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Preventability of percutaneous injuries in healthcare workers: a year-long survey in Italy

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Summary The aim of the study was to examine the preventability of percutaneous injuries either through the adoption of correct behaviour or by the use of needles with safety features. We analysed the report forms of occupational needlestick or sharps injuries in a sample of healthcare workers exposed to the risk of percutaneous injuries in the period between 1 June 2000 and 31 May 2001; the forms were returned to the regional SIROH (Italian Study on Occupational Exposure to HIV) centre in which all hospitals of the Piemonte region (Italy) participate. Percutaneous injuries caused by needles (injection, phlebotomy, infusion), suture needles and scalpels were analysed; three samples were extracted according to the type of device that caused the injury. In the sample of 439 needlestick-related percutaneous injuries, 74% were caused by incorrect health worker behaviour and 26% were unpreventable, seventy-nine percent of accidents caused by incorrect behaviour and 24% of accidents could have been prevented by using needles with safety features. In the sample of 221 suture needle and 114 scalpel injuries, incorrect health worker behaviour was identified in 26.2% and 14%, respectively, and unpreventable causes in 73.8% and 50.9%, respectively. A high rate of percutaneous injuries, especially those involving needles for injection, phlebotomy, infusion, and scalpels, could be prevented by adopting safe work behaviour practices and using personal protection equipment. The introduction of devices with safety features could lead to a significant reduction in the number of injuries from needles.

Introduction

Occupational exposure to bloodborne pathogens represents a major problem in healthcare due to the high frequency and severity of some of the infections that can occur. Most often the source of

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such transmission are needles and sharp instruments, which account for approximately 88% of injuries, with needles alone responsible for over 70%. Moreover, the percutaneous route exposes healthcare workers to a greater volume of biological fluids and infectious agents such as acquired human immunodeficiency virus (HIV), hepatitis B virus (HBV) and hepatitis C virus (HCV).[1]

The risk of occupational transmission of a bloodborne pathogen depends on the probability that an injury may occur, on the viral load in the injected volume and on the prevalence of the pathogen in the patient population. The first of these factors can be influenced by the healthcare worker and by healthcare policies.

Despite governmental regulations and training targeting healthcare workers, many do not appropriately apply isolation precautions,[3] which would reduce the probability of exposure to pathogens. As the adoption of precautions alone may not even be able to reduce the exposure to bloodborne pathogens, the use of medical devices incorporating safety features constitutes one of the more recent means to significantly reduce percutaneous injuries.[4]

NaSH data [National Surveillance System for Healthcare Workers, a voluntary surveillance system managed by the Centers for Disease Control and Prevention (CDC)] on an estimated total of 236 000 injuries per year show that 177 000 (75%) were preventable. Of these, 51 000 (21%) would be prevented by applying safe work practices, 58 000 (25%) by eliminating unnecessary use of needles, and 69 000 (29%) by using devices with safety features.[5]

According to estimates by the OSHA (Occupational Safety and Health Administration, USA), safe work practices, devices with safety features, personal protection equipment, post-exposure follow-up and education would protect 75% of unvaccinated individuals from HBV infection.[6] A study conducted at a university hospital in Paris showed that not recapping a needle, i.e. adoption of a safe work practice, reduced percutaneous injuries by 50%.[7]

In Italy, following the example of the US Exposure Prevention Network (EPInet), a standardized surveillance system for occupational exposure in hospitals, 127 hospitals participate in the SIROH (Studio Italiano sul Rischio Occupazionale da HIV). The objective of this study is to collect and analyse data regarding the accident, the presence of biological risk, the subjects and the place of exposure. A trend analysis of exposures in 18 hospitals participating in the SIROH-EPInet system from 1994 to 1998 (10 988 percutaneous exposures) showed a percutaneous exposure rate of approximately 13 per l00 beds.[2]

The objective of our study was to estimate, from a sample of healthcare workers exposed to percutaneous injuries in Piemonte region hospitals participating in the SIROH surveillance programme, the proportion of percutaneous injuries that would have been avoided by adopting the correct behaviour (use of protection equipment, and needle and sharps containers) and by adopting safe work practices. The proportion that could have been prevented by using devices with safety features was estimated from the total number of avoidable injuries involving needles.

