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Professional exposure of medical staff working in one of the hospitals of the Malopolska region between 2013 and 2016

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ABSTRACT

Introduction: Professional exposure of medical staff is an adverse event that might accompany the procedure of providing medical care.

Aim of the study: The objective of the study was the assessment of the incidence of professional exposure of medical staff providing medical care in one of the hospitals of the Malopolska region between 2013 and 2016.

Material and methods: In order to assess the exposure of medical staff an analysis of medical records from the period of 2013-2016 was carried out in the 5th Military Clinical Hospital and Polyclinic in Krakow. The source of information was an Individual Card of Professional Exposure including the results of blood tests or tests for other potentially infectious fomites. The study included all reported cases of professional exposure that appeared during the examined period in the examined 400-bed hospital.

Results: In the years 2013-2016 as many as 96 cases of professional exposure were observed, and they were more common in women – 70.8% and nurses – 50%. The dominating source of professional exposure was the operating theatre. The activities that potentially pose the highest risk of professional exposure included patient's treatment or surgery as well as collecting material for medical tests. An obvious exposure was observed in 72.9% of the cases, and blood was the statistically most common exposure material.

Conclusions: Despite significant professional exposure to fomites, especially to blood, no hepatitis B virus (HBV), hepatitis C virus (HCV), or human immunodeficiency virus (HIV) infections were observed in the examined medical staff.

Key words: professional exposure, medical staff, blood.

INTRODUCTION

In Poland there is no central register of professional exposure similar to the *Exposure Prevention Information Network* (EPINet), which is applied in many countries of the European Union and in the USA [1]. The lack of such a register makes is harder to assess the range of professional exposure that is an inherent risk factor while providing medical services. Although in scientific publications there can be found occasional reports about the incidence of needlestick injuries, cuts, or splashing during medical and nursing treatment, it is hard to determine which members of the medical staff are affected the most [2-5]. Moreover, available scientific publications describe this problem based on subjective diagnostic surveys, which present declared exposure rather than actual exposure [6-10]. Thus, the results describing the range of exposure may be underestimated or misinterpreted by researchers. In Poland there is a shortage of straightforward information about the range of exposure of medical staff to potentially infectious fomites depending on the place where medical treatment is provided, the character of the treatment, or correlation with particular medical units providing health care. It seems pointless to follow the procedure that used to be applied in the past, according to which any incidence of sharp injury was supposed to be registered in a special notebook, assuming that this particular person might develop a blood-borne

disease in the future. Only a few people, for their own safety, registered the incidence of needlestick or other sharp injuries. These entries were not followed by any consequences or further action. In the course of time, hospitals gradually introduced instructions on preventing infections including viral hepatitis or human immunodeficiency virus (HIV); however, they referred mostly to the issues such as patient's safety or keeping records [11]. Nowadays, binding provisions of labour law require that health care units should provide their medical staff with a safe and hygienic working environment, protect them against adverse circumstances, and prevent the spread of infections resulting from needlestick injuries or cuts [12]. The Council Directive 2010/32/EU of 10 May 2010 on prevention of sharp injuries in the hospital and healthcare sector, aiming at improving the conditions of the working environment, is in force in Poland [13]. This directive is the legal basis of the Regulation of the Minister of Health of 6 June 2013 [14]. Despite clear legal regulations, the problem of professional exposure remains a complicated issue undervalued by medical staff, managerial staff, and other decision-makers. The number of unwanted incidents is still growing. Therefore, it is essential to assess the risk factors of professional exposure in order to understand the danger that follows and to apply effective preventive strategies [15].

AIM OF THE STUDY

The objective of the study was the assessment of the incidence of professional exposure of medical staff providing medical care in one of the hospitals of the Malopolska region.

