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AN OVERVIEW NEEDLE STICKS OR SHARPS RELATED INJURIES AND BLOOD-BORNE PATHOGENS

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Abstract

Blood-borne pathogens are infectious microorganisms in human blood that can cause disease in humans. These pathogens include, not limited to, hepatitis B (HBV), hepatitis C (HCV), human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (ADIS), but also extended to other viruses, bacterial and protozoa infectious diseases. Needle-sticks and other sharps-related injuries may expose workers to blood-borne pathogens. ACGME core competencies: medical knowledge, practice-based learning and improvement, professionalism needle stick injury (NSI) became a major issue and most of the research focuses on Nurses, Doctors and other health care workers, but at the same time nursing students in clinical duties are at high risk. This is a short selected overview of nosocomial blood-borne pathogens transmitted to health care workers by injuries.

Key words: Nosocomial blood-borne pathogens, Health care workers, Accidental injuries.

Introduction

Porta *et al.* (1999) in USA declared that needle-stick injuries among health care workers were a recognized health hazard, with 400,000 injuries occurred annually among the 4 million health care workers in the United States. Existing needlestick injury literature primarily focuses on hospital sites and may not be generalizable to other health care settings such as nursing homes, home health care sites, clinics, and emergency response units. They added that nurses were at high risk of needlestick injury from syringes and I.V. equipment relative to the other health care workers. Recapping, prohibited by the OSHA Blood-borne Pathogens Standard, continues to be an identified cause of injury. Lipscomb *et al*. (2009) in USA reported that little was known about the risk of blood exposure among personnel providing care to patients residing at home. They documented and compared blood exposure risks among unlicensed home care personal care assistants (PCAs) and home care registered nurses (RNs). They added that both PCAs and RNs reported exposures to sharps, blood, and body fluids in the home setting at rates that warrant additional training, prevention, and protection. PCAs appear to be at increased injury risk when performing nursing-related activities for which they are inexperienced and/or lack training. Quinn *et al.* (2016) in USA considered this an occupational issue and reported that in countries with ageing people, home care (HC) aides were among the fastest growing jobs, with few quantitative studies of HC occupational safety and health (OSH) conditions. They assessed quantitatively OSH hazards and benefits for a wide range of HC working conditions, and compared OSH experiences of HC aides who were employed via different medical and social services systems.

Review and Discussion

Rice *et al.* (1996) reported that the incidence of penetrating skin wounds and needle penetration of gloves during operation was studied in orthopaedic surgeons. Significant hand wounds were found in 11% of surgeons before operations. Glove penetration during the closure of deep tissues occurred in 16% of the outer gloves and 6% of the inner ones when standard needle points were used. The surgeon sustained a needle-stick injury in 6% of this group. When a needle with a protective point was used, there were

no glove perforations. This simple precaution reduced the risk of transmission of bloodborne disease during operation.

Rogers *et al*. (2000) in USA evaluated interventions that reduce or prevent needle-stick injuries in health care occupations. Methods were Cochrane Collaboration search strategies to locate studies that evaluated interventions to reduce needle-stick injuries in health care occupations. Data were selected if they met the following criteria: (1) interventions were evaluated in the defined population; (2) interventions were randomized, with a comparison group(s); (3) outcomes were objectively measured and had interpretable data. Eleven studies met inclusion criteria. Main interest outcomes were changes in number of glove or skin perforations and in amount of skin contamination. They concluded that few randomized controlled trials were employed to evaluate the effectiveness of interventions to reduce needlestick injuries in health care occupations. The majority evaluated interventions during surgical procedures, rather than during patient care on nursing units, probably because the latter is more difficult to observe.

