstract

The working environment of healthcare workers (HCW's) exposes them to sharp injuries. The purpose of this project was to examine the injury registers, incidence of sharps injuries and blood splash exposures, and the post-exposure prophylaxis status of employees in a tertiary care hospital. The analysis included records from 54 locations of two units of a tertiary hospital attached to a Medical College. The study was conducted among 1219 health care workers (HCW's) from these units of the hospital of which 209 sharps injuries were recorded. Maintenance of the injury register overall was highly satisfactory in both units. The incidence of sharp injuries and blood splash exposures among healthcare workers was found to be 17.1%.

Among those who sustained injury/blood splash, 60.5% occurred in the age group of 20-30 years, 70% of which were females. Support staffs were at increased risk during waste management procedures. Thirty two percent of sharps injuries occurred in the wards. It was noted that 25.3% of the ward nursing staff had experienced a sharps injury.

Post-exposure prophylaxis for Hepatitis B (primary dose) was given to 25 HCW's, in addition to this 11 HCW's received booster doses. The basic regimen for HIV post-exposure prophylaxis was given to 4 HCW's. This study concludes that records maintenance was satisfactory and training and implementation of appropriate preventive measures can reduce the incidence of injuries.

Key words: sharps injuries; occupational exposure; post-exposure prophylaxis; India

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Introduction

Healthcare workers are at increased risk of infection with bloodborne pathogens through occupational exposure to blood and other body fluids.[1] Most HCW's exposures are the result of percutaneous injuries with sharp objects contaminated with blood or body fluids. These sharps include needles, scalpels, lancets, blades and broken glass. The pathogens most commonly transmitted to HCW's in occupational settings are the Hepatitis B and C viruses (HBV, HCV) and the human immunodeficiency virus (HIV). The average risk of transmission of HIV to a HCW after percutaneous exposure to HIV-infected blood has been estimated as 3 in 1000.[1,2] According to a WHO study, the annual estimated proportion of HCWs exposed to blood borne pathogens globally were 2.6% for HCV, 5.9% for HBV and 0.5% for HIV, corresponding to about 16,000 HCV infections and 66,000 HBV infections in HCW worldwide.[3]

More than 8 million HCWs in the United States work in hospitals and other healthcare settings. Estimates indicate that 600,000 to 800,000 such injuries occur annually. About half of these injuries go unreported.[4] Data from the EPINet system suggest that at an average hospital, workers incur approximately 30 sharps injuries per 100 beds per year. Most reported sharps injuries involve nursing staff; but laboratory staff, physicians, housekeepers, and other HCWs are also injured.

The purpose of this project was to study the maintenance of the injury register for sharps, identify the incidence of sharps injury, blood splash and their post exposure status among health care professionals working in a tertiary hospital in Bangalore.

Methods

A Retrospective record analysis of the injury register was done in two units of a tertiary hospital attached to the medical college in Bangalore. Injury register was initiated in the two units of the hospital between April and June 2007. Retrospective record analysis of this ongoing register was done for two and a half years (April 2007-December 2009). Duration of the study was from December 14th to 16th 2009. In all these areas the number and reported causes of injuries were documented. Fifty four (54) different departments were studied. These included the outpatient and inpatient wards of medicine and allied specialties, surgery, intensive care units, operating theatres and ancillary departments.

Unit one of the hospital was started initially in 1993 with outpatient services and gradually expanded its services. It serves patients of lower and middle socioeconomic background and it caters to teaching of undergraduate and postgraduate students. The total bed capacity was 450 with average occupancy of 375/day. Total numbers of outpatients were 135,878 and inpatients 18,737 during the year. Total staffs were as follows: Staff nurses- 253, support staff- 162, technicians- 42, Casualty Medical Officers- 4. Support staffs are defined as semi-skilled manual workers and in the hospital setup this includes workers involved in waste collection and maintaining the cleanliness of the hospital. These staff are involved in the collection and transportation of waste to the sub Centre.

Unit two of the hospital was started in 2004 and serves rich and insured patients. Doctors (251), postgraduates (62) and junior doctors (150) work in both these units of the hospital. The total bed capacity was 350 during the study with average bed occupancy of 475/day including day care procedures. Total numbers of outpatients were 126,063 and inpatients 16,736 during the year. Total staffs were as follows: Staff nurses- 146, support staff- 59, technicians- 88, Casualty Medical Officers- 2.

