

## Original Research Article

# A study of percutaneous injuries amongst health care workers in a tertiary care hospital

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### ABSTRACT

**Background:** Percutaneous injuries (PCI) pose a significant risk of occupational transmission of blood borne pathogens to health care workers (HCWs). Their incidence is considerably higher than current estimates, and hence a low injury rate should not be interpreted as a non-existent problem.

**Methods:** This prospective observational study was conducted over a period of 1 year at a tertiary care teaching hospital in northern India. As soon as the HCW sustains a PCI, they were instructed to report to the emergency department where note was made of all the details in the post exposure reporting form.

**Results:** The incidence of PCI in this study was found to be 4.3%. PCIs were reported maximum among nursing staff (63.41%) compared to doctors (36.58%). Majority of PCIs were reported within 1 hour of sustaining the injury (57.1%). Needle stick injury was the commonest injury sustained by HCWs (84.5%). 91.46% of HCWs were fully immunized against hepatitis B.

**Conclusions:** Preventing PCI is an essential part of infection control program in a hospital. Stress must be laid for mandatory reporting of all PCI irrespective of the source.

**Keywords:** Health care workers, Percutaneous Injuries, Needle stick Injuries

### INTRODUCTION

Healthcare workers in developing countries are at serious risk of infection from blood borne pathogens because of the high prevalence of these pathogens and the increased risk of occupational injuries.<sup>1</sup> Because of the environment in which they work, many health care workers (HCWs) from physicians, surgeons and nurses to housekeeping personnel, laboratory technicians and waste handlers are at an increased risk of accidental needle stick injuries (NSIs), injuries by sharps and splashes. These injuries can occur during a variety of procedures like recapping activity, handling/transferring specimens, collision between HCWs or sharps, during clean-up and passing/handling devices or failure to dispose off the needle in puncture proof containers. The prevalence of blood-borne viruses such as hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV) continue to

increase in general community putting health care takers at risk. There are more than 23 infectious diseases that can be passed on by a PCI, but those most frequently discussed are HIV, HBV and HCV.<sup>2</sup>

The estimated risk for HIV transmission after injury through a needle contaminated with HIV infected blood and after mucous membrane exposure is 0.3% and 0.09% respectively.<sup>3,4</sup> Though HIV transmission occurring through intact skin has been documented, the risk has not been precisely quantified, but the risk of transmission can be estimated to be far less than that of mucous membrane exposure.<sup>5,6</sup> The risk associated with a single parenteral exposure to blood from a source patient who has HBV infection ranges from 6% in HBV “e” antigen negative patients to as high as 40% in “e” antigen positive patients.<sup>7</sup> The average incidence of seroconversion to HCV after NSI from an HCV positive source is 1.8% (range 0-7%).<sup>8</sup>

According to the Center for Disease Control and Prevention, approximately 3,84,000 percutaneous injuries occur annually in the United States hospitals, with about 2,36,000 of these resulting from needle sticks involving hollow-bore needles. Exposure prevention information network (Epinet) data for 2003 reports a rate of approximately 27 NSIs per 100 beds in teaching hospitals.<sup>9</sup> The highest numbers of workers exposed are reported in sub-saharan Africa and southeast Asia. In eastern Africa alone, about 19% of HCWs are percutaneously exposed to HIV annually.<sup>10</sup> According to another World Health Organization (WHO) study, the annual estimated proportions of HCW 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.<sup>11</sup> A European survey of NSI found that nurses (91%) are the main group among health care providers who are more exposed to NSIs as compared to doctors and phlebotomist.<sup>12</sup> Worldwide, there are 296 cases of HIV seroconversion after occupational exposure, of which 56 are documented while 138 are possibly occupationally acquired.<sup>9</sup> In India, two possible cases of occupationally acquired HIV infection have been reported from Chandigarh.<sup>13</sup>

The under reporting of PCI events appears to be common within hospital environments, with surveys suggesting that  $\leq 80\%$  of nurses do not officially report their NSI incidents.<sup>14</sup> As there are few reports on NSIs from India, it is not possible to estimate an annual incidence.<sup>15-20</sup> The incidence is considerably higher than current estimates, and hence a low injury rate should not be interpreted as a nonexistent problem.

Henceforth this study was conducted with an aim to study the incidence and profile of PCI amongst different categories of HCWs.

## METHODS

This was a prospective cohort study conducted after institutional ethics committee clearance in the Department of Medicine, Christian Medical College and Hospital Ludhiana from 01 January 2015 to 31 December 2015.