Tan *et al.* (2001) declared that needle-stick injuries posed a significant risk to health care workers; however, appropriate use of needle-stick prevention devices, especially in comprehensive prevention programs, significantly reduced the incidence of injuries. Cost analyses indicate that use of these devices were cost-effective in the long term. To provide more scientific and cost data on efficacy of needle-stick prevention devices, recording of needle-stick injuries must be improved. Federal law now requires the use of safety-engineered sharps devises to protect health care workers, and state-level legislation on the use and evaluation of needlestick prevention devices was under consideration. Health care employers should evaluate the implementation of needle-stick prevention devices with the participated employees, who would use such devices and, appropriate, introduce such devices accompanied by necessary education and training, as part of a comprehensive sharps injury prevention and control program.

Smith *et al.* (2006a) in Korea reported that the needle-stick and sharps injuries (NSI) were known to affect professional nurses at high rates, but studies depended on official reported data. They surveyed a large cross-section of nurses from Gangneung Hospital. Four hundred thirty-two incidents of NSI were reported by 263 nurses (79.7%) in the last year (averaged 1.31events/nurse/year). Needles were the commonest devices affected 67.3%, comprised 52% of all NSI evennts, and 60% of the NSI events were contaminated devices. Opening an ampoule or vial was the commonest cause (affected 35.2% of nurses and accounted for 15.9% of all NSI events). Logistic regression showed that nurses worked in other departments were 5.4 times more likely to suffer any NSI and 4.7 times more likely to incur a syringe-needle injury than those in intensive care units or inpatient departments. Younger-nurses (< 27 years) were 4.5 times more to suffer NSI and 3.1 times more likely to incur a needle injury. Working mixed shifts also increased the risk of any NSI or syringe-needle NSI. They concluded that the NSI were common among nurses with a significant occupational burden for the large Asian demographic, and that intervention and prevention to reduce the NSI exposures were indicated.

Smith *et al.* (2006b) in Japan conducted a cross-sectional NSI survey targeting all nurses within a tropical Australian hospital, regardless of whether they had experienced an NSI or not. A total of 39 nurses reported 43 NSI events in the previous 12 months. The commonest causative device was a normal syringe needle, followed by insulin syringe needles, I.V. needles or kits and blood collection needles. Half of the nurses' NSI events occurred beside the patient's bed: drawing up medication was the commonest reason. Nurses working in the maternity/ neonatal wards were only 0.3 times as likely to have experienced an NSI as their counterpa-

rts in the medical or surgical wards.

Vanhille *et al.* (2012) in USA examined the incidence of sharps exposures among the otolaryngology residents, assessed characteristics of exposures, and determined rates of reporting the potentially career- and life-impacting exposures. Among 1,407 otolaryngology residents nationwide, 231 completed the survey. A total of 168 (72.7%) had at least one sharps exposure during residency, with most due to solid-bore needles (51.7%) and occurring in the operating room (67%). Fifty percent of residents reported exposures occurring in postgraduate year (PGY)-3 or PGY-4, whereas exposures occurred at lower rates in other PGYs, without difference in incidence of sharps exposures based on sexes or history of sharps exposure during medical school. Seventy-four participants had an exposure that they didn't report to the hospital, with the commonest reason for not reporting being the perceived burden of hospital testing protocol. They concluded that residents reported a high rate of sharps exposures during residency training, with a significant number of the exposures was unreported. Better education may be needed to help decrease these often preventable workplace exposures and to improve compliance with reporting and testing procedures.

Lakbala *et al.* (2014) by the cross-sectional study identified who sustains needle-stick and sharps injuries, under what circumstances and what actions taken to minimize risk and in response to intraoperative NSSIs. A total of 250 appropriated responders completed questionnaire (86%). Anesthesia 59 (27.4%) and operation room technicians 55 (25.6%) sustained the greatest numbers of NSSIs over the past year. Awareness of local protocols was significantly worse in the residents. The commonest reasons for noncompliance with NSSIs local protocols were not sure of the protocols 44 (20.4%) and prolonged operation so unable to leave operation (17.3%). They concluded that a revision of the local protocol to reduce the time took to complete may improve compliance. Education was of paramount importance in making health care workers aware of this issue. Application of safety devices led to a NSSIs reduction and reduced risk of blood borne infections.