MATERIAL AND METHODS

An analysis of medical records from the period 2013-2016 was carried out in the 5th Military Clinical Hospital and Polyclinic in Krakow. The study included all reported cases of professional exposure that appeared during the examined period in the examined 400-bed hospital, both in surgical and non-invasive treatment wards. The hospital provided medical treatment in the operating theatre, hospital accident and emergency unit, dental clinic and in other units including neurology, cardiology, general surgery, pulmonology, otolaryngology, ophthalmology, traumatology, orthopaedics, internal diseases, intensive care, anaesthesiology, neurosurgery, and an isolation unit.

The source of information for the analysis was an Individual Card of Professional Exposure including the results of blood tests or tests for other potentially infectious fomites. The data obtained from these records included: the date of the exposure, practised profession, the ward in which the exposure took place, results of post-exposure test, type of fomites, procedure during which the exposure took place, exposed part of the body, applied means of personal protection, applied post exposure procedure, personal details of the exposed person, as well as information about their vaccination and level of anti-HBs.

Formal consent of the hospital administrator was obtained in order to examine medical records and carry out the study. Medical records were analysed following the rules of personal data protection and the ethical principles for medical research defined by the Declaration of Helsinki. All documents examined in this analysis were complete and included all incidents of professional exposure recorded in the hospital between 2013 and 2016. Statistical analysis of the obtained results was conducted. Differences between variables were verified by means of χ^2 test of independence. The choice of nonparametric test was made according to the nominal character of variables. The level of significance was assumed at $p < 0.05$, and statistical calculations were carried out with the application of IBM SPSS Statistics 20 software.

RESULTS

As many as 96 cases of professional exposure to blood or other potentially infectious fomites were reported in the examined hospital in the period between 2013 and 2016. Three people reported to have been exposed twice, so the exact number of medical staff exposed to potentially infectious fomites was 93. In 2013 only 12 cases of exposure were reported (12.5% of all 96 reported cases), in 2014 the number of incidents reached 27 (28.1% of all 96 reported cases), in 2015 the number reached 24 (25% of all 96 reported cases), whereas in 2016 as many as 33 cases were reported, which made up 34.4% of all the cases reported between 2013 and 2016. In 2014 the number of reported exposures was more than twice as many as in 2013. A significant increase could also be observed in 2016 when the number of exposures was almost three times higher than in 2013. The differences in the incidence of exposure in particular years was statistically significant ($p = 0.0208$). Professional exposure was more common in women 70.8% ($n = 68$) than in men 29.2% ($n = 28$). No statistically significant correlation was observed between the number of cases reported in particular years and the gender of medical staff (Table 1).

The group consisting of nurses turned out to be the one that was exposed to infectious fomites the most, at 50% ($n = 48$), whereas doctors who experienced such exposures made up 36% of all medical staff examined ($n = 34$). The other medical staff members who reported exposure worked as paramedics 7% ($n = 7$), medical assistants 6.3% ($n = 6$), or a physiotherapist 1.0% ($n = 1$) (Figure 1).

Table 1. The number of reported cases of exposure between 2013 and 2016 and the respondents' gender

Year	Number of reported cases		Gender			
			W		M	
	n	%	*n*	%	*n*	%
2013	12	12.5	9	9.4	3	3.2
2014	27	28.1	18	18.7	9	9.4
2015	24	25.0	19	19.8	5	5.2
2016	33	34.4	22	22.9	11	11.4
Total	96	100.0	68	70.8	28	29.2
	$p = 0.0208$		$p = 0.7028$			

n – number of cases, W – women, M – men.

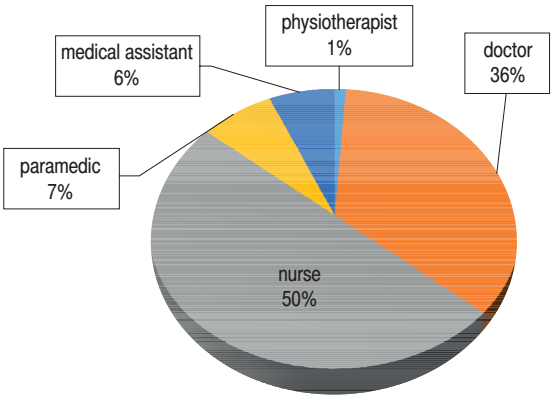

Figure 1. Exposure incidence and respondents' profession

No statistically significant correlation was found between the workplace and the number of exposure cases in particular years. There were some slight differences, which indicated that in 2013 exposure cases were more common in medical staff other than doctors and nurses (physiotherapists, paramedics, and medical assistants). In turn, in 2014 doctors experienced professional exposure more frequently than nurses or other medical staff, and in both 2015 and 2016 such exposure was more common in nurses than in doctors or other medical staff (Table 2).

