

Pattern and serological profile of healthcare workers with needle-stick and sharp injuries: A retrospective analysis

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ABSTRACT

Background: Needle-stick and sharp injuries (NSSIs) are very hazardous to healthcare workers (HCWs) working in any healthcare setting. The burden of NSSIs is more common in developing countries than in developed countries. **Materials and Methods:** A retrospective analysis was conducted in a multispeciality, tertiary level teaching medical institute. Total 78 NSSIs incidences from 2005 to 2013 were reviewed and included for the study. All the information were retrieved and entered in excel sheet for data analysis. **Results:** Total of 78 NSSIs cases were reported over a period of 9 years. Maximum incidences of NSSI were reported by nurses (61.5%). A higher proportion (41%) of cases occurred in critical units and emergency and the most common procedure (64.1%) was parenteral medication during which HCWs got NSSIs. Almost half (53.8%) of HCWs had received complete HBV vaccination. Out of 78, 40 HCWs only completed follow-up for 6 months and were found non-reactive for viral markers. **Conclusion:** The healthcare workers who were involved in patient care are at risk to get NSSIs. The primary prevention of NSSIs is very important. Every institute should have policies on ongoing training programme, HBV vaccination protocol, smooth system of NSSIs reporting, post-exposure prophylaxis (PEP) facilities and follow-up of HCWs with NSSIs to prevent the occurrence.

Keywords: Bloodborne diseases and post-exposure prophylaxis, healthcare workers, needle-stick injuries, sharp injuries

Introduction

Accidental sharp injuries are a major source of blood-borne diseases (BBDs) among healthcare workers (HCW) which can be prevented. These occupational exposures can result in the transmission of viruses such as human immunodeficiency virus (HIV), hepatitis C virus (HCV) and hepatitis B virus (HBV) and many other pathogens.^[1]

Globally, 39% of healthcare workers (HCW) with hepatitis C virus (HCV), 37% HCW with hepatitis B virus (HBV) and

4.4% of HCWs with human immunodeficiency virus (HIV) were infected by sharp injuries. Similarly, HCWs from SEAR B countries which included India were infected by HCV (51%), HBV (40%) and HIV (9.8%).^[2]

These injuries occur while working directly or indirectly with the patient and performing various procedures such as preparation and administration of drugs, recapping of the needle, disposal of sharps/needle, bed making, cleaning clinical areas, suturing, and so on.^[3,4]

The burden of needle-stick and sharp injuries (NSSI) are high in developing countries than in developed countries due to the existence of set rules, standards, adequate resources in developed countries. However, in India particularly, shortage of HCWs

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compounded by ignorance of safety policies, unawareness about HBV vaccination and patient overload in the hospitals are contributing factors to NSSI.^[2]

There are no data available on total incidences of sharp injuries, post-injury intervention and follow-up status of HCWs in India. There is a great need for active surveillance and follow-up to reduce incidence related to NSSIs and also develop strategies to prevent such injuries. The present study presents the results and outcome of 9 years of NSSI surveillance data in a tertiary care teaching hospital of Uttarakhand.

The aim of this study was to analyse self-reported cases of NSSIs to the infection control centre in a tertiary level teaching medical institute of Uttarakhand. All the cases were recorded for the nature of NSSIs and situation under which they occurred.

Materials and Methods

A retrospective analysis was conducted in a 750 multi-speciality bedded, tertiary-level teaching medical institute of Dehradun district in Uttarakhand state. Records of 86 NSSIs incidences from 2005 to 2013 were reviewed and after screening 8 NSSIs incidences were not included in the analysis due to incompleteness and other reasons.

All the incidence forms which were signed by the individual healthcare workers were only included in the present study. Data were tabulated with various information such as gender, job category, shift/time of injury, a clinical area where the injury occurred, type of work, HBV vaccination status, site of injury, reactivity (HBsAg, anti-HCV and anti-HIV) and intervention took after injury were recorded.