Lavoie *et al.* (2014) reported that needlestick injuries from devices used for blood collection or for injections expose healthcare workers to the risk of blood borne infections such as HBV, HCV, and HIV. Safety features such as shields or retractable needles could contribute to the prevention of these injuries and important to evaluate their effectiveness. They determined the benefits and harms of safety medical devices aiming to prevent percutaneous exposure injuries caused by needles in healthcare personnel versus no intervention or alternative interventions. **They** searched Central, Medline, Embase, Nhseed, Science Citation Index Expanded, Cinahl, Nioshtic, CISdoc and Psyc INFO (to January 2014) and LILACS (to January 2012). They included randomized controlled trials (RCT), controlled before and after studies (CBA) and interrupted time-series (ITS) designs on the effect of safety engineered medical devices on needlestick injuries in healthcare staff. They concluded that for safe blood collection systems was very low quality evidence in one study that these decrease needle-stick injuries (NSIs). For intravenous systems very low quality evidence that they resulted in a decrease of NSI compared with usual devices but moderate quality evidence that they increase contamination with blood. For other safe in-jection needles, the introduction of multiple safety devices or the introduction of sharps containers the evidence was inconsistent or there was no clear evidence of a benefit. All studies had a considerable risk of bias and the lack of evidence of a beneficial effect could be due both to confounding and bias. This does not mean that these devices are not effective. Cluster-randomized controlled studies are needed to compare the various types of safety engineered devices for their effectiveness and cost-effectiveness, especially in low- and middle-income countries.

Gopar-Nieto *et al.* (2015) in Mexico repo-

rted that sharps injuries were one of the most frequent health-care related accidents, which estimated globally those 35 million workers were at risk; in Mexico without available data for this injury types. They were associated with lack of training, instrument and procedure risk, fatigue and stress. The occupational distribution was nurses 45%, technicians 20%, doctors 20% and maintenance workers 5%. The commonest associated procedures were the injection, venipuncture, suture, and insertion and manipulation of IV catheters. HB is the most commonly transmitted agent. Emotional distress was huge as well as the cost of prophylaxis and follow-up. More than half of the injuries were not notified. The most common reasons for not reporting were: the belief that the exposure was low risk of infection, lack of knowledge of reporting systems and assumption that it is difficult to notify. Many strategies were created to reduce the sharps injuries incidence, such as identifying risk of blood exposure, creation of politics to minimize the risk, the education and training to create a safe workplace, the enhancing of the reporting system, by using of double-gloving and safety-engineered sharps devices. In many countries, these politics reduced the incidence of sharps injuries and economic burden.

Prasuna *et al.* (2015) in north India declared that needle stick injury (NSI) became a major issue and most of the health care workers, but at the same time nursing students in clinical duties are at high risk. Studies are available which examined NSI only in Medical students and health care workers. They carried out a cross-sectional study was conducted in North-East India. The participants comprised of 83 nursing students in 4^{th} year B.Sc. (N) and 3^{rd} year General Nursing and Midwifery (GNM). Students were questioned regarding their occurrence to Needle Stick Injury throughout their clinical training and measures taken following the exposure. They were also asked to complete the Knowledge questionnaire on NSI. They found that a high incidence of needle stick injuries among nursing students with more under-reported cases and subjects were not aware of post exposure measures. It was essential to deal on problems by regular trai-n ing on real-life procedure at the entry level and reporting system should be more user-friendly platform.

Choi *et al.* (2017) in USA reported that the hospital is a place of high risk for sharps and needle-stick injuries (SNI) and such injuries are historically underreported. They institutional reviewed board approved study compared the incidence of SNI among all the surgical personnel at a single academic institution via the anonymous electronic survey distributed to medical students, surgical residents, general surgery attending, surgical technicians, and operating room nurses. The overall survey response was 37% (195/528). Among all respondents, 55% (107/195) had a history of the SNI in the workplace. The overall report rate following an initial SNI was 64%. Surgical staff reported that SNIs more frequently, with an incidence rate ratio (IRR) of 1.33 (P=0.085) when compared with attending. But, when compared with surgical attending, medical students (2.86, P= 0.008) and residents (I2.21, P= 0.04) were more likely to cite fear as a reason for not reporting SNIs. About 65% of respondents didn't report their exposure either because of the consuming time process or the patient involved was perceived to be the low-risk or both. They concluded that the two commonest reasons for not reporting SNIs were the inability to correct time consuming reporting process and fear of embarrassment or punitive response because of admitting an injury.

