ORIGINAL PAPER

DOI: https://doi.org/10.20883/jms.2017.128

Can a healthcare worker be a source of an infection of a patient – a risk of transmitting the chickenpox and shingles virus VZV by the staff of hospital wards – preliminary research findings

Joanna Stryczyńska-Kazubska[1, 2], Ilona Małecka[1, 2], Maria Biskupska[1], Bartosz Bilski[1], Dorota Pietrzycka[3], Jacek Wysocki[1, 2]

[1] Department of Preventive Medicine, Poznan University of Medical Sciences, Poland
[2] Specialistic Hospital for Mother and Child, Poznań, Poland
[3] Department of Neonatology, Poznan University of Medical Sciences, Poland

ABSTRACT

Introduction. Chickenpox is a highly infectious disease, caused by the *Varicella-zoster* virus. An infection during pregnancy poses particular risk, as it may have serious consequences for both the pregnant woman and the fetus. The only effective and safe method of preventing chickenpox is protective vaccination.
Aim. This study aims to assess the risk of contracting the *Varicella-zoster* infection in a selected population of hospital workers, as well as the further transmission of the virus to newborns, mothers and older children.
Materials and Methods. A survey was conducted in September 2014 in three public hospitals in Poznań, among nurses and midwives working in paediatric, neonatal and maternity wards. 136 nurses and midwives participated in the survey.
Results. The analysis of the findings reveals that 114 staff members of the hospital wards, i.e. 83.82%, have had chickenpox in the past, 14 respondents (10.29%) have never had this illness, and 8 (5.88%) do not know if they have been ill, which means that 16% of the respondents could potentially contract chickenpox. For the majority of nurses and midwives (103) the infection had taken place before they started work. However, 11 respondents (8,08) were infected during employment.
Conclusions. 1) Nearly one out of 4 hospital staff members had no history of chickenpox contraction at the beginning of their employment. 2) Nearly 15% of the workers confirm that at the beginning of employment their immunity status was established on the basis of an interview. 3) The majority of employees negatively interviewed for chickenpox history have not been recommended to be vaccinated against this disease.

Keywords: chickenpox, healthcare staff, vaccinations

Introduction

Chickenpox is a highly infectious disease, caused by the *Varicella-zoster* virus (VZV), which belongs to the group of *Herpesviridae*. The infection is reactivated in the form of shingles.

Every year around 150–200 thousand people contract chickenpox, out of which 1,000 require hospitalisation, due to the severe course of the disease and complications. 208,276 cases of chickenpox were reported in 2012, whereas 1,364 persons were taken to hospital – which means that 1 in every 153 patients was hospitalised. In 2013 – 178,379 infections were reported [1].

As many as 90% of cases of chickenpox affect children and adolescents up to the age of 15 [2]. In many countries there are no precise statistics related to

this disease. However, data collected in the course of observational studies reveal a large scale of the problem of chickenpox infections and the resulting complications in the countries where mass preventive programmes through vaccinations are not run [3]. A large German study showed that the frequency of hospitalisation resulting from chickenpox and its complications before the introduction of the preventive vaccinations programme was 14.1 out of 100,000 children up to 16 and the rate for infants was 89.5 out of 100,000 [4].

The following groups of patients are particularly vulnerable to the severe course of chickenpox [2, 5]:

- persons with primary and secondary immunodeficiency,
- pregnant women,
- preterm newborns, born before the 28th week of pregnancy, regardless of the serological situation of the mother, as well as preterms born from seronegative mothers after the 28th week of pregnancy,
- newborns, particularly those whose mothers contracted chickenpox 5 days before or 2 days after birth,
- patients with chronic skin diseases (e.g. atopic dermatitis), or respiratory diseases.

Particular attention should be paid to the issue of the VZV infection during pregnancy, as it may have serious consequences for both the pregnant woman and the fetus [2]. Infection in the first 20 weeks of pregnancy carries a 2% risk of the innate chickenpox syndrome in the infant, with the hypoplasia of limbs, low birth weight, scars on the skin, microcephaly, chorioretinitis, cataracts and other organ lesions, as well as a 30% risk of death in the first months of life [6]. Chickenpox also poses a risk for the pregnant woman, particularly in the third trimester of pregnancy, as it causes a risk of pneumonia with the VZV etiology, which may lead to death in as many as 45% of cases [6].