### Selection criteria

All health care workers who were exposed to infectious body fluids.

### Methodology

Prior to the start of the study, all the staff who may be exposed to potentially infectious body fluids (PIBF) like cleaners, technicians, nurses and doctors in the hospital was informed regarding compulsory reporting of all percutaneous injuries, irrespective of the source. As soon as the HCW sustains a PCI he/she should thoroughly wash the wound with soap and water and report to the emergency department where note was made of all the

details in the post exposure reporting form which will include details of the source and the HCWs, like status of HBV, HCV and HIV other details like the vaccination status, incident (time, place and description), first aid and whether universal precaution were followed by the HCW.

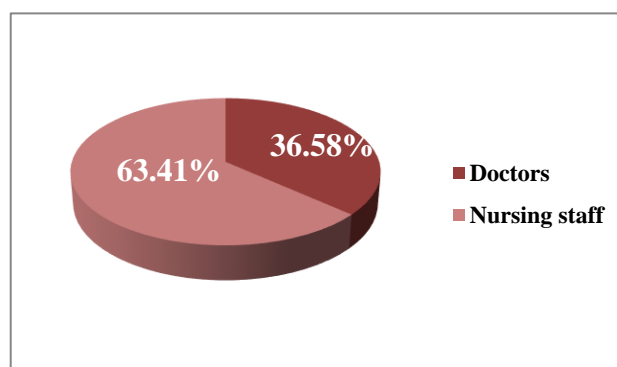
### Statistical analysis

Findings were analyzed under different headings to uncover various aspects of PCI. The statistical tools employed were-ratio, proportion pie charts, histograms and other basic methods of data interpretation.

## RESULTS

In this study total number of health care workers (which includes doctors, nurses and ward aids) were 1942 of whom 84 occupational exposures (PCI and splashes) were reported during the study period, giving an incidence of 4.3%. There were 2 HCWs who sustained PCIs/splashes twice during the study period.

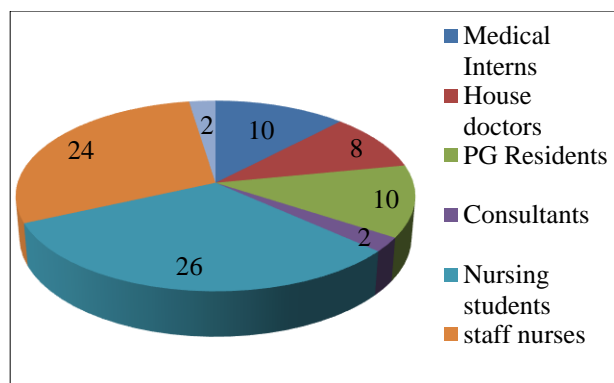
The number of female and male HCWs who sustained PCI were 55 (67.07%) and 27 (32.92%) respectively. 51 (62.19%) of PCI and splashes occurred among the HCW below 25 years of age and 31 (37.8%) occurred among HCWs above 25 years of age. The PCIs reported within 1 hour of injury were 48 (57.1%), within 1-6 hours were 23 (27.3 %) and  $>6$  hours were 13 (15.4%) respectively. Out of the total 82 PCIs and splashes, 52 (63.41%) were seen in the nursing staff and 30 (36.58%) were seen among the doctors as shown in Figure 1.



**Figure 1: Distribution of PCIs and splashes amongst doctors and nurses.**

Figure 2 shows the pattern of distribution of PCIs amongst the different categories of HCWs. Nursing students accounted for 26 (31.7%) whereas 24 (29.2%) were seen in nursing staff. Ward aids were 02 (2.4%), 10 (12.1%) in medical interns, 08 (9.7%) in house doctors, 10 (12.1%) in post graduate residents and 02 (2.4%) among consultants respectively.

Majority of the injuries in HCWs took place while handling of sharps followed by while recapping of needles as shown in Table 1.