Rezaei *et al.* (2017) in Iran carried out systematic review and meta-analysis to provide a precise estimate of the period prevalence of needle-stick injuries (NSI) among nurses working in hospitals and reported rate of NSI to nurse managers. They searched both international (PubMed, Scopus and the Institute for Scientific Information) and Iranian (Scientific Information Database, Iran-medex and Magiran) scientific databases to find

studies published from 2000 to 2016 of NSI among Iranian nurses. They found a sample of 21 articles with 6,480 participants, estimated that the overall 1-year period NSI prevalence was 44%. The overall 1-year period prevalence of reporting NSI to nurse managers was 42%. In meta-regression analysis, sample size, mean age, years of experience, and sex ratio was not associated with prevalence of NSI or reporting rate. The data collection year was positively associated with period prevalence of NSI ($P < .05$), but without period prevalence of reporting NSI to managers. The results showed a high NSI period prevalence, but low NSI reporting rate among nurses.

Oche *et al.* (2018) in Nigeria reported that the prevention of HIV/AIDS among healthcare workers (HCWs) remained a major topical issue worldwide. Accidental transmission of HIV infection to HCWs during occupational exposure is a real threat today. They assessed the knowledge, attitude, and practice of postexposure prophylaxis (PEP) among 156 HCWs in a tertiary health institution in Sokoto. They found that a total of 87.2% (136) of the respondents heard about PEP &71.8% (112) thought that HIV/AIDs could be prevented by PEP. A total of 71.2% (111) had good knowledge about PEP, but 86.8% (118) had a positive attitude toward PEP. They concluded that the study showed high knowledge and positive attitude toward PEP, but safety measures against needlestick injuries that could result in HIV infections was abysmally low. There was the need to create more awareness and strengthen the use of PEP protocol by all cadres of health workers as this would go a long way in minimizing blood-borne infections.

Papadopoli *et al.* (2019) in Italy reported that healthcare workers, in course of their professional activity, are potentially exposed to chemical, physical and above all biological risks. Their study involved, through an interviewer-administered structured questionnaire, undergraduate and postgraduate students attended postgraduate medical schools and healthcare professional schools who underwent occupational health visits from January 2015 to July 2018. They concluded that remarkable under-reporting, as well as a lack of preparedness of students for NSI preventive and post-exposure effective measures. They added that healthcare student education should be reinforced to ensure that safe practices were carried out if needles and sharps were involved, and stressed reporting NSI and adherence to post-exposure prophylaxis protocols.

Kimaro *et al.* (2018) in Tanzania reported that Infection with HIV was a serious public health problem that threatened the lives of many people including health care workers. Health care workers are frequently exposed to occupational hazards throughout their careers at risk of being infected by virus when caring for patients in health care facilities. Utilization of HIV Post-exposure Prophylaxis (HIV/PEP) being very vital once an individual was exposed. They carried out a descriptive cross sectional study from April to May 2013. Health care workers actively treating patients were enrolled from 18 heath facilities in Singida District Council. Data were collected using a self-administered questionnaire. They found that the occupantional exposure among health care workers was high with low utilization of HIV/PEP. Majority had inadequate knowledge of HIV/PEP. But, results highlighted the need to improve knowledge level of HIV/PEP and PEP utilization of among this at-high-risk-group.