Results were analysed using Microsoft excel 2013 to explore different aspects of NSSIs. Quantitative data were computed and presented in terms of mean ± standard deviation. Qualitative data were analysed and presented in terms of frequency and percentage.

Results

In the present study, a total of 78 cases of NSSIs were reported to hospital infection control committee over a period of 9 years. The distribution of NSSIs by year and job category of HCWs is presented in Table 1. Most incidences of NSSIs were reported by nurses (61.5%), followed by student nurses (16.7%).

Table 2 shows the year-wise distribution of HCWs according to their gender, shift duty and clinical area of work where NSSIs occurred. Female to male ratio of NSSIs was 1.6:1. These injuries mainly happened during morning shift duty and mainly in those working in critical units and emergency (41%). Majority of NSSIs were caused by needle prick injury (84.6%) and mainly occurred (64.1%) in the left-hand finger [Table 2].

Looking at types of activities the HCWs were performing or involved during NSSIs, maximum injuries occurred during parenteral medication administration (24.4%) [Table 3].

Details of vaccination status, results of the serological investigation and post-exposure prophylaxis (PEP) for HIV of HCWs as well as the status of source/patient (HBV/HIV/HCV/Unknown) are given in Table 4.

Discussion

Needle-stick and sharp injury is the most common occupational health hazard among healthcare workers. These injuries can result in developing blood-borne infectious diseases. In the current study, incidences of NSSI increased from 01 cases in 2005 to 15 cases in 2013. A similar trend was seen in other studies.^[5,6] This pattern could have resulted in increased frequency of regular training and awareness programmes organised by the infection control committee. Also, healthcare workers have developed awareness about the risk of NSSIs and their life-threatening consequences.

Studies revealed that about 22%–82% of cases remain unreported.^[7-9] Many reasons were reported for under-reporting of NSSIs such as busy schedule; HCWs were knowing the patient is not positive for HIV/HCV/HBV; not aware, how to report and the sharp instrument was not used on a patient at the time of injury.^[7,10]

There were different categories of HCWs who got exposed to blood or body fluids while working in the hospital. The proportion of NSSIs was more among nurses (62%), followed by nursing students (17%), doctors (13%) and least was among ward boys/housekeeping staffs 07 (9%). It has been reported in many works of literature that the incidence among nurses and nursing students are higher than the other HCWs^[5,6,11-13] since nurses are the major workforce who remain with the patient round the clock and provide direct patient care. Most of the blood and blood products, sampling and cannulisation procedures are performed

Table 1: Distribution of NSSIs incidence according to year and category of HCWs (n=78)

| Categories of HCW | 2013 f (%) | 2012 f (%) | 2011 f (%) | 2010 f (%) | 2009 f (%) | 2008 f (%) | 2007 f (%) | 2006 f (%) | 2005 f (%) | Total f (%) |
|---|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|----------------|
| Nurses | 10 (66.7) | 9.0 (60.0) | 7.0 (77.8) | 1.0 (50.0) | 4.0 (25.0) | 3.0 (42.9) | 10 (100) | 3.0 (100) | 1.0 (100) | 48 (62) |
| Student Nurses | 4.0 (26.7) | 3.0 (20.0) | 0.0 (0) | 0.0 (0) | 6.0 (37.5) | 0.0 (0.0) | 0.0 (0.0) | 0.0 (0.0) | 0.0 (0.0) | 13 (17) |
| Doctors (Surgeons/Physicians/Resident) | 0.0 (0.0) | 2.0 (13.3) | 1.0 (11.1) | 1.0 (50.0) | 5.0 (31.3) | 1.0 (14.3) | 0.0 (0.0) | 0.0 (0.0) | 0.0 (0.0) | 10 (13) |
| Ward attendants/Housekeeping staff/Technician | 1.0 (6.7) | 1.0 (6.7) | 1.0 (11.1) | 0.0 (0) | 1.0 (6.3) | 3.0 (42.9) | 0.0 (0.0) | 0.0 (0.0) | 0.0 (0.0) | 7 (9.0) |
| Total | 15 | 15 | 9 | 2 | 16 | 7 | 10 | 3 | 1 | 78 (100) |