Professional exposure cases were most common in the operating theatre – 24% (*n* = 23), and slightly fewer cases were observed in intensive care and the anaesthesiology ward 12.5% (*n* = 12) or the cardiology ward 11.5% (*n* = 11). Medical staff working in the hospital accident and emergency unit reported 9.4% of exposure cases (*n* = 9), and only occasional cases were observed in other wards. No significant differences were observed in the number of exposure cases in particular years as far as various hospital wards are concerned (Table 3).

Most professional exposure cases 81.3% (*n* = 78) took place during day shifts, between 7 a.m. and 7 p.m. In a few rare cases 18.8% (*n* = 18) exposure was observed during night shifts, between 7 p.m. and 7 a.m. No correlation was observed in particular years between the number of exposure cases and their time. Slight differences implied that in 2015 exposure was more common between 7 p.m. and 7 a.m. (33.3%), whereas in 2016 between 7 a.m. and 7 p.m. (35.9%).

The incidence of needlestick injuries was the most frequent reason of professional exposure, at 79.2% (*n* = 76), and less frequently it was splashing 15.6% (*n* = 15) or cuts 5.2% (*n* = 5). Every medical staff

Table 2. The number of reported cases of exposure between 2013 and 2016 and the respondents' profession

Year	Profession									
	Physiotherapist		Doctor		Nurse		Paramedic		Medical assistant	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
2013	1	100.0	6	17.6	2	4.2	1	14.3	2	33.3
2014	0	0.0	12	35.3	12	25.0	3	42.9	0	0.0
2015	0	0.0	6	17.6	15	31.3	1	14.3	2	33.3
2016	0	0.0	10	29.4	19	39.6	2	28.6	2	33.3
Total	1	100.0	34	100.0	48	100.0	7	100.0	6	100.0
	$p = 0.1106$									

n – number of cases

Table 3. The number and percentage of reported cases of exposure between 2013 and 2016 in particular units

Unit	Number of reported cases in total and in particular years									
	Total		2013		2014		2015		2016	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Operating theatre	23	24.0	0	0.0	10	43.5	5	21.7	8	34.8
Pulmonology	3	3.1	0	0.0	0	0.0	1	33.3	2	66.7
Neurology	4	4.2	1	25.0	1	25.0	2	50.0	0	0.0
Otolaryngology	6	6.3	1	16.7	1	16.7	1	16.7	3	50.0
Ophthalmology	1	1.0	0	0.0	0	0.0	0	0.0	1	100.0
General surgery	6	6.3	1	16.7	1	16.7	0	0.0	4	66.7
Traumatology and orthopaedics	5	5.2	0	0.0	0	0.0	3	60.0	2	40.0
Internal diseases	8	8.3	3	37.5	4	50.0	0	0.0	1	12.5
Intensive care and anaesthesiology	12	12.5	2	16.7	3	25.0	4	33.3	3	25.0
Cardiology	11	11.5	1	9.1	2	18.2	3	27.3	5	45.5
Neurosurgery	3	3.1	1	33.3	0	0.0	2	66.7	0	0.0
Isolation unit	1	1.0	0	0.0	0	0.0	1	100.0	0	0.0
Dental clinic	4	4.2	1	25.0	2	50.0	1	25.0	0	0.0
Hospital accident and emergency unit	9	9.4	1	11.1	3	33.3	1	11.1	4	44.4
Total	96	100.0	$p = 0.2557$							