Katsevman *et al.* (2020) found that needlestick injuries among medical students (MS), nursing students (NS), and residents continued to be an occupational hazard, frequently and incorrectly regarded as low-risk, and exacerbated by underreporting. They studied rates of needle-stick injury, reasons for underreporting, and how explicit announcements that patients were high-risk (HIV, hepatitis, or IV drug abuse history) might affect actions of those at the risk of sustaining an injury. They found that 30/224 (13%) of MS, 6/65 (9%) of NS, and 67/126 (53%) of

residents experienced needle-stick injuries. 37% of MS, 33% of NS, & 46% of residents attributed lack of concentration as injury cause. Residents had the lowest percentage of underreporting (33%), with rates of 40% and 83% among MS and NS, respectively. Top reasons for non-reporting included the injury being perceived as trivial (22%) and patient being low-risk (18%). A majority reported that pre-operative high-risk announcements were required (91%), and would promote culture of safety (82%), reporting of injuries (85%), and increased concentration during procedures (70%). They recommended routine announcements during pre-operative time-out & nursing/resident hand-offs that state a patient was high-risk if applicable, and that such policy would promote a culture of safety, situational awareness, and incident reporting.

Choi *et al.* (2020) in USA assessed whether facial trauma wound care and antibiotic use recommendations are guided by evidence-based practice (EBP) or practice patterns, and strategies to improve EBP ad-option among surgical trainees. They found that response rate was 50.3% overall (78/155). For recommendations on facial trauma wound and antibiotic use, non-specialty junior residents most frequently relied on their own senior or specialty residents (79.1%); non-specialty senior residents relied on specialty residents (67.9%). Specialty junior residents most often relied on their own senior residents (51.0%), the majority of whom made recommendations based on their own knowledge (73.2%). Questions assessing EBP knowledge had Cronbach's α of 0.98; response accuracy was similar between specialty & non-specialty residents (54.6% vs. 55.5%, P= 0.96). When provided recommendations that conflict with EBP, both non-specialty and specialty residents more frequently followed recommendations rather than EBP; junior residents reported doing so to avoid conflict with superiors. Total 92.6% of surveyed residents felt cross-departmental EBP guidelines would improve patient care. They concluded that facial trauma wound care and antibiotic recommendations disseminate down seniority and from craniofacial specialty to non-specialty residents, yet knowledge of EBP among senior specialty and non-specialty residents was weak. EBP was difficult to adopt in the absence of consensus society guidelines. To cover, they reviewed EBP for facial trauma and plan to update the trauma manual with cross-departmental guidelines to facilitate EBP adoption among trainees.

Vardhini *et al.* (2020) in south India focused on the evaluation of present knowledge, and practice of nurses and paramedical workers on post-exposure prophylaxis against HIV. A descriptive cross-sectional questionnaire study about the knowledge and practice of PEP against HIV among Staff nurses and Paramedical workers was done at a tertiary care hospital in South India. The data analysis was performed using SPSS software version 24 to compare the knowledge between nurses and paramedical workers were significant. They found that a low-level practice of HIV/PEP among staff nurses and paramedical workers despite their better knowledge, which could be improved by providing formal training sessions to the health care workers.

Sethi *et al*. (2020) reported that the needlesticks were common work-related injuries suffered by health care professionals, and identified prevalence of needle-stick/sharps injuries of residents working in the operating room and identify contributing factors and barriers to reporting/seeking treatment. They distributed 17-questions survey on needle-stick injuries was distributed to 168 residents in anesthesiology, surgery, and surgical subspecialties and the responses were analyzed for the statistical significance of differences observed between departments. They found that of 138 respondents (82% response), 49% of residents had at least one needle-stick injury during training. One quarter didn't report their injuries to employee health or seek treatment, with the largest percentage from general surgery (53%). The primary re-

asons for not reporting injuries or seeking treatment included time away from patient care and lack of concern about the injury. More than half (64%) of the anesthesiology residents who reported an injury thought fatigue was a contributing factor. They concluded that 50% of residents sustained an injury and a quarter of injuries didn't get reported, with the most valid reason being too much time away from the patient care. Only anesthesiology residents commonly cited fatigue as a contributor to their needle-stick/ sharps injury. Understood the program-specific needle-stick/sharps injury incidence and prevalence, and attitudes about reporting injuries and to seek treatment, was a first step to prevent of injury for residents in training.