Table 2: Characteristics of healthcare workers with NSSI (n=78)

| Characteristic | | 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 | 2005 | Total | |
|-----------------------------|------------------------------|------|------|------|------|------|------|------|------|------|-------|------|
| | | | | | | | | | | | f | % |
| Gender | Male | 5 | 7 | 2 | 1 | 8 | 7 | 0 | 0 | 0 | 30 | 38.5 |
| | Female | 10 | 8 | 7 | 1 | 8 | 0 | 10 | 3 | 1 | 48 | 61.5 |
| Shift | Morning | 9 | 8 | 6 | 1 | 14 | 7 | 5 | 2 | 1 | 53 | 67.9 |
| | Evening | 4 | 5 | 3 | 1 | 1 | 0 | 3 | 0 | 0 | 17 | 21.8 |
| | Night | 2 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 06 | 07.7 |
| | General | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 02 | 02.6 |
| Clinical areas | Critical Units and Emergency | 9 | 6 | 5 | 0 | 3 | 3 | 5 | 0 | 1 | 32 | 41.0 |
| | Surgical Units | 3 | 1 | 2 | 1 | 4 | 1 | 2 | 2 | 0 | 16 | 20.5 |
| | Medical Units | 1 | 5 | 1 | 0 | 2 | 1 | 1 | 1 | 0 | 12 | 15.4 |
| | Operating Rooms | 1 | 2 | 0 | 0 | 6 | 1 | 0 | 0 | 0 | 10 | 12.8 |
| | Gynae/Pediatrics | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 0 | 0 | 08 | 10.3 |
| Type of injury | Needle prick | 12 | 12 | 8 | 1 | 12 | 7 | 10 | 3 | 1 | 66 | 84.6 |
| | Solid cut | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 03 | 03.8 |
| | Splash on face/eye | 2 | 2 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 09 | 11.5 |
| Site of injury/ exposure | Left hand finger | 12 | 6 | 8 | 1 | 8 | 6 | 7 | 1 | 1 | 50 | 64.1 |
| | Left hand thumb/palm | 1 | 3 | 0 | 0 | 2 | 0 | 3 | 1 | 0 | 10 | 12.8 |
| | Right hand finger | 0 | 2 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 05 | 06.4 |
| | Right hand thumb/palm | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 03 | 03.8 |
| | Left Foot/sole | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 01 | 01.3 |

Table 3: Type of activities associated with NSSIs (n=78)

| Type of activity | Frequency | % |
|------------------------------|-----------|------|
| Medication (IM, IV, ID, SC) | 19 | 24.4 |
| Insertion of IV cannula | 19 | 24.3 |
| Lancet prick for RBS | 13 | 16.7 |
| Venipuncture | 09 | 11.5 |
| Post-medication/recapping | 09 | 11.5 |
| Dialysis | 04 | 05.1 |
| Assisting surgery | 04 | 05.1 |
| Disposal of biomedical waste | 04 | 05.1 |
| Sharps left inappropriately | 03 | 03.8 |
| Intubation | 03 | 03.8 |
| Total | 78 | 100 |

RBS=Random Blood Sugar, IM=Intramuscular, IV=Intra venous, ID=Intradermal, SC=Subcutaneous

by nurses and nursing students hence they are more prone to NSSIs. Doctors are also prone to get NSSIs since they are more involved in performing invasive procedures. Less clinical skills among student nurses and a higher turn over of nurses could also be one of the major causes of NSSIs.

Though older and more experienced HCWs also can get such injuries the risk is less.^[14] Another important point is to keep in mind is about the housekeeping staffs, as they are more vulnerable to get NSSIs and are generally unaware of reporting such injuries.

Out of 78, the proportion of females were 1.5 times more than males, a similar result was reported from India,^[4,15] as well as other countries.^[5,6,14,16-18] It is a fact that in any healthcare centres more HCWs are females due to a higher ratio of females among the nursing profession.