n – number of cases

member who experienced professional exposure in the form of needlestick injuries or cuts was wearing safety gloves at that time. These types of exposure usually took place while taking samples for tests and/or during a treatment/surgery, in each case the percentage reached 21.9% (*n* = 21). In 18.8% of cases the exposure circumstances were different, including administering anaesthetics, stopping bleeding, inserting stitches, nursing, or rehabilitation. Professional exposure was less common during injections, at 14.6% (*n* = 18); inserting/removing PVC (peripheral venous catheters), at 12.5% (*n* = 13); or cleaning, at 10.4% (*n* = 10) (Figure 2).

Blood was reported to be the most frequent infectious material 86.5% (*n* = 83), whereas in 5.2% of cases (*n* = 5) it was respiratory system secretion and in another 5.2% of cases the fomites were not identified. There were also single cases of exposure to human tissue, some unidentified body fluid, or other fomites – 1.0% (*n* = 1) in each case. The findings show that blood was a significantly more frequent infectious material in particular years, although in 2013 fluids and secretions other than blood were also a significant infectious factor (Table 4).

In 70 cases (72.9%) the exposure was obvious, and in another 19.8% of cases (*n* = 19) it was only a potential exposure. There were some cases of splashing fomites on healthy skin 5.2% (*n* = 5), or no information about the type of exposure was given 2.1% (*n* = 2). No statistically significant correlation was found between the type of professional exposure and its incidence in particular years.

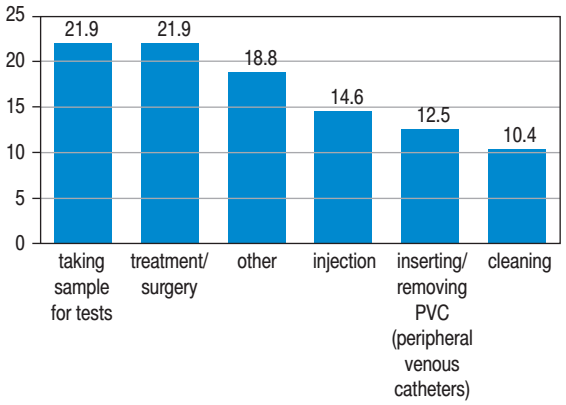

Figure 2. Exposure incidence and activities during which it took place

All the people who experienced professional exposure had taken a complete cycle of hepatitis B vaccination 36 months prior to this undesired event. In 68.1% of respondents who experienced exposure (*n* = 62) the level of anti-HBs exceeded 100 IU/l, less frequently, in 27.5% of respondents (*n* = 25), it ranged between 10 and 100 IU/l. Only in a few cases was the level of anti-HBs antibodies lower than 10 IU/l.

No statistically significant differences were found in particular years in the level of anti-HBs antibodies in the respondents who experienced exposure. In almost all respondents examined on the day of exposure negative test results were obtained as far as anti-HBs and anti-HIV antibodies are concerned, and only in one case was the anti-HBs antibodies test positive.

Table 4. Exposure incidents and the type of infectious fomites

Type of infectious fomites	Number of exposure incidents in particular years							
	2013		2014		2015		2016	
	n	%	*n*	%	*n*	%	*n*	%
Blood	7	58.3	26	96.3	23	95.8	27	81.8
Other	5	41.7	1	3.7	1	4.2	6	18.2
$p = 0.0052$								

n – number of cases

The serological status of patients who were the source of exposure to hepatitis B antigen was negative in most cases, at 91.7% (*n* = 88). Positive results were observed in only 2.1% of patients (*n* = 2), in a few cases the source of exposure was unknown 5.2% (*n* = 5), and in one case no consent to collect blood samples for hepatitis B virus (HBV), hepatitis C virus (HCV), HIV tests was obtained from the patient who was the source of exposure. In the majority of patients, 80.2% (*n* = 77), hepatitis C antigen was negative as well. Moreover, the HIV antigen tests turned out to be negative for the vast majority of patients who were the source of exposure 90.6% (*n* = 87). Positive results of the test were observed in only three patients – 3.1% of all cases. Three members of medical staff were qualified for HIV infection prevention procedure. This procedure was applied in two cases (a doctor and a nurse) because the third person (a paramedic) rejected the offer of pharmacological prevention of HIV infections. None of the respondents who reported the incidence of exposure to biological material in the examined period of time were infected with HBV, HCV, or HIV.

