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# Alexandria Journal of Medicine

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## Safe injection procedures, injection practices, and needlestick injuries among health care workers in operating rooms <sup>☆</sup>

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### ARTICLE INFO

#### Article history:

Received 7 August 2016

Revised 10 October 2016

Accepted 13 November 2016

Available online xxx

#### Keywords:

Needlestick injuries

Sharps injuries

Injections

Post-exposure prophylaxis

Operating rooms

### ABSTRACT

**Background:** Of the estimated 384,000 needle-stick injuries occurring in hospitals each year, 23% occur in surgical settings. This study was conducted to assess safe injection procedures, injection practices, and circumstances contributing to needlestick and sharps injuries (NSSIs) in operating rooms.

**Methods:** A descriptive cross sectional approach was adopted. Modified observational checklists based on World Health Organization (WHO) definitions were used in operating rooms (n = 34) and interview questionnaire was administered to HCWs (n = 318) at the Alexandria Main University Hospital.

**Results:** Safe injection procedures regarding final waste disposal were sufficiently adopted, while measures regarding disposable injection equipment, waste containers, hand hygiene, as well as injection practices were inadequately carried out. Lack of job aid posters that promote safe injection and safe disposal of injection equipment (100%), overflowing of sharps containers and presence of infectious waste outside containers (50%), HCWs not cleaning their hands with soap and water or alcohol-based hand rub (58.1%), and HCWs not wearing gloves during IV cannula insertion (58.1%), were all findings during observations. High prevalence of NSSIs was reported (61.3%), mostly during handling suture needles (50.8%). In addition, 66.2% of the injured HCWs were the original user of the sharp item which was contaminated in 80% of injuries. At time of NSSI, 79% HCWs were wearing gloves. The most common injured sites were left fingers (39.5%), and 55.4% of injuries were superficial. After exposure, 97.9% did not report their exposure. The source patient was not tested for HBV, HCV and HIV infection in more than 70% of injuries and 96.9% of injured HCWs did not receive post exposure prophylaxis.

**Conclusion:** The study highlighted that inadequately adopted safe injection procedures and insufficient injection practices lead to high prevalence of NSSIs in operating rooms.

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### 1. Introduction

“Needlestick injury (NSI)” is a puncture wound, cut, or scratches inflicted by medical instruments intended for cutting or puncturing (cannulae, lancets, scalpels, etc.) that may be contaminated with a patient’s blood or other body fluids. As needles cause more than 70% of sharps related injuries, the term (NSI)s is sometimes used instead or combined with sharp injuries (SIs).<sup>1,2</sup> A “Safe injection” is defined as one that does not harm the recipient, the provider or the community. Thus, the risk of infection of health care

workers (HCWs) from contaminated sharps and needlesticks should be considered part of a larger risk-factor group called “Unsafe injections”.<sup>3</sup>

Needlestick injury (NSI) is considered the second commonest cause of occupational injury within the National Health Service (NHS).<sup>2</sup> Occupational exposure to bloodborne pathogens from NSIs exposure is a serious problem in healthcare due to the high frequency and severity of the infections that can occur.<sup>4</sup> Centers for Disease Control and Prevention (CDC) estimate that each year 385,000 needlesticks and sharps injuries (NSSIs) are sustained by hospital-based healthcare personnel; an average of 1000 sharps injuries per day.<sup>5</sup>

The World Health Organization (WHO) estimates suggest that 1 in 10 HCWs worldwide sustain a NSI each year.<sup>6</sup> The WHO states that among the 35 million HCWs worldwide, about 3 million receive percutaneous exposures to bloodborne pathogens each year; 2 million of those to hepatitis B virus (HBV), 0.9 million to

Peer review under responsibility of Alexandria University Faculty of Medicine.

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<http://dx.doi.org/10.1016/j.ajme.2016.11.002>

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hepatitis C virus (HCV) and 170,000 to human immunodeficiency virus (HIV).<sup>7</sup> The estimated risks of transmission of infection from an infected patient to the HCW following a needle-stick injury are to be: hepatitis B – 3–10% (up to 30%); hepatitis C – 0.8–3%; HIV – 0.3% (mucous membrane exposure risk is 0.1%).<sup>8</sup> Data from Exposure Prevention Information Network (EPINET) system suggest that in an average hospital, workers incur approximately 27 needle-stick injuries/100 beds/year.<sup>9</sup>

An assessment done by the WHO Eastern Mediterranean Regional Office shows an average of 4 NSIs per year per HCW.<sup>10</sup> In Egypt, a study conducted in Gharbiya Governorate, showed that 66.2% of HCWs reported that they experienced at least one SI in their working life.<sup>11</sup> Another study was conducted at the 3 teaching hospitals of Alexandria University, reported that 67.9% of HCWs had at least 1 SI in the previous 12 months.<sup>12</sup>

The operating room continues to rank as one of the highest-risk hospital settings for percutaneous injury.<sup>13</sup> It is considered as the second most common site of sharps injuries after inpatient wards.<sup>2,14</sup> Of the estimated 384,000 needle-stick injuries occurring in hospitals each year, 23% occur in surgical settings.<sup>15</sup>

In developing countries, few efforts have been undertaken to raise awareness about (NSSIs) among HCWs and hospital managers, unsafe practices are common and there is an inadequate post-exposure management.<sup>6</sup> This study was conducted at the Alexandria Main University Hospital (AMUH), to assess procedures adopted in operating rooms for safe injection and sharp use, evaluate injection practices, and identify circumstances and factors contributing to NSSIs as well as post exposure management.