**Figure 2: Distribution of PCI among different categories of HCWS.**

**Table 1: Modes of injury (n=84).**

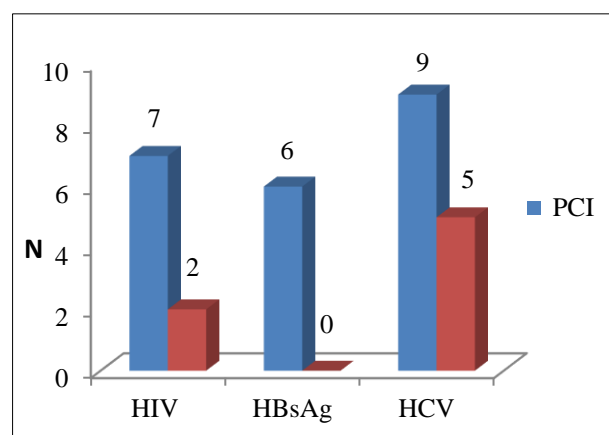
Mode of injury	N	%
Recapping of needles	26	30.9
Handling sharps	30	35.7
Improperly disposed sharps by others	12	14.2
Manipulating needle in patients	09	10.7
Splashes	07	8.3

Amongst the PCI, maximum number were NSI which was seen in 71 (84.5%) HCWs, followed by injuries due to splashes and sharps in 7 (8.33%) and 6 (7.14%) respectively.

Of the total PCI, 72 (85.7%) were from a known source and 12 (14.2%) were from an unknown source. Amongst

the source which were known, 29 (34.5%) were seropositive and 43 (51.1%) were seronegative.

A total of 22 HCWs sustained PCI from a seropositive source, 7 of whom were from HIV positive source, 6 from surface antigen of HVB (HBsAg) positive source and 9 from HCV positive source. There were a total of 7 HCW who sustained splashes from a seropositive source; 2 of these were from HIV positive source and 5 from HCV positive source (Figure 3).



**Figure 3: Seropositive status of source and profile of PCI and splashes amongst HCWs.**

The exposure code (EC) which is defined as the type of exposure occurred after a contact with a potentially infectious material. It has to be evaluated on case by case basis. Exposure code in our study was as shown in Table 2. Majority of the patients had EC 3 seen in 66 (78.5%) patients which forms the severe form of exposure.

**Table 2: Distribution of exposure codes in PCI (n=84).**

Exposure code	Characteristics	N	%
EC 1	Mucous membrane/skin integrity compromised, small volume few drops for short duration	8	9.5
EC 2	Large volume e.g. several drops, major splash/longer duration for several minutes or more. Less severe, solid needle or superficial scratch	10	11.9
EC 3	More severe (e.g. Large bore hollow needle, deep puncture, visible blood on device or needle used in patients artery/vein	66	78.5

Out of total 82 HCWs who sustained a PCI, 75 (91.46%) were immunized against HVB and 7 (8.5%) were not immunized. Among a total of 82 HCWs who sustained PCIs, 31 (37.82%) of them followed universal precautions and 51 (62.19%) did not follow universal precautions. HCWs with work experience of less than 1 year, the number of PCI reported was 36 (43.9%), in those with 1-3 years' work experience there were 22 (26.8%) PCIs in 1-3 years group and 24 (29.2%) PCIs in those with more than 3 years' work experience group.

## DISCUSSION

This was a prospective cohort study conducted in a tertiary care hospital in northern India to understand the profile and incidence of PCIs amongst HCWs. There are very few prospective studies done on occupational hazards in India.<sup>15,21</sup>

The incidence of PCI noted in the present study was (84, 4.3%) (Figure 1). According to 2003 'exposure prevention information network (Epinet)' data, in an average hospital, workers incur approximately 27 NSIs/100 beds/year.<sup>9</sup> An

equivalent number of injuries for a 700 bedded teaching hospital such as Christian Medical College, Ludhiana would be 189 reports in a year. Thus the number of PCIs reported in our study is far less than the expected, based on the Epinet data. A similar prospective study done by Pournaras et al in Greece had found the incidence of NSI to be 2.4% per year, which was comparable to our results.<sup>22</sup> In the absence of active surveillance it is not possible to define whether the reported number of cases in our study is a true finding or is it due to under reporting. The lower figures may also be due to the fact that HCWs tend to report only source positives injuries or splashes.

In our study, nurses outnumbered doctors which can be compared to a study done at a tertiary care centre at Delhi by Muralidhar et al in 2007.<sup>17</sup> Hence nurses form a large category of HCWs where education about PCIs may need to be addressed. Amongst doctors, interns and post graduate residents had the maximum exposure to PCIs in our study (12.1%) followed by house doctors (9.7%). In a prospective, questionnaire-based study among medical interns in our institution done in 2005 an incidence of PCIs as high as 157.89 per 100 person-years has been documented.<sup>20</sup> Since Interns and post graduate residents form a small proportion of the medical or nursing staff in a teaching hospital, but accounted for a large proportion of the injuries, this can be a reflection of the larger number of exposure prone procedures conducted by these categories of HCWs or reflect their inexperience. In a similar study from southern India, out of 296 HCWs reporting NSIs, there were 84 (28.4%) nurses, 27 (9.1%) nursing interns, 45 (21.6%) cleaning staff, 64 (21.6%) doctors, 47 (15.9%) medical interns, and 24 (8.1%) technicians.<sup>15</sup> Majority of the HCWs who sustained PCIs were nurses and medical interns which were common in both the studies.