Due to the high infectivity of chickenpox, the only effective and at the same time safe method of its prevention is protective vaccination.

Healthcare workers are a professional group which, on the one hand, is exposed to the risk of infection through contact with patients, or infected material and, on the other hand, may become a source of infection for patients. The latter aspect, often disregarded, imposes a moral obligation on the healthcare staff and personnel to protect themselves from infections, especially those which can be prevented through vaccination. In the first place this obligation refers to the staff and personnel members who have contact with patients from the risk groups of the severe course of the disease and complications, i.e. patients with chronic illnesses, newborns, infants, and pregnant women. The role of healthcare workers in transmitting infections of influenza and diphtheria has been described and documented. VZV infection also belongs to this group of diseases.

According to American standards only staff and personnel members with documented immunity to the VZV infection may have contact with patients with chickenpox, disseminated shingles, or uncovered skin lesion related to shingles. Nevertheless, it should be pointed out that a patient's infectivity starts 2 days before the appearance of the first symptoms, so it is difficult to conduct such a selection of workers from the beginning [7]. Therefore, it would be justified to introduce a mandatory test of the level of the IgG antibodies among staff and personnel of infectious diseases wards and vaccinate those who do not have the immunity against the VZV virus.

Aim

The research objective was to assess the risk of the chickenpox virus infection in the selected population of workers of hospital wards and the further transmission of the virus to newborns, mothers and older children.

Material and Methods

Diagnostic survey was used as a method. On the basis of literature and the authors' professional experience, an original questionnaire was formulated. It consisted of eight closed questions, related to the respondents' chickenpox history (two questions), their decision to get vaccinated against chickenpox (two questions), their contact with the VZV at work (one question), as well as the medical care provided by the occupational physician in terms of the chickenpox prevention (three questions). Along with the above mentioned questions, the respondents' demographic data were collected (gender, age, work experience, occupation, workplace, education).

The survey was conducted in September 2014 in three public hospitals in Poznań, among nurses and midwives employed in paediatric, neonatal and maternity units, as well as in delivery rooms and wards of pregnancy pathologies. The medical staff and personnel selected for the survey had contact with patients who run the highest risk of contracting chickenpox with a severe course and complications. 136 employees took part in the survey: 58 (42.65%) nurses and

Table 1. Characteristics of the surveyed group of health professionals

Total number of respondents	N = 136
Gender	women 97.8% (n = 133) / men 2.2% (n = 3)
Neonatal/maternity/other wards	neonatal ward – 63.24% (n = 86) paediatric ward – 18.38% (n = 25) maternity ward – 5.88% (n = 8) delivery room – 6.62% (n = 9) pregnancy pathologies ward – 5.88% (n = 8)
Age	20–30 – 22.8% (n = 31) 31–40 – 27.9% (n = 38) 41–50 – 40.5% (n = 55) > 50 – 8.8% (n = 12)
Work experience	< 10 – 36.8% (n = 50) 10–20 – 25.7% (n = 36) 21–30 – 32.4% (n = 44) > 30 – 5.1% (n = 7)

78 (57.35%) midwives. Data related to the group of respondents are presented in **table 1**.

The quantitative study was conducted by means of the JMP 4.0.2. statistical programme.

Results

The conducted analysis shows that 114 of the surveyed employees of hospital wards, i.e. 83.82%, have had chickenpox in the past, whereas 14 respondents (10.3%) have not had this disease, which means that more than 16% of the survey participants are potentially vulnerable to contracting chickenpox. The majority of the nurses and the midwives, i.e. 75.74% (103 respondents) were infected with the *varicella* virus in the pre-employment period. However, 11 respondents (8.08%) were infected during their employment. Thus, if a similar survey had been conducted for this population at the moment they were beginning their employment, the proportion of persons with the chickenpox history would have been 24.26% (33 persons). These data have been illustrated in **Figure 1**.