## 2. Material and methods

A descriptive cross sectional approach was adopted. All operating rooms at AMUH were observed (n = 34). All HCWs (surgeons, anesthetists, nurses, ancillary workers, and housekeepers) who worked in the operating rooms, and agreed to participate were included in the study (n = 318). The fieldwork of the study started in April 2014 throughout November 2014.

### 2.1. Study tools

#### 2.1.1. Modified observational checklists based on (WHO) definitions<sup>16</sup>

These checklists were used to assess *safe injection procedures* adopted in the operating rooms. Eighteen items were observed as follows: (i) disposable injection equipment: 5 items with a total score of 5; (ii) hand hygiene measures: 4 items with each item was a total score of 4; (iii) waste containers: 6 items with a total score of 6; and (iv) final waste disposal: 3 items with a total score of 3. Each item was given a score of either 0 (the safe measure not applied) or 1 (the safe measure applied). The absolute and percent score were calculated for each measure, then, the total percent score was calculated. Operating rooms were visited during morning shifts.

Moreover, observational checklists were used to assess *injection practices* including: safe preparation of injection, hand hygiene, use of antiseptics for cleaning the patient's skin before the procedure, use of new pair of gloves with each injection, needle recapping, and immediate disposal of sharps and infectious waste. Types of injections in operating rooms included intravenous injections, intravenous infusions, epidural, spinal, caudal anesthesia as well as central venous catheter and arterial line administration. In every operating room, observation of each type of injection was done once. Fifteen items were observed to assess injection administration practice. Each item was given a score of either 0 (the safe practice not done) or 1 (the safe practice done), then, the absolute and

percent score were calculated. The study included 62 observations of injection practices.

#### 2.1.2. Self-structured predesigned interview questionnaire<sup>5,16,17</sup>

It was administered to HCWs in the operating rooms to collect information about: (a) Sociodemographic and occupational characteristics; (b) Frequency of accidental exposure to NSSIs during the last 6 months; (c) Characteristics of the last NSSI experienced by the injured HCWs, regarding the type of sharp instrument causing the injury; the source of injury; the timing, the site and depth of injury as well as the use of gloves at time of exposure; and (d) Post-exposure management, regarding first aid measures; reporting; source patient and injured HCW blood testing for HBV, HCV, and HIV, post-exposure prophylaxis (PEP), and follow-up care.

#### 2.1.3. Interview questionnaire with infection control supervisor<sup>16</sup>

The head of infection control unit at AMUH was interviewed using a predesigned questionnaire based on World Health Organization (WHO) definitions,<sup>16</sup> in order to assess the injection and sharps safety policy adopted in the operating rooms. Questions were designed to collect information about the adoption of injection and sharps safety guidelines and healthcare waste disposal guidelines, the availability of training courses to HCWs, and provision of post-exposure prophylactic medications for high risk exposures.

### 2.2. Statistical analysis of the data

The collected data were coded and typed onto computer files using SPSS software program version 20.0.<sup>18</sup> Descriptive statistics included arithmetic mean (X), standard deviation (SD), frequency and percentages. Analytic measures included Chi-square test, and Monte Carlo test. The level of significance selected for results was 5% ( $\alpha = 0.05$ ).

### 2.3. Ethical clearance

The study was approved by the Research Ethics Committee at the Alexandria University Faculty of Medicine. Objectives of the study, procedures, types of information to be obtained, and publication were explained to HCWs. An informed consent was obtained from each participant in the study. Collected data were confidentially kept and insured.

## 3. Results

### 3.1. Safe injection procedures in the operating rooms (n = 34 operating rooms)

In the studied operating rooms, *disposable injection equipment* were not reused (100%), and no loose disposable phlebotomy equipment were found (100%). On the other hand, there was loose disposable needles and syringes outside of packaging and not disposed in a waste container (14.7%), and loose intravenous infusion equipment (2.9%). In addition, job aids posters that promote safe administration of injections were not found (100%). Moreover, blunt suture needles, sheathed scalpels, and other engineered sharps safety devices were not found. As regards *hand hygiene* measures, in all operating rooms, there were job aids posters for appropriate hand hygiene, besides, there was running water and povidone-iodine (Betadine) for washing hands as well as alcohol-based hand rub, however, there was no soap for hand wash (Table 1).

Additionally, there were separate *waste containers* for sharps, infectious and non-infectious waste in all operating rooms (100%), also, one or more sharps container "in stock" was available

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