In the current study, NSI was the commonest injury sustained by HCWs 71 (84.5%), followed by injuries due to splashes and sharps which was seen in 7 (8.33%) and 6 (7%) respectively. In a study from Chandigarh, out of the total 95 episodes of exposure, 70.5% were due to NSI which was similar to our study.<sup>23</sup> A similar study from a tertiary care hospital at Delhi found that 80% of HCWs had experienced NSI at some point in their careers.<sup>17</sup> A cross-sectional survey of HCWs from 7 rural health settings in north India, gathering data pertaining to occupational exposure to blood and blood products among HCWs also found a prevalence of NSI as high as 73%.<sup>24</sup>

In our study exposure to HCV positive source (14) was maximum among health care workers followed by HIV (9) and HBsAg (6). This may be due to the higher prevalence of HCV positivity in our community as shown in a population-based seroepidemiologic study in northern India done by Sood et al.<sup>25</sup>

In the current study, based on the nature and degree of exposure, PCIs were classified into three categories namely EC1, EC2 and EC3 in their ascending grade of severity with the least severe injury as EC1 and most

severe injury as EC3. The incidence of transmission of BBV (blood borne viruses) was seen maximum with a EC3 (i.e. a deep puncture caused by a large hollow bore needle with visible blood at the tip) which is already described previously. The present study showed that in our hospital 66 (78.5%) of HCWs sustained EC3 grade of injury which was alarming.

Out of total 82 HCWs who sustained a PCI, 75 (91.46%) had received three doses of the vaccine against hepatitis B and had an anti-HBs titre >100 IU/ml and 7 (8.5%) were not adequately immunized. This high immunization status against HBV among HCWs in our hospital is probably because the HCWs anti-HBs status is evaluated on pre-employment health checkup and their HBV vaccination series is started if they have not been vaccinated in the past. This ensures that all HCWs are protected against HBV. In a similar study from south India, out of 296 HCWs who sustained NSI 198 (66.8%) had received complete HBV vaccination which was attributed to the good surveillance program in place in their institution.<sup>15</sup> Among a total of 82 HCWs who sustained a PCI, 51 (62.19%) did not follow the universal precautions. The study from Vellore, India also showed similar results with most NSIs (n=223, 75.3%) occurring when universal precautions were not followed.<sup>15</sup> A study from Goa by Salelkar et al also showed that despite regular and intensive educational efforts, only 58% of HCWs were using personal protection equipments at the time of injury.<sup>26</sup>

In this study maximum PCI was reported among HCWs with a work experience of less than 1 year (36 43.9%). Telali et al in their study in south India reported that as work experience increased the incidence of NSIs decreased which was comparable to our study.<sup>27</sup>

There is a paucity of data on occupational hazards among the HCWs in India. In our study the incidence of PCI seems to be lower than expected which may be attributed to under reporting. Small sample size may also reflect a lower incidence of PCI in our study. Improper handling and disposal and a lack of adherence to standard procedures are responsible for the majority of PCIs, indicating that there is a window of opportunity for significant reduction of PCIs through education. Some institutions in India have a staff student health service facility in place, which maintains records and registers the incidence of PCI and has protocols for management and follow-up of PCI cases. This is a dire necessity in all large health care facilities with a large turnover of patients and a high rate of PCI.

The exposure code used in our study is an important tool to assess occupational hazards. In previous studies this tool was used to assess the severity of injury cause by a HIV positive index case. However this tool can be used in occupational exposures with other blood borne viruses. Lack of time and non-availability of materials are the major reasons given by HCWs for not taking universal precautions. It must be made a priority to provide materials

to effect this at an easily accessible location especially so in emergency situations.

## CONCLUSION

In conclusion, PCIs were observed in all categories of HCWs. There is a scope for improvement in safety protocols. Preventive strategies have to be devised and reporting of PCI and splashes need to be made mandatory. Issues requiring attention include use of safety engineered devices (SED), recording and reporting of incidents, training of all HCWs in handling and disposal of sharps, establishing a staff student health service, universal HBV immunization for all HCWs and inculcating a responsible attitude among HCWs.

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