Chen *et al.* (2021) in Taiwan reported that the burnout, musculoskeletal pain, and sharps injuries (SIs) affected medical workers. They used questionnaire for an observational and cross-sectional study, based on me mbers at a hospital affiliated with a medical university. The valid responses constituted 68.5% (1734/2531). Items were drawn from the Nordic Musculo-skeletal Questionnaire and Copenhagen burnout inventory and concerned work experience, occupational category, presence of chronic diseases, sleep duration, overtime work, and work schedule. Statistically, they found that personal and work-related burnout ranks, sex, work experience ranks, occupational groups, drinking in past month, sleep duration per day, presence of chronic diseases, overtime work ranks, and work schedule were associated with SIs. Frequent upper limb and lower limb pain (pain occurring every day or once a week) determined to be related to SIs. High personal burnout (>Q3) and high work-related burnout (>Q3) mediated the relationship between SIs and frequent lower limb pain. Also, frequent lower limb pain mediated the relationship of SIs with high personal and high work-related burnout. High personal and high work-related burnout mediated relation-ships of SIs with overtime work and irregular shift work. Mediating model provided strong evidence of an association between mental health and SIs. They concluded that burnout was determined to contribute to sharps injuries (Sis) occurrence; specifically, it mediated the relationships of SIs with frequent musculoskeletal pain, overtime work, and irregular shift work.

Ahadizadeh *et al.* (2021) in USA reported that up to 800,000 percutaneous injuries involving healthcare workers occur each year. Morbidity of the needle-stick injuries (NSIs) ranged from nothing to death. The incidence of NSI in otolaryngology residency was deemed to be high based on prior studies. Data showed that surveys were received from 314 residents (31 programs). A total of 509 needle-sticks were primarily occurred during junior years (post-graduate year 1-3, 81%). Sixty-eight percent of residents had experienced an NSI. Of the residents that had an injury, sticks mean number was 2.37 sticks/ resident. Junior residents were less likely to report their injury compared to senior ones (50% vs. 30%). The primary reason for not reporting was the time commitment. Residents underestimated their risk of acquiring HIV (51%) and overestimated their risk of acquiring hepatitis C virus (90%). They concluded that occupational exposure was high in healthcare and particularly high in surgical trainees. Majority of otolaryngology trainees underwent a needle-stick injury in their junior years. There continued to be underreporting of these injuries by residents, who report that the process was too time-consuming. Most residents didn't have an accurate understanding of the actual risk of acquiring a blood-borne disease. These data emphasize the need for education regarding risks and development of strategies to encourage reporting of injuries.

In Arab Countries; Alwutaib *et al*. (2012) in Kuwait found good knowledge among nurses about transmission diseases. Memish *et al*. (2013) in Saudi Arabia found that needle-stick and sharp object injuries were a major occupational challenge to health care workers. They added that prevention must be

based on different working lines as immunization, education of health care workers and proper engineering control measures.

Abdel-Motagaly *et al.* (2017) in Egypt reported that nurses in health care workplaces face a serious danger threatening life by accidental exposure to pathogens blood and body fluids, which could be virus, bacteria, or parasites. Saleh *et al.* (2017) in Egypt tested the Military Nursing knowledge on mode of transmission of four Egyptian zoonotic parasitic diseases, by blood transfusion and/or needle-stick injury. They concluded that the educational intervention showed significant improvements the staff nursing knowledge, performance and attitude, and that continues training programs about blood parasites acquired by needle stick injury must be developed and provided on regular basis.

Suliman *et al.* (2018) in Jordan reported that student nurses were at high risk of blood-borne pathogens transmitted by needle-stick injury (NSI). The understanding of various NSI aspects was essential if they were to avoid risks associated with it. A cross-sectional and descriptive design was on 279 student nurses at one private and four governmental universities distributed allover Jordan, with 22 questions developed from NSI literature. Questionnaire was divided into three sections: background to measure their demographics; knowledge, to measure nurses' understanding of NSI; and prevalence to measure exposure to NSI and follow-up measures. Student nurses were recruited on Facebook. The study was available Online for a full semester in 2016/2017. They concluded that student nurses have a moderate understanding of issues regarding NSI. This knowledge improved with seniority. But, exposure to NSI and its under-reporting was a prevalent problem. They recommended that focusing on NSI in the nursing curriculum and providing more protection and post-exposure intervention during clinical practice.

