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PREVALENCE OF NEEDLE STICK INJURY AMONG RESIDENTS AND HOUSE SURGEONS IN A TERTIARY CARE SETTING, ALAPPUZHA

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Abstract

Background: Needle stick injuries (NSIs) represent a significant occupational hazard among healthcare workers, particularly residents and house surgeons who are frequently exposed to sharp instruments during clinical procedures. These injuries carry substantial risk of blood-borne pathogen transmission including HIV, hepatitis B, and hepatitis C.

Objective: This study aimed to determine the prevalence of NSI and assess awareness and practices regarding universal precautions and post-exposure prophylaxis (PEP) among residents and house surgeons in a tertiary care setting in Alappuzha, Kerala.

Methods: A cross-sectional study was conducted among 129 residents and house surgeons at Government T.D Medical College, Alappuzha. Data were collected using a semi-structured questionnaire administered through Google forms. Statistical analysis included descriptive statistics (mean ± SD, percentages) and inferential statistics (chi-square test, odds ratios) to identify associations between variables.

Results: The prevalence of NSI was 58.9% (n=76). Among those who experienced NSI, 28.9% reported more than three injuries, with 73.7% occurring during procedures and 68.4% while suturing. Surgical departments accounted for 63.2% of injuries. Only 52.6% reported the incident to authorities, primarily due to considering it not serious (32.5%) or being busy (37.5%). Post-exposure, 86.8% cleaned the wound with soap and water, but only 11.8% took PEP. Checking anti-HBsAg titre was significantly associated with experiencing NSI (OR=2.16, 95% CI: 1.02-4.57, p=0.042). Reporting NSI was significantly associated with PEP uptake (p=0.002).

Conclusion: The high prevalence of NSI coupled with low reporting rates and PEP uptake highlights significant gaps in occupational safety practices. There is an urgent need for targeted educational interventions, improved reporting systems, and accessible PEP services to protect healthcare workers from preventable occupational hazards.

Keywords: Needle stick injury, healthcare workers, post-exposure prophylaxis, universal precautions, occupational safety, medical residents

Introduction

Needle stick injuries (NSIs) are among the most common occupational hazards faced by healthcare workers (HCWs) worldwide [1]. These injuries, defined as accidental skin-penetrating wounds caused by needles, scalpels, or other sharp objects contaminated with blood or body fluids, pose a significant risk for transmission of blood-borne pathogens including hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) [2]. The World Health Organization estimates that more than 2 million occupational NSIs occur annually among HCWs globally, with prevalence rates ranging from 3.5% to nearly 100% across different healthcare settings [3].

The risk of infection following NSI varies by pathogen, with transmission rates estimated at 0.3% for HIV, 9-30% for HBV, and 1-10% for HCV [4]. These risks are particularly concerning for medical residents and house surgeons who, as frontline healthcare providers, perform numerous invasive procedures during their training, often under conditions of high workload and time pressure [5]. Studies have shown that medical students and junior doctors experience higher rates of NSI compared to other healthcare workers, with prevalence rates ranging from 30% to 79% in various settings [6,7].

Despite the availability of standard precautions and post-exposure prophylaxis (PEP), underreporting of NSIs remains a significant challenge, with studies indicating that 40-95% of NSIs go unreported [8,9]. This underreporting prevents timely access to PEP and appropriate follow-up care, increasing the risk of seroconversion and subsequent infection [10]. Factors contributing to underreporting include perceived low risk, lack of time, inadequate knowledge about reporting procedures, and fear of professional consequences [11].

In India, several studies have documented the prevalence of NSI among healthcare workers, with rates varying from 34.5% to 79.5% across different regions and healthcare settings [12,13,14]. However, there is limited data specific to residents and house surgeons in Kerala, particularly in tertiary care settings where the volume of procedures and complexity of cases may increase exposure risk. Understanding the prevalence, patterns, and determinants of NSI in this population is crucial for developing targeted interventions to improve occupational safety.