As many as 91 respondents (66.91%) have had contact with a patient with chickenpox or shingles at work. However, only 20 survey participants (14.70%) declare that the occupational physician asked them about their *varicella* history during the interview before employment. Nearly a third of the respondents i. e. 38 respondents (27.95%) did not hear such a question, whereas 78 persons (57.35%) do not remember if this issue was raised during the medical interview. In the population of healthcare workers with no history of *varicella*, only in 2 cases the occupational physician informed them about a possibility of getting vaccinated and only in one of these cases such vaccination would have been financed by the employer. Only two persons from the group of employees with negative *varicella* history got vaccinated, which accounts for only 9.09%. On the other hand, 50% of this group (11) would not decide to get vaccinated, even if the procedure were financed by the employer. As few as 8 respondents (36.36%) would take advantage of the procedure and 3 persons (13.65%) have no opinion in this matter (**Figure 2**).

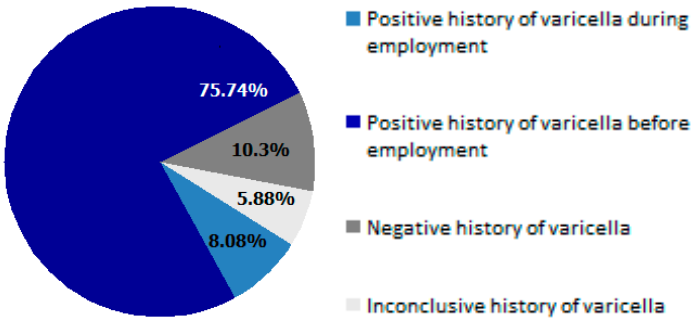

Figure 1. The percentage of respondents surveyed for *varicella* infection before the onset of work

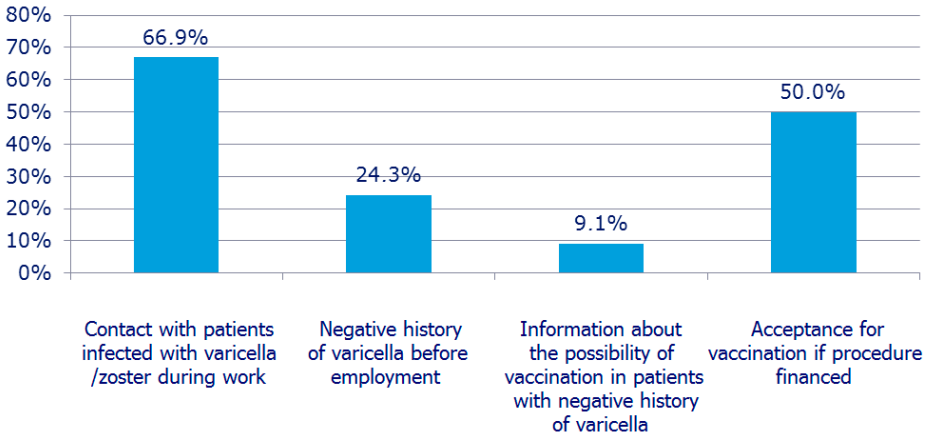

Figure 2. Selected aspects of prevention and treatment in the surveyed group of health care professionals

Discussion

Among the surveyed healthcare staff and personnel who have contact with patients from the groups of a high risk of a severe course of *varicella* infection, at the moment of the survey every sixth of them cannot be regarded as immune to the virus, on the basis of the interview. Almost 10% of the respondents were infected with *varicella* during their employment in the hospital. In other words, at the onset of employment in hospital wards every fifth person should be considered vulnerable to VZV infection in their first professional contact with a patient. Literature based on the results of serological tests for the VZV antibodies in the IgG class reveals that the proportion of staff vulnerable to infection is lower [8, 9]. A Spanish study showed 95% of seropositive healthcare employees, as opposed to 83% in our research [8]. In compliance with the guidelines of the Centre for Disease Control and Prevention (CDC), staff members who, until the moment of exposure, had not been vaccinated against chickenpox and who cannot be deemed immune on the basis of the generally accepted criteria (documentation, serological test, or two doses of vaccination), in the case of a contact with a patient with chickenpox, disseminated shingles, or uncovered shingles rush, should be removed from work between the 8th and the 21st day from the contact [7].