DISCUSSION

Between 2009 and 2016 as many as 1462 cases of occupational diseases that affected medical staff and social workers were recorded in the Central Register of Occupational Diseases. In 2016 this percentage was 42.6% lower than in 2009. The average annual incidence rate in these years reached 26.3 per 100,000 employees [16]. Although a decrease in the number of reported cases of occupational diseases has been observed in recent years in Poland, hepatitis is still likely to remain the most frequent occupational disease in the group of medical staff. The main infectious factor is in this case exposure to blood or other infectious fomites, and almost every other case of an occupational disease reported by medical staff refers to nurses [16]. This study also shows that exposure was most frequent in nurses and then in doctors, who made up one third of all exposed employees. These findings are confirmed by Szczypta *et al.*, according to whom the most numerous group that experienced exposure were nurses (67.8%) and then doctors (29%) and then other medical staff (1.5%). However, the studies by Gańczak *et al.* carried out in obstetrics and gynaecology wards showed that doctors were more susceptible to professional exposure (76.2%) than nurses (57.3%) [3]. It is worrying that both doctors and nurses frequently fail to report the incidence of professional exposure even if they realise what consequences may follow the lack of post-exposure treatment [17-19]. It is reassuring, though, that the study of Garus-Pakowska and Górajczyk conducted in a group of health care workers showed that the period of employment coincides with the need to protect against professional exposure such as needlestick injuries (OR 1.33, 95% CI: 0.99-1.78) [10]. Unfortunately, this study belongs to a group of only a few similar ones which emphasise the positive prevention measures applied by medical staff, because the other sources point out that professional exposure which is not reported at all makes up 27% to 80% of all incidents of sharp injuries that are experienced while providing medical service [9]. In the examined hospital the incidence of exposure was more common during day shifts (7 a.m. to 7 p.m.) – 81.3% than at night – 18.8%. The most frequent exposure locations included the operating theatre (24%) and intensive care and anaesthesiology ward (12.5%). It might have resulted from the fact that most medical procedures were conducted just in this time and place. The studies carried out by Pelc in the Hospital in Przeworsk show that in the years 2010-2013 in a group of 31 health-care workers who reported an incidence of exposure nearly a half of all cases happened in the operating theatre [20]. Similar results were obtained by Kocur *et al.* in the City Hospital in Zabrze in the years 2006-2015, where also the operating theatre was the place where the incidence of exposure was the most frequent [4]. Similarly, the studies of Szczypta *et al.* also show that medical treatment facilities were the main place where the incidence of exposure was observed (72% of the cases of exposure reported in this hospital) [2]. On the other hand, Garus-Pakowska and Szatko discovered in their studies that it was not only the staff working in medical treatment facilities that were vulnerable to exposure, but also health-care workers employed in non-invasive treatment wards [19].

In Poland the incidence of sharp injuries is quite frequent in numerous health-care facilities. According to the studies conducted by Pelc [20], as many as 20 out of 31 cases of exposure were connected with medical procedures such as inserting/removing PVCs (peripheral venous catheters), and taking blood samples for tests or injections, which in the studies by Szczypta *et al.* made up 77% [2]. In this study sharp injuries made up 79.2% of all exposure cases, and fingers (67.7%) and hands (15.6%) were the most exposed body parts. Similarly, in the study by Paruzel *et al.* fingers and hands were the most vulnerable to exposure, at 75.4% and 11.5%, respectively [21].

