THE COMPARISON OF SHARPS INJURIES REPORTED BY DOCTORS VERSUS NURSES FROM SURGICAL WARDS IN THE CONTEXT OF THE PREVALENCE OF HBV, HCV AND HIV INFECTIONS*

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The aim of the study was to evaluate the nature and frequency of sharps injuries among doctors and nurses from the same surgical/gynecological wards and the prevalence of HBV/HCV/HIV infection.

Material and methods. An anonymous cross-sectional sero-survey, with ELISA system used to detect anti-HBc, anti-HCV, anti-HIV, was conducted among 89 doctors and 414 nurses from 16 randomly selected hospitals in West Pomerania, Poland, between January-June 2009.

Results. During the preceding 12 months, 82% doctors and 44.4% nurses (p<0.0001) had sustained at least one sharps injury; 12.3% doctors vs 2.2% nurses (p<0.003) sustained more than 10 injuries. The multivariable regression model revealed that being a doctor was associated with a greater odds (OR 4.2) of being injured with sharps. Sixty nine percent of nurses sustained a hollow-bore needle injury vs 8.9% doctors; p<0.001. Anti-HBc were found in 16.4% of doctors and 11.2% of nurses, p>0.28; anti-HCV – in 1.1% of doctors vs 1.4% of nurses, p>0.79; no anti-HIV positive cases were found. The analysis of potential risk factors for contracting a HBV revealed that for both job categories only length of employment was associated with an increased odds of being infected.

Conclusions. Although the prevalence of HBV/HCV infection between doctors and nurses does not differ significantly, modifiable risk factors for contracting a BBI such as frequency and nature of sharps injuries may differ, which call for tailoring preventive measures to specific job categories. Long lasting exposure to injury events should be taken into consideration while assessing the risk for acquiring an occupational infection with HBV, HCV or HIV.

Key words: sharps injuries, blood-borne pathogens, HBV, HCV, HIV, prevalence, surgical staff, occupational exposure, occupational infection

Injuries caused by needles and other sharps medical devices are a major threat to the health and safety of health care workers (HCWs). The physical, and psychological suffering, the distress, consequent sickness from contracting hepatitis B (HBV), hepatitis C (HCV) and human immunodeficiency virus (HIV) and absenteeism resulting from such infections places further strain on already limited human resources in healthcare (1, 2). It is estimated that HCWs in Europe suffer 1 million needle-sticks injuries each year, of which 40% relate to nurses, although doctors are also at risk (1).

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Surgical staff might be considered at most risk of accidental viral infection due to their higher exposure to blood (3). Gynecologic, cardiovascular and orthopedic surgeries involve the highest frequency of injuries (2, 4). According to reports, cuts or needle-sticks may occur in as many as 15% of operations (3, 5). Surgeons and first assistants are at highest risk for injury, scrub nurses and scrub technicians sustain the second highest frequency of injuries (3, 6). Another study on hospital-based HCWs in Germany showed that surgical nurses had the highest average number of injuries during the last 12 months compared to other nurses (7).

Although many studies have examined sharps injuries in surgical setting, there is a lack of studies coming from Central Europe, particularly comparing directly doctors and nurses from the same wards and examining the possible health consequences of injuries such as HBV, HCV and HIV infections in both groups. The detection of differences in the epidemiology of sharps injuries and in the prevalence of blood borne infections (BBI) between doctors and nurses may help to tailor specific preventive measures to specific job categories.

The objective of this cross-sectional sero-survey was to compare the nature and frequency of sharps injuries among doctors and nurses from the same surgical/gynecological wards from randomly selected hospitals in Western Pomerania region, Poland, as well as the prevalence of HBV/HCV/ HIV infection in two job categories. In addition, the selected alleged risk factors for acquiring an occupational infection were evaluated.

MATERIAL AND METHODS

**Design and setting**: a cross-sectional sero-epidemiological study conducted from January to September 2009 among doctors and nurses employed in surgical/gynecological wards of 16 randomly selected hospitals in the region of Western Pomerania, Poland.

**Study population and sampling**: the sampling frames included a list of hospitals obtained from the local health department, multistage stratified sampling was used. First, all hospitals were stratified into urban and rural to ensure representation of different hospital levels, with random selection of 6 urban hospitals (2 teaching and 4 municipal) from Szczecin – the capital of the region, and 10 rural hospitals from the region. A pilot study was done in one selected teaching hospital (8) (the results included in the study). In the next step a stratified sampling of wards proportionate to numbers of surgical/gynecological wards was done for each hospital. Blood samples were obtained from all eligible doctors and nurses/midwives who gave informed written consent to participate.