Only around 15% respondents declare that at the onset of their employment they were asked about their history of *varicella* infection, the majority of them do not remember this fact, whereas nearly every third respondent claims that such interview never took place. Among the employees without documented immunity, only two were informed about the indication for vaccination against chickenpox. Over 66% of respondents have had contact with patients infected with VZV in the course of their professional activity. As the research shows, the majority of employees participating in the survey are exposed to contact with patients infected with VZV. Lack of information and a failure to undertake preventive actions poses a risk for employees to be infected with the *varicella* virus and to further transmit it. Taking into account the fact that infectivity starts 2 days before the first symptoms of chickenpox, the procedure of removing a staff/personnel member from work upon the appearance of the first symptoms does not seem justifiable. Instead, the recommended by CDC principle of removing from work employees potentially vulnerable to infection would bring much better results. Unfortunately, in Poland there are no guidelines for collecting data related to employees' immunity, which substantially hampers effective protection of patients exposed to the risk of infection.

The presented findings definitely indicate a high proportion of healthcare workers who, on the one hand, are vulnerable to infection with the chickenpox and shingles virus, and on the other, are themselves a potential source of infection for patients. The most worrying facts are: the lack of knowledge about the state of immunity of workers, the lack of awareness of the necessity of taking a preventive action by means of protective vaccination among healthcare employees, as well as the lack of appropriate procedures for situations when an employee has had contact with a person infected with VZV. A case of chickenpox infection in the maternity ward in Częstochowa, described in *Medycyna Praktyczna* magazine, may serve as an example. The Director of the hospital underlines the fact that 3 members of the maternity ward workers were removed from work for 2 weeks. However, undertaking the proper action in this situation was difficult because of

the fact that no data about the employees' immunity against VZV had been collected before.

The findings related to the recommendations with respect to VZV vaccinations for employees who are not immune to the chickenpox virus are equally alarming. Only 9% (2 persons) of those who were not proven to have the immunity, were recommended to get vaccinated, and only one person was offered a vaccination at the employer's cost. Lack of such recommendations in Polish healthcare institutions, shown by this research, results from the absence of official guidelines for vaccinating medical staff against the chickenpox virus in Poland. It is worthwhile to mention the fact that the recommendations for vaccinating employees vulnerable to chickenpox, particularly those working in paediatric, gynaecological-maternity, oncological, and intensive care units, have been issued by the German Standing Committee on Vaccination at the Robert Koch Institute (STIKO), CDC, Immunization Action Coalition, Green Book and Royal College of Physicians in Great Britain and others [7, 11–14].

The recommending bodies stress the fact that the risk of a hospital infection with the *varicella* virus disrupts the organisation of hospital care and the necessary preventive measures are time-consuming and costly.

Taking into account the security of patients and the staff, functioning of healthcare institutions and the costs, it seems justified to expand the recommendations for protective vaccinations of the healthcare staff in Poland [15–17]. On the basis of literature, as well as the findings of the conducted research, it is reasonable to consider performing serological tests of medical staff with a negative history of chickenpox.

Another disquieting fact are the data revealing that only a half of the surveyed nurses and midwives would decide to get vaccinated against *varicella*, even if the procedure were financed by the employer.

The Society for Healthcare Epidemiology of America emphasises the fact that protective vaccinations of healthcare employees are safe and effective and serve the purpose of protecting both the staff and the patients. Moreover, the introduction of an educational programme for medical staff has substantially improved the proportion of vaccinated healthcare employees. The Society is of the opinion that if the percentage of the vaccinated employees remains low, the vaccinations should be made mandatory [18]. A further question that arises here is whether or not vaccinations against chickenpox should become a part of the Vaccination Calendar.