Materials and methods

Preventability of occupational needlestick and scalpel injuries

We analysed the report forms of occupational needlestick or scalpel injuries in a sample of healthcare workers exposed to percutaneous injuries in the period between 1 June 2000 and 31 May 2001. The forms were returned to the regional SIROH centre in which all Piemonte hospitals participate (approximately 15 000 beds, 550 000 annual admissions, over 28 000 healthcare workers). Information was collected on the type of injury, and its preventability was evaluated case by case. Percutaneous injuries caused by needlesticks (injection, phlebotomy, infusion), suture needles and scalpels were analysed.

Preventability estimates were based on three factors concurrent at the time of the injury: (1) correct behaviour of the subject or other individuals involved; (2) use of personal protection equipment; (3) use of needles with safety features (when available on the market). Data were also collected on the non-preventability of the injury (e.g. unpreventable injury caused by sudden movement of the patient during blood draw or injection). Statistical data analysis was carried out using the SPSS statistics program.

Sampling

Three samples were extracted according to the type of device that caused the injury: a sample of 439 subjects was selected from 1077 needlestick injuries, and 114 subjects from 121 scalpel injuries. Suture needlestick injuries were analysed from the total documented by the report forms (221).

The samples were extracted assuming a preventability of 25% (range 22–28%) and a confidence level of 95%. The sample size was determined using the

EpiInfo6 program, and the sampling was carried out using the SAS statistical analysis program.

Results

Needlesticks

In the sample of needlestick injuries, 35.8% were caused by syringe needles, 46.2% by phlebotomy or infusion needles and 12.1% were injuries sustained from other types of needles; information was not available for 5.9% of injuries. Three hundred and twenty-five injuries (74.0% of the sample, CI 95%: 69.7–77.9%), would have been prevented by adopting safe work practices and using personal protection equipment, whereas 114 injuries were not preventable (26.0%; CI 95%: 22.1–30.3%). Table I lists the dynamics of the injury. If devices with safety features had been available, 258 preventable injuries (79.4%; CI 95%: 74.7–83.4%) and 27 not preventable injuries (23.7%; CI 95%: 16.8–32.3%) would have been avoided (Table II).

Suture needle injuries

In the sample of suture needle injuries, 58 were preventable (26.2%; CI 95%: 22.1–30.3%), and 163 were unavoidable (73.8%; CI 95%: 67.6–79.1%). In 36.7% of cases (CI 95%: 30.6–43.2%) the injury was not caused by the user. Table III lists the dynamics of the injury.

Table I Dynamics of needlestick injuries

	N	Percent	CI 95%
Preventable			
Use of kidney basin/drapes	32	7.3	5.2–10.1
Needle disposal in nonrigid containers/improper places	54	12.3	9.6–15.7
'Cobra like' effect[a]	14	3.2	1.9–5.3
Needle tip sticking out of rigid container	27	6.2	4.3–8.8
Needle transfer between two persons	1	0.2	0.0–1.3
Recapping	22	5	3.3–7.5
Cannula puncture during infusion	6	1.4	0.6–2.9
Injury on withdrawing needle from vessel/muscle	90	20.5	17.0–24.5
Injury while closing rigid container	5	1.1	0.5–2.6
During needle disconnection	13	3	1.7–5.0
During disposal	61	13.9	11.0–17.4
Total	*325*	*74*	*69.7–77.9*
Not preventable			
Injury while moving patient	8	1.8	0.9–3.6
Sudden movement of patient	63	14.4	11.4–17.9
During use	43	9.8	7.4–12.9
Total	*114*	*26*	*22.1–30.3*

[a] Twist of butterfly pipe during disposal and percutaneous injury in forearm.

Table II Preventability using needles with safety features

	N	Percent	CI 95%
Preventable	258/325	79.4	74.7–83.4
Not preventable	27/114	23.7	16.8–32.3

Scalpel injuries

In the sample of scalpel injuries, 56 were preventable (49.1%; CI 95%: 40.1–58.2%), and 58 (50.9%; CI 95%: 41.8–59.9%) were unavoidable. In 57.0% of cases (CI 95%: 47.8–65.7%) the injury was not caused by the user. Table IV lists the dynamics of the injury.

In all cases, the report form provided a description of the dynamics of the injury. In most cases, the description was accurate. When the description was inaccurate, the form was examined to reconstruct the dynamics of the injury. Incorrect modes of behaviour comprised:

- use of kidney basins or drapes instead of needle or sharp disposal containers, especially in bedside procedures;
- incorrect disposal of needles in non-rigid containers (workers sustain injuries when collecting waste bags) or leaving them in improper places (e.g. on the floor);
- inadequate use of rigid containers i.e. filled over marked capacity;
- common operative errors or inattention (34%) on completing the healthcare procedure (injection or phlebotomy) or during disposal of needles.