**Study instrument**: a self-administered questionnaire included questions that anonymously queried medical personnel on the following: demographic: age, gender, job category; vaccination for hepatitis B; non-occupational risk factors for acquiring a BBI (previous surgery, transfusions, intra-venous drug abuse, tattoos, risk factors in sexual partners); occupational risk factors: years in practice, number and type of percutaneous injuries sustained during the last year, not wearing gloves routinely during the previous year, not reporting of exposures, type of ward, type of hospital.

Enzyme immunosorbent assays (ELISA) system version 3.0 were used to detect anti-HBc, anti-HCV and anti-HIV (Abbott Laboratories Inc., Abbott Park, Il, USA).

Testing was performed in the referential laboratory in the teaching hospital. All samples at or above the minimum positive value were considered reactive and repeated in duplicate. Results that were positive by two different assays were considered positive. Two weeks after sampling the participants could call the investigators and obtain their results by code. A specialist consulted participants with evidence of liver disease. The study received ethical approval from the Pomeranian Medical University Ethical Committee.

**Statistical analysis**: data were entered and validated using a customised program STATISTICA PL Version 7.1. (StatSoft Inc., 2005). In univariate analysis, for categoric variables groups were compared using the chi-square test with Yates’ correction and Fisher’s exact test; the U Mann-Whitney test was used for numeric variables. When more than two hypotheses were tested, Bonferroni’s correction for multiple comparisons was used (adjusted to number of hypotheses). All variables significant (p<0.05) in the univariate analyses were entered into logistic regression model with R software (9).
RESULTS

Demographics

Of the total 590 personnel eligible, 503 individuals (70.2%), 89 doctors and 414 nurses, consented to participate. Almost three thirds of doctors (66/89; 74.2%) were male and all nurses were female. Age for doctors ranged from 26 to 65 (median 42), for nurses – from 24 to 60 years (median 42). Mean years in practice for doctors was 16 years (range 1-40), for nurses – 20 (range 1-46). A half of participants (254/503; 50.3%) were from provincial hospitals, the rest from urban ones (157; 31.2% from teaching hospitals, 92; 18.3% from municipal hospitals). Approximately half of the doctors and nurses (276/503; 54.9%) were working in general surgery wards, 100/503 (19.9%) – at gynacologic wards, 34/503 (6.8%) at another surgical wards (orthopedics, thoracic surgery). In addition, 70 nurses were working in the operating room, 23 within the admitting area.

Injuries

During the preceding 12 months, 50.7% (255/503) of respondents (doctors 82%, nurses 44.4%, p<0.0001) had sustained at least one sharps injury. The median number of yearly injuries per doctor was 3, range 0-100 (interquartile range, 1-5/year), per nurse – 0, range 0-50 (interquartile range, 0-1/year). Doctors reported a total of 810 sharps injuries (mean 9.1) in the previous year, nurses – 555 (mean 1.3). The frequency of sharps injuries differed significantly among injured doctors and nurses (tab. 1). The multivariable regression model revealed that being a doctor and working at orthopedic ward were associated with a greater odds (OR 4.2 and 5.2 respectively) of being injured with sharps. Regarding the most recent injury, the majority of doctors had been injured by a solid needle while suturing (61/73, 83.6%) and several had sustained another injury, including 8.2% by a hollow-bore needle, 8.2% by an instrument and 1.4% by a glass made ampule. For nurses, 126/182 (69.2%) had been injured by a hollow bore needle, 13.7% by a needle while suturing, 8.8% while using an instrument and 8.3% by an ampule (fig. 1).

Table 1. Frequency of sharp injuries in the previous year among injured doctors and nurses from surgical/gynaecological wards. Western Pomerania region, Poland, 2009

<table>
<thead>
<tr>
<th>Number of injuries/year</th>
<th>Doctors n=73</th>
<th>Nurses n=182</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>number</td>
<td>%</td>
<td>number</td>
</tr>
<tr>
<td>1-5</td>
<td>51</td>
<td>69.9</td>
<td>169</td>
</tr>
<tr>
<td>6-10</td>
<td>13</td>
<td>17.8</td>
<td>11</td>
</tr>
<tr>
<td>&gt;10</td>
<td>9</td>
<td>12.3</td>
<td>4</td>
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</table>

Occupational risk factors for contracting BBI

More than three thirds of doctors (77.5%) and 84.5% of nurses (p>0.16) claimed they had never used safe needles or scalpels. Most of the doctors (91%) and nurses (92.3%) (p>0.67) wore gloves during invasive procedures. There were some missing answers regarding a question about recapping. For those who gave the answer, rates of avoiding recapping did not vary significantly by occupation; compliance was slightly higher among doctors, with 58.2% (39/67) never recapping needles, than among nurses, with 56.1% (212/378) never recapping; (p>0.34). Five of 89 doctors and 11 of 414 nurses, were not immunised due to clinical hepatitis B infection. From the remaining number, 1.2% of doctors were unimmunized for HBV, compared with 0% nurses (p<0.04).