The "global patient safety action plan 2021–2030" adopted by the 74th World Health Assembly emphasizes the importance of health worker safety as a prerequisite for patient safety [15]. This aligns with the broader objective of occupational health to promote and maintain the highest degree of physical, mental, and social well-being of workers in all occupations [16]. Despite these global initiatives, NSIs continue to represent a significant public health challenge that requires context-specific solutions.

This study aimed to determine the prevalence of NSI among residents and house surgeons in a tertiary care setting in Alappuzha, Kerala, and to assess their awareness and practices regarding universal precautions and post-exposure prophylaxis. Additionally, the study sought to identify factors associated with NSI occurrence, reporting behavior, and PEP uptake to inform the development of targeted interventions for improving occupational safety in this population.

Materials and Methods

Study Design and Setting

A cross-sectional study was conducted among residents and house surgeons at Government T.D Medical College, Alappuzha, Kerala, India. This tertiary care teaching hospital serves as a major referral centre for the region and provides comprehensive medical services across various specialties.

Study Population and Sample Size

The study population included all house surgeons and residents (junior residents, senior residents) working at the institution during the study period. Based on previous studies reporting NSI prevalence rates of approximately 50% among similar populations, with a 95% confidence level and 10% margin of error, the minimum required sample size was calculated to be 97 participants. Accounting for potential non-response, we aimed to recruit 120 participants. Ultimately, 129 residents and house surgeons participated in the study.

Inclusion and Exclusion Criteria
Inclusion criteria comprised all house surgeons and residents working at Government T.D Medical College, Alappuzha, who provided informed consent to participate in the study. The only exclusion criterion was unwillingness to provide consent.

Data Collection Tool
A semi-structured questionnaire was developed based on a comprehensive review of literature and similar studies conducted in other settings. The questionnaire included sections on:
Sociodemographic characteristics (age, gender, marital status, duration of residency/house surgeoncy) Safety practices and precautions (use of gloves, needle recapping, needle disposal practices) Vaccination status against hepatitis B Exposure history (blood/body fluid exposure, NSI occurrence) NSI characteristics (frequency, timing, procedures involved, departments, perceived causes) Reporting behavior and reasons for non-reporting Post-exposure actions taken (wound care, PEP uptake, screening for blood-borne pathogens) Awareness and training regarding NSI prevention and management The questionnaire was pre-tested among a small group of residents (n=10) not included in the final sample to assess clarity, comprehensiveness, and time required for completion. Based on feedback, minor modifications were made to improve the instrument.

Data Collection Procedure
Data was collected in July 2023. The questionnaire was administered electronically through Google Forms. The link to the questionnaire was shared through official communication channels of the institution, including departmental WhatsApp groups and email lists. Participants were provided with detailed information about the study purpose, procedures, and their rights as research participants. Informed consent was obtained electronically before participants could access the questionnaire. Reminder messages were sent at weekly intervals to improve response rates.

Statistical Analysis
Data was extracted from Google Forms and entered into Microsoft Excel for cleaning and coding. Statistical analysis was performed using SPSS version 27.0 (IBM Corp., Armonk, NY, USA). Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation (SD). The chi-square test was used to assess associations between categorical variables, and odds ratios (OR) with 95% confidence intervals (CI) were calculated to measure the strength of associations. A p-value of <0.05 was considered statistically significant.

Ethical Considerations
The study protocol was approved by the Institutional Ethics Committee of Government T.D Medical College, Alappuzha (approval number IEC/TDMC/2023/56). Confidentiality of participant information was maintained throughout the study by using anonymized identifiers and storing data in password-protected files. Participants were informed that their participation was voluntary and that they could withdraw from the study at any time without consequences.

Results
Sociodemographic Characteristics
A total of 129 residents and house surgeons participated in the study. The mean age of participants was 26 ± 3.7 years (range: 23-43 years). The majority were females (70.5%, n=91) and had marital status as single (64.3%, n=83). House surgeons constituted 41.1% (n=53) of the participants, while residents accounted for 58.9% (n=76). Among residents, 40% were in their first year of residency (JR1), 17.3% in JR2, 32% in JR3, and 10.7% were senior residents.