Two investigation teams were formed for the study. Each team comprised of one faculty member from the Department of Community Medicine, one member from the Hospital Infection Control committee and one senior nursing staff member. The injury register was conceptualised, developed by the Health Care Waste Management Cell of the department. The contents in the register are as follows: Date of injury/blood splash, name, age, designation, sex of the person who sustained the injury, time of injury and reporting and time when action taken, work areas where exposure occured, how it happened (description), patient's HIV, HCV, HbsAg status, type of exposure (blood filled device, blood /body fluid exposure, body part exposed, type of device), Post exposure prophylaxis: Investigation done, treatment given, follow up dates for treatment

and testing. The investigating team looked into the daily and nil reporting of injury register. The contents of the injury register were recorded; the relevant nursing supervisor was questioned regarding any missing data since she was responsible for collating the data and the same could be retrieved through her.

As per the World Health Organization (WHO) guidelines and protocol, the hepatitis B vaccination status of the HCWs who sustained sharps injury, was documented. According to hospital policy, the source patient and the HCW were tested to determine their hepatitis B status. If the HCW's hepatitis B antibody was more than 10 IU/ml, they were considered protected and immunoglobulin was not administered.

Statistics

Data was entered in Microsoft Excel and was analysed using SPSS version 18.0. Frequencies and proportions were calculated for several key factors in the study. Chi square test and Fishers exact test were used to compare the difference in proportions. $P<0.05$ was considered as statistically significant.

Results

Self-reported sharps injuries were included, as part of an ongoing surveillance programme of the hospital infection control committee. The injury register was initiated at different points of time, based on the inpatients and availability of nursing staff. In Unit I of the tertiary care hospital, the injury register was started between April and June 2007 as each new ward was opened in 24 different locations. Daily reporting of injuries was continued on a consistent basis.

The injury register was present in all locations (100%). The criteria for satisfactory maintenance of the register were neatness and legibility, regular daily entry, including nil reporting which was countersigned by the infection control nurse and nodal officer in charge. Maintenance was considered highly satisfactory, if all of these criteria were met; satisfactory, if two criteria were met and not satisfactory, if only one criterion had been met. Maintenance was "highly satisfactory" in 18 areas (75%), "satisfactory" in 2 areas (8.3%) and "not satisfactory" in 4 areas, which included the mortuary, the Surgical Intensive Care Unit, General Medicine ward and Surgery Outpatient department (OPD) (16.7%).

In Unit II of the tertiary care hospital, the injury register was started on 1st May 2007 in 30 locations and daily entry was done thereafter. On the day of visit by the team, the injury register was present in 28 of the 30 locations (93.3%). The two locations where the injury register was not found were Paediatric OPD and Emergency ICU (6.6%). Maintenance of the register for Unit II was "highly satisfactory" in 22 locations (73.3%), "satisfactory" in 5 (16.6%) locations, and "not satisfactory" in one (3.3%), the Dental OPD. In 25 locations (83.3%), the staff in charge mentioned that there was no difficulty in maintaining the register. Staff at 3 locations (10%) considered some difficulty in entering the data. Daily recording was not done during the visit by the investigating team, due to the high case load in the OPD or the frequent change in personnel that occurred in this department. Sometimes data is entered once in three days. The nursing staff stated that follow-up action for sharps injuries was not difficult.

Table I. Age distribution of HCW's of the two units in the hospital

Age (years)	Doctors	Staff nurses	Lab technicians	Support staff
≤20	Nil	46 (11.5)	05 (38.4)	39 (17.6)
21 – 30	190 (40.5)	116 (29.1)	36 (27.6)	100 (45.2)
31 - 40	150 (31.9)	173 (43.3)	68 (52.3)	75 (33.9)
41 - 50	62 (13.2)	46 (11.5)	19 (14.6)	07 (3.1)
51 - 60	67 (14.3)	118 (29.5)	02(1.5)	Nil
Total	**469(38.4)**	**399 (32.7)**	**130 (10.6)**	**221(18.1)**

Figures in parentheses indicates percentages

Table II. Sex distribution of HCW's of the two units in the hospital

Sex	Doctors	Staff nurses	Lab technicians	Support staff
Male	251 (53.5)	06 (1.5)	78 (60.0)	67 (30.3)
Female	218 (46.4)	393 (98.4)	52 (40.0)	154 (69.6)
Total	**469 (38.4)**	**399 (32.7)**	**130 (10.6)**	**221 (18.1)**