Among 73 doctors who had sustained an occupational injury during the preceding year,
15% had reported the most recent injury, compared with 16.5% of nurses (p>0.92). Reasons for not reporting varied between occupations: the main commonly stated reason (56.7%) for doctors was the lack of time, for nurses – a belief that a patient was not infected (51.8%).

Non-occupational risk factors for contracting BBI

Of 414 nurses, 53.1% had any surgery in the past, 10.9% – received blood transfusion in the past, 8% had a tattoo application, 9.2% declared risk factors in sexual partner(s), 3.4% – intravenous drug abuse. Of 89 doctors, 36% had had any surgery, 4.5% – received blood transfusion in the past, 19.1% declared risk factors in sexual partner(s), none had had a tattoo application or reported intravenous drug abuse.

Prevalence of anti-HCV, anti-HBc and HBsAg

The prevalence of anti-HBc in doctors (11.2%; 95% CI:5.5-19.7%) was lower than in nurses (16.4%; 95% CI:13.2-20.3%) but did not differ significantly (p>0.28). The prevalence of anti-HCV in doctors (1.4%; 95% CI:0.03-6.1%) did not differ significantly (p=0.79) from the prevalence in nurses (1.1%; 95% CI: 0.7-3.1%). There was no anti-HIV positive case among the study participants (0/513; 0%. 95% CI:0-0.7%). A multivariate logistic regression model revealed that in nurses, for anti-HBc and anti-HCV seropositivity, only length of employment was associated with an increased odds of being infected (p<0.002; OR 3.19 and p<0.006; OR 2.8 respectively). In doctors, for anti-HBc seropositivity, only length of employment was associated with an increased odds of being infected (p<0.02; OR 12.1). Anti-HCV seropositivity in doctors was not taken to the analysis due to a small number of cases.

DISCUSSION

We found significantly higher frequency of sharps injuries and annual rates of injuries sustained in the previous year among the doctors compared to nurses working at the same wards. The multivariable regression model revealed that being a doctor was associated with a greater odds of being injured with sharps. Skin injuries among doctors mainly occurred from suture needles while among nurses from hollow-bore ones. The prevalence of markers of HBV and HCV infection did not differ significantly between doctors and nurses. The analysis of potential risk factors for contracting a HBV revealed that for both job categories only length of employment was associated with an increased odds of being infected.

Our findings, and others (10 – 13), confirm that injuries among doctors occur more often than in nurses. However, not many studies compared the nature and frequency of sharps injuries among doctors and nurses from the same wards, to our knowledge none compared it in the context of the prevalence of HIV/HBV/HCV infection.

The prevalence of infection in patients, determine the risk of infection among HCWs together with other factors such as the probability of transmission by contact with blood and a number of blood contacts (14). As doctors and nurses from our study had been working at the same wards, they had been caring for the same patients. The prevalence of HBsAg, anti-HCV and anti-HIV among surgical patients hospitalized on the same wards from which doctors and nurses, participants of the recent study, were recruited was studied by us previously (15) (0.9%, 1.1% and 0% respectively). The percentages of occupationally injured by sharps as well as rates of sharps injuries were significantly higher in doctors than in nurses, however, the prevalence of HBV and HCV in our study was similar in both job categories. It may be a result of several factors. As proven by our and other (15, 16, 17) findings, physicians’ injuries were mainly caused by suture needles which are believed (18) to be less efficient in transmitting BBI than hollow-bore ones. Secondly, it has been suggested that gloves may be less effective in removing blood from phlebotomy needles than from suture needles, as most of the blood is on the inside hollow portion of the needle (18). In addition, for a number of procedures surgeons use double gloving, which additionally reduce the volume of blood carried by a needle when the injury occurs (19, 20).