In the case of suture needles, the percentage of injuries that could have been prevented was markedly lower (26%) than needlesticks from phlebotomy or injection needles, because most occur during the suture procedure. It is noteworthy that approximately 10% of injuries occurred during needle transfer from one person to another, probably because the transfer is unannounced and the 'no-touch technique' was not used; 10% occurred in manoeuvering the needle tray and 4% of the healthcare workers sustained needlesticks from incorrect disposal of needles.

In the case of scalpels, the percentage of injuries during use was high (51%). Eighteen percent of injuries occurred during passage of the scalpel between persons, 6% due to incorrect disposal and

Table III Dynamics of suture needle injuries

	N	Percent	CI 95%
Preventable			
Use of kidney basin/drapes	1	0.5	0.1-2.5
Needles placed in nonrigid containers/improper places	9	4.1	2.2-7.6
While handling needle rack	6	2.7	1.3-5.8
Needle tip sticking out of rigid container	1	0.5	0.1-2.5
Needle transfer between two persons	21	9.5	6.3-14.1
While filling needle rack	7	3.2	1.5-6.4
During needle disconnection	2	0.9	0.2-3.2
During disposal	5	2.3	1.0-5.2
While washing surgical knives	4	1.8	0.7-4.6
Needle on trolley	2	0.9	0.2-3.2
Total	*58*	*26.2*	*20.9-32.4*
Not preventable			
Sudden movement of patient	4	1.8	0.7-4.6
During use	159	71.9	65.7-77.5
Total	*163*	*73.8*	*67.6-79.1*

13% during disposal or manoeuvering of instruments on the trolley.

Discussion

The adoption of safe work practices and the use of available personal protection equipment would have avoided most needlestick injures (74%). Sixty-five percent of needlesticks would have been prevented by using devices with safety features.

Table IV Dynamics of scalpel injuries

	N	Percent	CI 95%
Preventable			
Use of kidney basin/drapes	1	0.9	0.2-4.8
Scalpels placed in nonrigid containers/improper place	7	6.1	0.2-4.8
Improper use of scalpels	2	1.8	0.5-6.2
Scalpel sticking out of rigid container	2	1.8	0.5-6.2
Scalpel transfer between two persons	20	17.5	11.7-25.6
Recapping	1	0.9	0.2-4.8
Injury while closing rigid container	2	1.8	0.5-6.2
Taking scalpel apart	3	2.6	0.9-7.5
During disposal	11	9.6	5.5-16.5
Scalpel on trolley	4	3.5	1.4-8.7
During washing of surgical knives	3	2.6	0.9-7.5
Total	*56*	*49*	*40.1-58.2*
Not preventable			
During use	58	50.9	41.8-59.9
Total	*58*	*50.9*	*41.8-59.9*

The percentage of injuries that could have been avoided using these devices among unpreventable injuries is not high (23.7%) because they occur during the use of the needle.

To effectively reduce the number of exposures, a combination of measures should be instituted and directed towards healthcare workers: education and information about universal precautions, adoption of devices with safety features and review of the critical point in the practical procedures, disposal and elimination of devices.[4,8]

The conclusion to be drawn from our results is that a high percentage of percutaneous injuries, especially those involving needles for injection, phlebotomy, infusion, and scalpels, could be prevented by adopting safe work practices and using personal protection equipment. Particular attention should be directed towards the disposal of needles and sharps, both in terms of use of disposal containers and of correct handling and transfer techniques of suture needles and scalpels followed by correct disposal procedure.

The introduction of devices with safety features could lead to a significant reduction in the number of injuries from needles because healthcare operators are protected even when there is incorrect behaviour due to lack of education, or hurried manoeuvering in urgent situations, or major attention to the care to the patient rather than to one's own safety. The elevated costs of these devices do not currently allow their large-scale use in hospitals. In consideration of cost containment and reduction of the number of injuries, a compromise solution would be to identify those hospital units where percutaneous injuries could be prevented with devices with safety features and to introduce their use in these alone. However, the choice to adopt devices with safety features should not be based on economic aspects alone, as even if the number of HBV, HCV or HIV preventable infections in healthcare workers is not great, it bears ethical and legislative implications.

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