Figures in parentheses indicates percentages

Unit I recorded 83 injuries and Unit II documented a total of 126 injuries prior to the date of this survey. The nursing staff of Unit II mentioned an additional five unrecorded injuries had occurred. On further interrogation, it was observed that it was self inflicted and due to sterile, disposable injuries. Doctors comprised 38.4% of the total employees, 32.7% staff nurses, 10.7% lab technicians and 18.1% were support staff (Table I). Among these employees, 67.1% were females and 32.9% of them were males (Table II). Among 1219 employees, 209 (17.1%) had sharps injury. Incidence of sharps injury was maximum in the age group of 21-30 years (28.7%) followed by 41-50 years (20.1%) (Table II). Out of 817 female employees, 18.0% sustained sharps injury and among 402 males the incidence of sharps injury was 15.4% (Table IV). It was noted that the highest incidence of sharps injuries occurred in the support staff (39.3%), followed by staff nurses (13.2%), and doctors (11.7%) who handled the waste in both Units. The HCW's who documented the least injuries were the laboratory technicians (Table V). The incidence in various categories of HCW's was found to be statistically significant ($p<0.005$). It was also observed that in Unit I, sixteen junior doctors doing their internship and six residents pursuing Masters degrees had sharps injuries. In Unit II of the hospital, usually the senior doctors performed surgery, since it was a corporate hospital.

Table III. Age and unit wise distribution of sharp and blood splash injuries among HCW's

Age in years	Unit I	Unit II	Total
≤20	04 (4.8)	05 (3.9)	09 (4.2)
21 – 30	43 (51.8)	84 (66.6)	127 (60.5)
31 - 40	20 (24.1)	21 (16.6)	41 (19.5)
41 - 50	15 (18.1)	12 (9.5)	27 (12.8)
51 - 60	01 (1.2)	04 (2.5)	05 (2.3)
Total	**83 (40)**	**126 (60)**	**209 (100)**

Figures in parentheses indicates percentages Fischer's exact p value=5.07

Table IV. Sex and unit distribution of blood splash injuries among HCW's

Sex	Unit I	Unit II	Total
Male	29 (34.9)	33 (26.2)	62 (29.6)
Female	54 (65.1)	93 (73.8)	147 (70.3)
Total	83 (40.0)	126 (60.0)	209 (100)

Figures in parentheses indicates percentages Fischer's exact p value =0.60

Table V. Distribution of the HCW's who had sharps injuries in the two units

Category	Sharps injuries n= 204	HCW's n = 1219
Doctors	55 (11.7)	469 (38.5)
Nursing staff	53 (13.3)	399 (32.7)
Lab Technician	09 (6.9)	130 (10.7)
Waste Handlers	87 (39.4)	221 (18.1)
Total	**204***	**1219**

**Information for 5 employees who sustained injuries was missing*
Figures in parentheses indicates percentages

The highest incidence of sharps injuries among the various locations included in this study was found in the wards in both the Units of the hospital (n= 68, 32.2%). The statistical difference in wards and other locations in the two units were compared (Table VI). It was found that there was no statistical difference in the distribution of sharps injury in wards and other localities (p=0.22). The difference in the incidence of sharps injuries among other locations in the two Units was, however, statistically significant (p<0.05).The majority of injuries (61%, n=128) were due to sharps (Table VII), often sustained during various surgical procedures. The difference in the incidence of sharps injuries during various procedures in the two Units was statistically significant (p<0.001).The entire description of the event causing injury is not documented (Table VIII) which is a limitation of the study and is therefore recommended to be included in the injury register.

In this study, none of the HCWs who had been immunised for hepatitis B had a low antibody titre, so immunoglobulin was not administered to any of them. However, the first dose of the hepatitis B vaccination series was administered to four HCWs from Unit I and twenty HCWs from Unit II. These individuals were advised about the immunisation schedule for the remaining doses of vaccine. Booster doses of hepatitis B vaccine were given to seven HCWs from Unit I and four from Unit II. It was noted that no intervention was needed for 173 HCW's because they had completed the entire series of hepatitis B immunizations.

The source patients were tested for their HIV, hepatitis B and hepatitis C status as per WHO guidelines. Four of the source patients were identified as being positive for HIV. Two HCWs from each Unit received the basic regimen of the post-exposure prophylaxis. Follow-up dates for testing were not available, but it was noted that expanded treatment was not required.