Most frequent incidence of NSSIs occurred in morning shift (68%), which is consistent with the studies from India; Kerala,^[4] Andhra Pradesh^[19] and Germany.^[14] Whereas, some of the study results were in contrary to the present study, which reported a higher incidence of NSSIs in the evening shift^[15] and night shift.^[20] This differences may be due to the type and level of healthcare services, the ratio of healthcare workers and patient, rest/break in duty and level of stress among HCWs.

Across the world NSSIs cases were reported in different clinical units, data from the present study is similar to various other studies^[5,21,22] where a large proportion (41%) of NSSIs occurred in the critical unit and emergency room. Both, in critical care units and emergency room HCWs, perform procedures on urgent basis with immense pressure to save the life of patient which increases the chances of NSSIs. Other literature has reported a higher incidence in operation theatres,^[1,15] inpatient units,^[1,19,23,24] surgical units,^[16] medical units,^[4] obstetrics and gynaecology.^[15] This shows that every clinical area of the hospital has a risk where HCWs may get NSSIs, hence it is important for every HCW to have clinical expertise and use standard precautionary measures to prevent such injuries.

The needle-stick injury was the most reported exposure (84.6%), followed by splash (11.5%) and solid cut (3.8%). Similarly, Chang^[23] and Nagao^[25] reported hollow needle (76.9%), and injury by other sharp devices (11.9%) whereas, Nouetchognou^[26] found splash to be the most common (60.3%) cause of exposure to blood and body fluid by HCWs. The most common type of exposure to blood and body fluid by HCWs are needle-stick injury because syringe is the most used sharp device in a healthcare setting by medical, nursing and paramedical staffs. These injuries are preventable by proper adherence to the

Table 4: Serological profile and follow-up of HCW with NSSIs

| Characteristics | | Frequency | % |
|---|---|-----------|------|
| HBV vaccination status (n=78) | Completed | 42 | 53.8 |
| | Incomplete | 15 | 19.2 |
| | No | 09 | 11.5 |
| | Unknown | 12 | 15.4 |
| Anti-HBs Titre (n=78) | Positive | 05 | 06.4 |
| | Negative | 13 | 16.7 |
| | Screening not done/History not Provided | 60 | 76.9 |
| Post-exposure management (n=78) | Post-injury Hep B vaccination | 28 | 35.9 |
| | Post-injury Hep B HBIG | 00 | 00.0 |
| | Tetanus Toxoid (TT) | 78 | 100 |
| Status of Source/patient (HBV/HIV/HCV/VDRL) screened (n=78) | HBsAg and HCV reactive | 01 | 01.3 |
| | HBsAg reactive | 07 | 09.0 |
| | Anti-HCV reactive | 07 | 09.0 |
| | Anti-HIV reactive | 12 | 15.4 |
| | Not done/unknown | 26 | 33.3 |
| | VDRL reactive | 01 | 01.3 |
| | Negative for HBV/HCV/VDRL/HIV | 24 | 30.8 |
| Status of HCW at time of NSSI (HBV/HIV/HCV) (n=78) | Negative | 78 | 100 |
| | Positive | 00 | 0.00 |
| Post-exposure prophylaxis for HIV (n=50) | Indicated* | 38 | 76.0 |
| | Incomplete | 02 | 04.0 |
| | Completed PEP (28 Days) | 10 | 20.0 |

*Indicated includes 12 Anti-HIV reactive + 2sources unknown

handling of the instrument, double gloving and use of face shield or goggles.

The most common site of injury was a left-hand finger, a similar phenomenon was seen in other studies.^[11,27,28] Since most people are right-handed and the left is the passive hand, hence more prone to injuries.

In most of the studies, injection and blood sample collection procedure was reported as a common cause of NSSIs^[21,29] whereas in other studies^[6,25] NSSIs occurred during a surgical procedure. In our study, injectable medications (24.4%), insertion of IV cannula (24.3%), performing RBS procedure (16.7%), blood sample collection (11.5%) and recapping (11.5%) were the most common activities during which HCWs got NSSIs.