The analysis of potential risk factors for contracting a BBI revealed that, for both job categories, sharps injuries sustained during

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the 12 months before the study was conducted were not associated with an increased odds of being infected. In the multivariable regression model the only factor which was associated with an increased odds of being infected was length of employment. It seems that long lasting exposure to injury events and other blood and body fluids exposures rather than self-reported one-year sharps injury statistics should be taken into consideration while assessing the risk for accruing an occupational infection with HBV, HCV or HIV. Due to the fact that prior events are not fatal ones and not substantially disabling so as to remove the individual from exposure, a given HCW is at risk of re-injury. Injuries do not occur on random, nor do sharps injuries. In our study 30% of doctors and 8% of nurses/midwives sustained more than 6 percutaneous contacts in the previous year. Similar data come from our previous study and from an American study (20, 21). Another words, medical staff can not substantially disabling so as to remove the individual from exposure, a given HCW is at risk of re-injury. Injuries do not occur on random, nor do sharps injuries. In our study 30% of doctors and 8% of nurses/midwives sustained more than 6 percutaneous contacts in the previous year. Similar data come from our previous study and from an American study (20, 21). Another words, medical staff can sustained multiple sharps injuries. These repeated injury events are not independent, as the likelihood for further events is related to prior events and the injury outcome suffered.

The best way to protect against needlestick injuries is use of safety devices (22, 23). These devices are an important tool in the reduction of needlestick injuries which may result in a decrease in prevalence of BBIs. Sadly, such devices have not been widely implemented at Polish surgical wards yet.

It is disturbing that the majority of staff did not report their injuries, which is consistent with the other findings which had found reporting rates from 3 to 89% (12, 13, 14, 17, 23). Reasons for not reporting varied between occupations: the main commonly stated reason for doctors was the lack of time, for nurses – belief that a patient was not infective. Such perception is often erroneous, because patients with BBI can be unaware that they are infected. As proven by our previous study on 1652 surgical patients from the same hospitals in which the current study was conducted, asymptomatic patients infected with HBV and HCV posed a great risk of occupational infection (15). Therefore, HCWs should regard the blood of all patients as potentially infectious.

Potential limitations of this study include that it was confined to HCWs in hospitals from West Pomeranian region, and it may not be generalizable to all Polish hospitals. Another limitation was its reliance on self-reported injuries which raises the issue of underreporting. Participation or recall bias is also possible. In addition, exposures via mucous membranes were not evaluated in the study. Although the frequency of seroconversion per exposure to HIV, HBV or HCV infected blood in these situations is much lower than from inoculation injuries, these types of exposures might increase the overall risk of seroconversion (14).

Policies to reduce the frequency and health consequences of needle-stick injuries for surgical staff should focus on several interventions. For doctors the routine use of blunt suture needles for the closure of fascia and muscles should be recommended as published evidence shows their role in decreasing the risk of injuries. Another intervention would be to encourage the use of skin closure by wound-closing adhesive strips. Hands-free techniques and no touch techniques to minimize manual manipulation of sharps should be used whenever possible. For residents, further practical training in basic surgical techniques with handling solid needles, possibly with designated mentors, would be of value. The practice of wearing two pairs of gloves should be recommended as offering a higher degree of protection from sharps injuries (4, 18, 19, 24). Attention should be focused on introducing formal programs, on mandatory basis, to change the attitudes about the exposure risk. Such programs should include information on injury prevention and should be evaluated periodically to ensure effectiveness (24). So far, it seems that a training in infection control is not effective at Polish hospitals, as it does not influence positively safe work practices nor injury rates.

An introduction of safety devices is needed, especially for nurses. In Europe, the Directive 2010/32/EU approved on May 10 2010 requires Member State to implement within three years a global strategy to prevent occupational exposures in the healthcare setting, particularly with respect to needle-stick and sharp injuries, including the adoption, based on risk assessment, of devices incorporating safety features (25). Use of needle-less systems and appropriate disposal of needles to avoid recapping also needs to be encouraged. Furthermore, underreporting is an area that should be addressed so that doctors and nurses working at surgical suite recognize the importance of reporting of exposures. Administrative controls are neces-
sary to facilitate both: reporting process and surveillance of sharps injuries, as well as to create a universal reporting system, on a national scale.

Although the prevalence of HBV and HCV infection among doctors and nurses working at the same surgical wards is similar, risk factors for sharps injuries differ, which call for tailoring specific preventive measures to specific job categories, with special emphasis on personnel who sustain multiple injuries. Prevention truly begins when all of those, working in or for the health sector, are able and willing to accept that most injuries are preventable.

REFERENCES