Exposure History and NSI Prevalence

The prevalence of NSI among participants was 58.9% (n=76). Among those who experienced NSI, 27.6% (n=21) had injury once, 30.3% (n=23) had injuries two times, 13.2% (n=10) had injuries three times, and 28.9% (n=22) had injuries more than three times. The majority of NSIs (73.7%, n=56) occurred during procedures, with 15.8% (n=12) occurring after procedures and 10.5% (n=8) occurring both during and after procedures. The most common procedures during which NSIs occurred were suturing (68.4%, n=52), administering injections (23.7%, n=18), IV cannulation (9.2%, n=7), drawing blood (5.3%, n=4), and checking random blood glucose (7.9%, n=6).

Safety Practices and Precautions

Regarding safety practices, 63.6% (n=82) of participants reported always using gloves during procedures, while 36.4% (n=47) reported using them only sometimes. Needle recapping after use was practiced always by 47.3% (n=61), sometimes by 25.6% (n=33), and never by 27.1% (n=35) of participants. The majority (97.7%, n=126) reported that they had been disposing of needles properly always, with most using white containers (94.6%, n=122) for needle disposal. Regarding hepatitis B vaccination, 84.5% (n=109) were fully vaccinated, 13.2% (n=17) partially vaccinated, and 2.3% (n=3) unvaccinated. However, only 38.8% (n=50) had ever checked their anti-HBsAg antibody titre.

NSI Characteristics and Contributing Factors

The mode of injury was most commonly during doing procedures by self (76.3%, n=58), followed by accidental (39.5%, n=30) and while assisting others (21.1%, n=16). The types of sharps involved included suturing needles (67.1%, n=51), hypodermic needles (47.4%, n=36), and scalpels (7.9%, n=6). NSIs were most commonly reported from surgical and allied departments (63.2%, n=48), followed by medical and allied departments (36.8%, n=28), gynecology (17.1%, n=13), preventive clinics (13.2%, n=10), and peripheral postings (9.2%, n=7).

Participants identified several factors contributing to NSIs, with heavy workload being the most common (40.8%, n=31), followed by uncooperative patients (21.1%, n=16), carelessness (21.1%, n=16), lack of adequate protective measures (9.2%, n=7), and lack of proper training (7.9%, n=6).

Reporting Behaviour and Post-Exposure Actions

Only 52.6% (n=40) of participants who experienced NSI reported the incident to authorities. The main reasons for not reporting were considering the injury not serious (32.5%, n=13), being busy (37.5%, n=15), feeling it was not necessary to report (22.5%, n=9), not knowing where to report (12.5%, n=5), and fear of reporting (2.5%, n=1).

Regarding post-exposure actions, 86.8% (n=66) cleaned the wound immediately with soap and water, while 13.2% (n=10) did nothing and continued with work. Only 11.8% (n=9) of participants took PEP after NSI. Among those who did not take PEP (n=67), the reasons included feeling PEP was not necessary (50%, n=30), following advice from others that it was not needed (35%, n=21), fear of side effects (10%, n=6), and not knowing where to get PEP (6.25%, n=8). Following NSI, 51.3% (n=39) screened themselves for HIV/HBV/HCV, while 48.7% (n=37) did not.

Factors Associated with NSI, Reporting, and PEP Uptake

Table 1 presents factors associated with experiencing NSI. Checking anti-HBsAg titre was significantly associated with experiencing NSI (OR=2.16, 95% CI: 1.02-4.57, p=0.042). Female gender showed a trend toward association with NSI (OR=1.95, 95% CI: 0.91-4.2, p=0.085), but this did not reach statistical significance. Other factors including marital status, sensitization during student days, attendance at workshops/CMEs on NSI, skill lab training, glove use, needle recapping, and vaccination status were not significantly associated with NSI occurrence.