Similar to the present study, Dilie *et al.*^[29] from Ethiopia also reported that the most common activity for NSSIs was an injection, whereas results from Cicek *et al.*^[6] reported a higher incidence of recapping and blood collection activities leading to NSSIs and study from Italy^[28] found that during blood sample collection procedure (21%) HCWs got more NSSIs than other procedure.

With reference to HBV vaccination status of HCWs, 42 (53.8%) had completed the HBV vaccination schedule and 15 (19.2%) were yet to complete. Twenty-one (26.9%) had not taken even a single dose or did not clearly remember taking the vaccination.

It has been recommended by the World Health Organization (WHO) that every healthcare worker working at any

level from primary care centre to the tertiary level hospital should be vaccinated with hepatitis B vaccine.^[30] In the present study, 42 (53.8%) HCWs had completed the HBV vaccination schedule and 15 (19.2%) were yet to complete. Twenty-one (26.9%) had not taken even a single dose or did not clearly remember taking the vaccination.

Similarly, in a study by Sukriti *et al.*,^[31] 55.4% of HCWs were found to be fully vaccinated. In contrary to the present study Chinthia *et al.*^[4] and Bhattarai *et al.*^[32] reported a large number (82% and 86.5%) of HCWs receiving all three doses of Hep. B vaccination. Vaccination status of HCWs reflects their awareness level regarding the need for HB vaccination and existing vaccination plans in the institution.

Out of 18 HCWs with NSSIs who were screened for anti-HBs titre, 05 (6.4%) were found to have levels of ≥ 10 μ IU/mL, 13 (16.7%) had < 10 μ IU/mL. None of the HCWs received post-injury HBIG but all (100%) received tetanus toxoid (TT) vaccination.

Serological status of 52 source patients for HBV/HCV/HIV/VDRL (viral markers) could be assessed; 08 (10.3%) patients were HBsAg reactive and 08 (10.3%) were HCV reactive, 12 (15.4%) were HIV reactive and 01 (1.3%) was VDRL reactive. Results of 26 (33.3%) source/patients were not available/screened. In a study,^[33] results are reported in a similar trend where 17% of sources were positive for either viral marker. Whereas in another study,^[21,34] a lower proportion (approximately 17%) of source patient was found reactive for viral markers.

Though these results appear to be alarming were HIV, HCV and HBV infected people are living in the general population without being aware of their infective stage. However, this may not be a true picture because (a) HCWs receive minor NSSIs frequently which may be ignored/not reported routinely; (b) HCWs preferentially (in a panic) report to the ICTC clinic only when they know about the reactive HBV/HCV/HIV status of the source patient. This emphasises the need to carry out awareness programmes on prevention of NSSIs, preventive HBV vaccination and need for compulsory reporting of all NSSIs.

Out of 78 cases of NSIs, PEP (zidovudine, nevirapine, lamivudine) for HIV was started in 66 HCWs and after testing for viral markers PEP was continued in only 12 were put on continued treatment. However, due to side effects, only 10 could continue the entire course. Follow-up till 6 months was done only in 40 cases, none of which showed conversion in the reactive statuses to the viral markers.

Conclusion

It is necessary to prevent NSSIs for HCWs working at the primary care level to tertiary care level. The incidence of NSSIs among HCWs have been reported from many years and various strategies (e.g., educational training and workshops) introduced to prevent and minimise such events. Everyone who is involved in patient care is at risk to get such NSSIs, hence it should be mandatory to get immunised against HBV and other available vaccination.

It is also necessary to provide complete treatment after NSSIs if indicated. Herein, we recommend that at every institution there should be policies and protocols for the mandatory regular training programme, vaccination of HCWs and post-exposure prophylaxis with regular follow-up; also there should be an online portal by Government of India where each case should be registered for better planning and interventional strategies.

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Conflicts of interest

There are no conflicts of interest.

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