El-Saaidi *et al.* (2021) in Egypt reported that in developing countries, risk of blood-borne diseases such as human immuno-deficiency virus, hepatitis B virus, & hepatitis C virus was high for healthcare workers. To evaluate infection control knowledge, attitudes and practices, as well as the associated risk of percutaneous infection among dental students, a cross-sectional study was conducted in four Egyptian public dental schools in 2016. A total of 1776 students received an anonymous questionnaire on infection control knowledge, attitudes, and practices and needle and sharps injuries occurrence; 1067 (60.1%) completed the questionnaire. Third- (pre-clinical), fourth- (junior-clinical), and fifth-year (senior-clinical) students comprised 44.2%, 15.6%, & 40.2%, respectively. Although the majority of them reported good attitudes and practices for infection control, knowledge scores were generally low. Female students scored higher on self-protection and sterilization practices than did male students, and the fourth-year students showed significantly higher scores for infection control practice than did the fifth-year students. In multivariate analysis, higher scores of infection control practices were associated with higher scores for attitudes to infection control and fewer (1-3) needle injury experiences. Although an alarming proportion had experienced needle or sharps injuries during clinical training, about 30% of the students didn't receive a complete HB vaccination. More infection control education must introduce refresher training before graduation that focuses on injury prevention and post-exposure protocols.

Al Qadire *et al.* (2021) in Oman reported that incidence of needle stick injuries was higher among nurses with a low level of knowledge on the prevention, and who didn't received the relevant training during their undergraduate study. They used an online cross-sectional survey questionnaire involved 167 students from a governmental university. Questionnaire consisted of 30 questions; eight general questions, knowledge related ones, and questions about risk factors, prevention measures, and actions in a case of needle stick injury. Participants 81.2% were females; mean age was 23.3 (SD= 4.5)

years. Mean total knowledge score was 6.6/ 10 (SD=2.1), also 18.2% (32) of students' experienced needle stick injury. The injuries were 71.9% (24) occurred during medication preparation and administration. Main NSI cause was recapping the needles 59% (19). The student nurses have a moderate level of knowledge about needle stick injury prevention measures and lack many facets of safe infection control practice. They concluded that the collaborative effort of nursing administrators from both academic and clinical areas was a must to put effective strategies to reduce or eliminate needle-stick injuries.

Razzakh and Qureshi (2021) in Qatar reported that NSIs were common among HCP, but most of the exposed HCP had adequate immunity to HBV, but neither HBV, HCV, nor HIV transmission was among them

Recommendations

1- Blood & its products for transfusion must be screened for all blood-borne diseases.

2- A standard immunizations and other prophylaxis must be part of health care worker's medical file, include vaccine type, dose, administration date & site, manufacturer, and lot number.

3- Risky immunocompromised patients must not receive live vaccines as yellow fever oral typhoid, nasal influenza, and OPV, MMR and varicella vaccines. Inactivated vaccines include meningococcal, parenteral typhoid, hepatitis A and B, rabies, Japanese encephalitis, inactivated influenza, IPV, Tdap & Td.

4- Follow standard precautions to prevent spreading of blood-borne pathogens and others whenever there is a risk of exposure to blood or other bodily fluids.

5- Protect workers with personal protective equipment as gloves, masks, gowns, and goggles, especially in emergency room, operating room, and medical ward settings to avoid blood and body fluids transmission.

6- Prompt reporting of exposures is a must, not only for management or director, but also to identify workplace hazards and evaluation of preventive measures. Exposure circumstances must be recorded in a conrumstances must be recorded in a confidential medical record.

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