Table 2 shows factors associated with reporting NSI to authorities. Sensitization during student days showed a trend toward association with reporting (OR=2.66, 95% CI: 0.92-7.71, p=0.066), but this was not statistically significant. Attendance at workshops/CMEs on NSI and skill lab training were not significantly associated with reporting behavior.

Table 3 presents factors associated with PEP uptake following NSI. Reporting NSI to authorities was significantly associated with taking PEP (p=0.002). All participants who took PEP had reported their NSI to authorities. Other factors including attendance at workshops/CMEs on NSI, sensitization during student days, and skill lab training were not significantly associated with PEP uptake.

Table 1: Factors associated with needle stick injury

Factors	Needle stick injury (n=76)	Odds ratio (95% CI)	p-value
Checked anti HBsAg titre	35 (46.1%)	2.16 (1.02-4.57)	0.042
Female	58 (76.3%)	1.95 (0.91-4.2)	0.085
Marital status (single)	48 (63.2%)	0.88 (0.42-1.84)	0.737
Sensitization during student days	56 (73.7%)	0.73 (0.32-1.69)	0.467
Attended workshop/CME on NSI	12 (15.8%)	0.52 (0.22-1.24)	0.139
Skill lab training during HS	38 (50%)	1.04 (0.52-2.09)	0.916
Habit of using gloves during procedures (sometimes)	30 (39.5%)	1.38 (0.66-2.89)	0.390
Habit of recapping needle (always)	35 (46.1%)	0.89 (0.44-1.79)	0.815
Fully vaccinated	67 (88.2%)	1.95 (0.75-5.1)	0.169

Table 2: Factors associated with reporting to authorities following needle stick injury

Factors	Reported to authorities (n=40)	Odds ratio (95% CI)	p-value
Attended workshop/CME on NSI	6 (15%)	0.88 (0.26-3.03)	0.842
Sensitization during student days	33 (82.5%)	2.66 (0.92-7.71)	0.066
Skill lab training during HS	20 (50%)	1.0 (0.41-2.46)	1.000

Table 3: Factors associated with post exposure prophylaxis following needle stick injury

Factors	Post exposure prophylaxis (n=9)	Odds ratio (95% CI)	p-value
Attended workshop/CME on NSI	2 (22.2%)	1.63 (0.29-9.0)	0.573
Sensitization during student days	8 (88.9%)	3.17 (0.37-27.07)	0.270
Skill lab training during HS	5 (55.6%)	1.29 (0.32-5.22)	0.723
Reported NSI to authorities	9 (100%)	Not applicable	0.002

Discussion

This study found a high prevalence of needle stick injuries (58.9%) among residents and house surgeons in a tertiary care setting in Alappuzha, Kerala. This prevalence is consistent with findings from previous studies conducted in similar settings across India, which have reported NSI rates ranging from 47.2% to 79.5% among medical residents and interns [12,13,14]. The high prevalence observed in our study underscores the significant occupational risk faced by this group of healthcare workers, who are frequently exposed to sharp instruments during clinical procedures, particularly during their formative years of training.

The finding that 28.9% of participants who experienced NSI had more than three injuries is particularly concerning, as repeated exposures increase the cumulative risk of blood-borne pathogen transmission. This highlights the need for targeted interventions to reduce the incidence of NSI in this population. The majority of injuries occurred during procedures (73.7%), particularly while suturing (68.4%), which is consistent with previous studies reporting suturing as a common cause of NSI among surgical residents [17,18]. The high proportion of self-inflicted injuries (76.3%) suggests that improving technique and adherence to safety protocols during procedures could be an effective strategy for reducing NSI occurrence.