Table VI. Distribution of sharps injuries according to locations in the two Units

Speciality (location)	UNIT I n (%)	UNIT II n (%)	Total (%) n (%)
Operation theatre	24 (28.9)	16 (12.7)	40 (19.1)
Intensive care unit	11 (13.3)	29 (23.0)	40 (19.1)
Dialysis	03 (3.6)	09 (7.1)	12 (5.7)
Casualty	03 (3.6)	20 (15.8)	23 (11.0)
Radiology and therapy	03 (3.6)	01 (0.7)	04 (1.9)
Lab	01 (1.2)	03 (2.3)	04 (1.9)
Wards (surgery, medicine and allied)	31 (37.3)	37 (29.3)	68 (32.2)
Others * #	07 (8.4)	11 (8.6)	18 (8.6)
TOTAL	**83 (39.5)**	**126 (60.5)**	**209 (100)**

** Mortuary had 7 injuries in unit I. #OPD=06, Blood bank=04 sub centre (common storage area for biomedical waste) =01 had 11 injuries in Unit II. Fishers exact test p value = 0.0004*

Table VII. Type of injury among HCW's in the two units

Type of injury	Unit I n (%)	Unit II n (%)	Total (%) n (%)
Needle prick	40 (48.2)	88 (70.0)	128 (61.0)
Cut injury	11 (13.2)	12 (9.5)	23 (11.0)
Surgical blade	15 (18.2)	05 (4.0)	20 (10.0)
Blood splash	01 (1.2)	02 (1.4)	03 (1.0)
No information	16 (19.2)	19 (15.1)	35 (17.0)
Total	**83 (39.5)**	**126 (60.5)**	**209 (100)**

Fishers exact test p value = 0.003

The present study attempts to find out the documentation process and timeliness of reporting of sharps injuries in the register, to illustrate the epidemiology of sharps injury and blood splash exposure, and the possible corrective actions. Documentation of sharps injuries defines the incidence and ensures the awareness of HCW's regarding the serious, hazardous, nature of these injuries. It is also a surveillance tool for immediate post-exposure prophylaxis to be given. Sharps injuries are largely preventable, if appropriate and timely, preventative actions are taken. The Occupational Safety and Health Administration (OSHA) is the primary regulatory agency for sharps injury prevention in the US. OSHA published the original Bloodborne Pathogens Standard (BBP) in 1991.This standard requires employers to take action to reduce employees' risk of exposure to bloodborne pathogens. The standards include awareness and training regarding SI, recording a description of injuries including, maintenance of medical records for injured workers, implementation of an exposure control plan, Universal Precautions, engineering measures for safer medical devices, appropriate personal protective equipment (PPE), hepatitis B vaccination and evaluation and management of post-exposure prophylaxis.

In 2001, OSHA published a revised bloodborne pathogen standard reflecting the changes Congress had specified in the Sharps Injury Safety and Prevention Act. It required maintaining a log of percutaneous SIs for every establishment having more than 10 employees. Information on the type and brand of device involved, the department where the incident occurred, and an explanation of how the injury occurred would be documented in the logbook. Subsequently, it has been shown that safer needle devices have reduced SIs by 62%-88%.

Maintenance of the registers was satisfactory regarding regular entries. Females showed a higher incidence of sharps injury as compared to males,

Table VIII. Distribution of event for sharps injury among HCW's of the two Units

Event causing injury	Unit I n (%)	Unit II n (%)	Total n (%)
During surgical procedure	38 (46.0)	56 (44.4)	94 (45.0)
During waste management procedures	29 (35.0)	51 (40.5)	80 (38.3)
No information	16 (19.0)	19 (15.1)	35 (16.7)
Total	**83 (39.5)**	**126 (60.5)**	**209 (100)**

Fishers exact test p value = 0.6286

which was similar to the study by Shah *et al.*[5] where females (n=148, 69.2%) showed a higher incidence of injuries as compared to males (30.8%). Support staff showed the maximum number of injuries, due to lack of awareness related to improper handling of the waste and not wearing the appropriate personal protective devices, when needed. In addition, it was noted that injuries occurred from overfilled puncture proof sharp containers and from sharps sticking out through the plastic liners during transportation. There were two designated waste handlers in the subcentre to receive the waste twice daily, as per the schedule of timings. Segregation of waste should be done at source by the doctors, nurses and lab technicians. If it is inappropriate, the responsibility shifts to the support staff to rectify and bear the brunt of these misgivings. Without personal protective equipments, they are even more susceptible to sharps injury.

The findings of this study differ from the study by Wicker *et al.*[6] where physicians (55.1%) had the highest risk of SI and Sharma *et al.*[7] where nurses (28.4%) had the highest risk.

It was noted that most of the injuries occurred in the wards, which was similar to the results reported by Shah *et al.* (20.9%).[5] The colour-coded plastic liners picked up by the support staff was done under supervision, but a lack of awareness and a casual attitude were responsible for the high number of injuries seen. Most of the injuries were due to needlesticks, which was different from the study by Adegboye *et al.*,[8] where broken glass specimen containers (39%) were a common cause of injury. Sharps injuries by needlestick was due to surgical procedure, which differed from the study by Jayanth *et al.*[9] where mainly hollow bore needles (n=230, 77.7%) were the cause.