It is widely acknowledged that the risk of sharp injuries can be minimised by wearing protective gloves. It has been proven that gloves may form a barrier in the event of needlestick injuries and block off as much as 86% of blood when a solid needle is used and 50% of blood in the case of a hollow-bore needle injury. Protective gloves are also a preventive measure against direct contact with potentially infectious material [22]. In this study all the respondents declared that they were wearing protective gloves at the time of exposure. However, the findings of the study by Gańczak *et al.* were more worrying because even though every ninth respondent declared that they were wearing gloves at the time of contact with potentially infectious material, every 20th respondent admitted not doing it at all [3]. Another survey conducted in a group of 487 health-care workers in 26 Polish hospitals showed that nurses, more often than others, for example doctors or paramedics, took their protective gloves off in order to facilitate medical procedures. The difference was statistically significant (p = 0.036). Moreover, the tendency to take off their protective clothing significantly coincided in the examined group with a longer period of employment (OR 1.16, 95% CI: 0.995-1.36) [10]. Unfortunately, Jonczyk *et al.* in their study also discovered that the longer the nurses' period of employment, the more vulnerable they were to injuries [6].

In the authors' own study, it was difficult to determine the direct cause of professional exposure, but it seemed to be the most common while collecting material for laboratory tests or during surgeries. Nevertheless, the results of other studies show that a direct cause of professional exposure may be not only negligence or mistakes while performing the procedure but also a so-called sense of urgency [23, 24]. This term is defined as a sense of pressure to perform the task as quickly as possible due to work overload and/or understaffing. According to Jonczyk *et al.*, professional exposure resulted from rushing [10], whereas, according to Piatek, its causes included rushing and tiredness, understaffing, and too many patients who had to be looked after by one nurse during her/his shift [25]. Mehrad *et al.* claim that there is a correlation between psychosocial factors including stress at work and vulnerability to injuries in nursing staff [26]. Garus-Pakowska and Górajski noticed that apart from rushing (31.4%) and lack of attention in health-care workers (27%), also unexpected behaviours of patients may be the results of injuries during medical procedures [10]. In recent years in Poland a significant shortage of medical staff has been observed, and consequently, an inadequate number of nursing and medical procedures that the staff must perform while looking after patients [27, 28].

In 1993 the European Parliament approved a law that recognised hepatitis virus as the most serious risk factor for medical staff. Since 1989 the number of vaccinated health-care workers has been gradually growing, and obligatory vaccination has been introduced [29]. In the examined hospital all health-care workers who experienced exposure had taken a complete three-dose cycle of hepatitis B vaccination 36 months prior to this undesired event, and their level of antibodies was sufficient.

There are no HCV or HIV vaccines, and therefore it is essential to take proper preventive measures such as reporting the cases of professional exposure in order to introduce proper post-exposure prevention procedures [2].

Medical staff should do their duties and follow procedures in a responsible and reliable way. They should not be afraid of taking care of patients who are infected with HIV, HBC, or HCV or those who are carriers of blood-borne pathogens. They should not be afraid that patients are not obliged to inform the medical staff about their being carriers of some infectious diseases. This concern and anxiety are not always connected with the knowledge that medical staff possess. Knowledge does not always have a significant influence on the change of attitude towards self-protection against infections, including the act of reporting the incidence of exposure. It might result from the fact that the procedure of reporting exposure is highly formalised or, which is even more likely, from the common belief shared by medical staff that professional exposure is an inherent element of their work and reporting it is a waste of time. Inefficiency of obligatory training sessions carried out among medical staff, faulty methods of teaching or social approval and assent given when the incidents of exposure are not reported are also the reasons of improper behaviour of medical staff as far as reporting undesired events is concerned.

CONCLUSIONS

Despite significant professional exposure to fomites, especially to blood, no HBV, HCV, or HIV infections were observed in the examined medical staff.

It is vital to introduce safe equipment to medical and nursing treatment so as to eliminate any professional exposure.

Although professional exposure is most frequently observed in nurses and doctors, the other medical staff (including the cleaning staff) should also be properly educated as far as professional exposure to infections is concerned.

Disclosure

The authors declare no conflict of interest.

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