Surgical and allied departments accounted for 63.2% of NSIs, reflecting the higher risk associated with surgical procedures compared to medical specialties. This finding is consistent with previous research showing higher NSI rates among surgical residents compared to non-surgical residents [19]. The identification of heavy workload as the most common perceived factor contributing to NSIs (40.8%) aligns with studies linking long working hours, fatigue, and high patient loads to increased risk of occupational injuries among healthcare workers [20].

The low reporting rate (52.6%) observed in our study is consistent with previous research documenting widespread underreporting of NSIs among healthcare workers [8,9]. The main reasons for not reporting—considering the injury not serious (32.5%) and being busy (37.5%)—reflect both knowledge gaps regarding the potential consequences of NSI and systemic barriers to reporting in busy clinical environments. This underreporting is particularly concerning given that only 11.8% of participants took post-exposure prophylaxis (PEP) after NSI, and all who took PEP had reported their injury to authorities. This highlights the critical link between reporting and access to PEP, and underscores the importance of creating a culture that encourages reporting of all occupational exposures.

The finding that only 38.8% of participants had ever checked their anti-HBsAg antibody titre, despite 84.5% reporting full vaccination against hepatitis B, suggests a potential gap in post-vaccination monitoring. This is particularly relevant given that checking anti-HBsAg titre was significantly associated with experiencing NSI (OR=2.16, p=0.042), possibly reflecting greater awareness and vigilance among those who have undergone antibody testing.

The low uptake of PEP (11.8%) observed in our study is concerning given the proven efficacy of PEP in preventing HIV transmission after occupational exposure [21]. The most common reason for not taking PEP was feeling it was not necessary (50%), followed by advice from others that it was not needed (35%). This suggests significant knowledge gaps regarding the indications for PEP and the potential consequences of NSI, particularly among junior healthcare workers who may rely on the guidance of seniors who themselves may have incomplete knowledge.

The lack of significant association between most preventive factors (sensitization during student days, attendance at workshops/CMEs on NSI, skill lab training) and NSI occurrence, reporting, or PEP uptake is surprising and warrants further investigation. It is possible that the quality or content of these educational interventions was insufficient to translate into improved practices, or that other factors such as workplace culture, resource availability, and supervisory support play more critical roles in determining outcomes.

Our findings have several implications for practice and policy. First, there is a clear need for enhanced educational interventions targeting residents and house surgeons, focusing not only on prevention strategies but also on appropriate post-exposure management, including the importance of reporting and PEP. Second, healthcare institutions should implement user-friendly reporting systems that minimize barriers to reporting, such as time constraints and concerns about professional consequences. Third, ensuring easy access to PEP and clear guidelines on its use is essential to improve uptake following NSI. Fourth, addressing workload issues through adequate staffing and workflow optimization could help reduce the risk of NSI associated with fatigue and time pressure.

The strength of our study was the use of a comprehensive questionnaire based on previous research. However, several limitations should be acknowledged. First, the cross-sectional design precludes establishing causality between observed associations. Second, self-reported data may be subject to recall bias, particularly regarding the frequency and circumstances of NSI. Third, the study was conducted in a single institution, which may limit the generalizability of findings to other settings. Finally, the relatively small sample size may have limited the power to detect significant associations between some variables.

Conclusion

This study found a high prevalence of needle stick injuries (58.9%) among residents and house surgeons in a tertiary care setting in Alappuzha, Kerala, with low rates of reporting (52.6%) and post-exposure prophylaxis uptake (11.8%). The majority of injuries occurred during procedures, particularly suturing, and were most commonly attributed to heavy workload. Checking anti-HBsAg titre was significantly associated with experiencing NSI, while reporting NSI was significantly associated with taking PEP. These findings highlight significant gaps in occupational safety practices and underscore the need for targeted interventions to improve prevention, reporting, and management of NSI among healthcare workers in training. Healthcare institutions should prioritize creating a culture of safety that encourages reporting, ensures easy access to PEP, and addresses systemic factors

such as workload that contribute to occupational injuries. Further research is needed to evaluate the effectiveness of specific interventions aimed at reducing NSI and improving post-exposure management in this population.

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