From this retrospective record analysis, the cause for blood splash exposures could not be determined. In 73 (24.6%) of SIs, the source patient was unknown. HBV vaccination was initiated among 25 HCWs; 11 received boosters and 57 had completed the full course of vaccination in both the units. Wicker *et al.* noted that the average of vaccinated persons was 78.2%, as opposed to 3.1% with no vaccination.[6]

Data from EPInet suggested that in an average hospital, HCWs incur approximately 27 sharps injuries/100 beds/year.[10] There were only a few reports from India on SI[11,12] and with limited data, it was not possible to estimate an annual incidence for SIs among Indian HCWs.

The National Audit Office, London[13] stated that 4% of HCWs sustain 1-6.2 sharps injuries each year. These injuries occurred in clinical areas, such as wards and theatres, but also in non-clinical areas, due to accidental handling of inappropriately discarded sharps.

Very few studies have been done in India documenting the frequency of SI and use of post-exposure prophylaxis (PEP) protocols following an injury.[14,15,16] Awareness about maintenance of a comprehensive SI register to assist in the identification of high-risk areas and procedures and the appropriate preventive measures can reduce the incidence of SIs. When an SI occurs, reporting is important to facilitate immediate assessment for treatment, and for the assessment of any necessary and further preventative measures. For the injured individual, SI reporting initiates evaluation of the need for PEP and can help to decrease anxiety, since HCWs suffer from emotional distress following a sharps injury. Follow-up testing, if indicated, allows for early detection of a possible seroconversion. Injury reporting allows for the identification of hazardous devices or procedures and also serves to diminish the risk of future injuries. Preventive strategies, such as HCW education, increased use of Universal Precautions and implementation of engineered sharps safety devices, have been shown to significantly reduce injuries due to sharps.[17,18,19,20]

The Healthcare Waste Management Cell and Hospital Infection Control Committee along with the Medical Education Unit of this hospital are conducting regular classes for medical students and residents to increase awareness regarding SI prevention and reporting. A Standard Operating Procedure (SOP) is displayed in all the units to highlight the mechanism for and advantages of SI reporting. The floor supervisor documents all SI's and the Infection Control Nurse collects further information. The identified Nodal Officer will be informed for assessment of post-exposure investigations and prophylaxis.

Regular technical skills training is given to residents and nursing staff in the hope of reducing SIs, including no recapping of needles, use of a kidney tray for carrying and exchanging instruments, dressing trolley to be brought adjacent to the patient, etc. The nursing supervisor regularly trains and re-trains waste handlers, including housekeeping staff, in safe procedures for the safe management and transport of healthcare wastes. Staff nurses are trained to dispose sharps safely as a single unit to an appropriate sharps container, and not to overfill these containers. The Healthcare Waste Management Committee evaluates the waste management system every month and reports the non-compliance in the monthly infection control meetings. Additionally, nurses are evaluated every year, before approval of their annual pay increments. These are some of the successful initiatives that have been adopted by the institution.

Underreporting rates of 22% to 82% have been documented in the literature.[21,22,23,24] The lack of reliable data at the national level is an important issue in relation to efforts to assess the impact and incidence of SI. Some of the reasons for underreporting by the health staff are considering it as a minor problem, blaming themselves for the mishap or fear of being blamed by others and the perceived low risk of infection. Processes of reporting are bureaucratic or time consuming, and staff are not aware of associated risks and discouraged from reporting since nothing will change, are additional barriers to or reasons for non-reporting.[25] Educating and training HCWs, especially housekeeping, laboratory and nursing staff, can increase reporting rates and awareness that even a minor injury should be reported. The doctors and nurses need to analyse SI data in order to plan preventative strategies and follow a hopefully decreasing trend in injury rates, incorporating a culture of safety to work environment, and selecting and evaluating safety-engineered SI prevention devices.[26,27]

Conclusions

Introduction of injury register and its utilisation has been demonstrated in this study. A detailed description of every SI event has not been recorded which is a limitation of the study. Training and awareness on early reporting of sharps injuries and blood splash exposures helps in immediate follow up of the health worker with appropriate investigations and timely management. Further studies on trends in the incidence of SI and blood splash exposures to demonstrate a decrease in SI rates will help to establish a model surveillance system in the country.

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Principal and Dean and Hospital infection control Committee members

Ethical Approval

Permission for the present study was obtained from the Head of institution. This study was conducted as a part of the monthly hospital infection control committee review. The data was collected from the injury registers maintained in the wards of the hospital.

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