Conclusions

1. Nearly every fourth healthcare employee could not be regarded as immune to VZV at the onset of their employment, on the basis of the interview.
2. Less than 15% of workers confirm that at the beginning of their employment in a healthcare institution their immunity status was established by means of an interview.
3. The majority of employees with a negative *varicella* history were not recommended to get vaccinated against chickenpox.
4. It is worthwhile to consider routine testing of the staff of infectious diseases wards for the *varicella* antibodies and persons without the immunity should be obligatorily vaccinated.
5. It would be justified to introduce vaccinations against chickenpox into the Vaccination Calendar.

Acknowledgements

Conflict of interest statement
The authors declare no conflict of interest.

Funding sources
There are no sources of funding to declare.

References

1. Państwowy Zakład Higieny: Meldunek roczny o zachorowaniach i zatruciach związkami chemicznymi w Polsce w 2012 i 2013 roku. www.pzh.gov.pl (accessed: 19.01.2015).
2. CDC: Prevantion of Varicella. Recommendation of the Advisory Committee on Immunization Practices. MMWR. 2007;56(RR04):1–40.
3. Bonnani P, Breuer J, Gershon A, Gershon M, Hryniewicz W, Papavangelou V et al. Varicella vaccination in Europe – Talking the practical approach. BMC Medicine. 2009;7:26.
4. Liese JG, Grote V, Rosenfeld E, Fischer R, Belohradsky B, Kries R et al. The burden of varicella complications before the introduction of routine varicella vaccination in Germany. Pediatr Infect Dis J. 2008;27(2):119–124.
5. Linder N, Waintraub I, Smetana Z, Barzilai A, Lubin D, Mendelson E et al. Placental transfer and decay of varicella-zoster virus antibodies in preterm infants. J Pediatr. 2000;137:85–89.
6. Sauerbrei A, Wutzler P. Neonatal varicella. J Perinatol. 2001;21:545–549.
7. CDC: Immunisation of Health-Care Personnel: Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR. 2011 Nov. 25;60(RR07):1–45.
8. Urbiztondo L, Bayas JM, Broner S, Costa J, Esteve M, Campins M et al. Varicella-zoster virus immunity among health care workers in Catalonia. Vaccine. 2014 Oct 14;32(45):5945–5948.
9. Vandersmissen G, Moens G, Vranckx R. Occupational risk of infection by varicella zoster virus in Belgian

healthcare workers: a seroprevalence study. Occup Environ Med. 2000 Sep;57(9):621–626.
10. Kołton R. Ospa wietrzna na oddziale położniczym. mp.pl/szczepienia (accessed 19.01.2015).
11. Varicella Zoster Virus. Occupational aspects of management. A National Guide. Royal College of Physicians London 2010. https://www.rcplondon.ac.uk (accessed: 19.01.2015).
12. Statement of the German Standing Committee on Vaccination at the Robert Koch Institute Recommendations of the Standing Committee on Vaccination (STIKO) at the Robert Koch Institute / Effective. 2013 Aug;26:34.
13. Healthcare Personnel Vaccination Recommendations. Immunization Action Coalition Saint Paul, Minnesota. http://www.immunize.org (accessed: 19.01.2015).
14. Varicella. https://www.gov.uk/government/collections/immunisation-against-infectious-disease-the-green-book (accessed: 19.01.2015).
15. Bilski B. Wybrane problemy profilaktyki i epidemiologii zawodowych chorób zakaźnych w Polsce. Wydawnictwo Naukowe Uniwersytetu Medycznego im. Karola Marcinkowskiego w Poznaniu, Poznań 2013.
16. Rozporządzenie Ministra Zdrowia i Opieki Społecznej z dnia 30 maja 1996 r. w sprawie przeprowadzania badań lekarskich pracowników, zakresu profilaktycznej opieki zdrowotnej nad pracownikami oraz orzeczeń lekarskich wydawanych do celów przewidzianych w Kodeksie pracy. Journal of Laws No. 69, point 332 of 1996.
17. IDSA, SHEA, and PIDS Joint Policy Statement on Mandatory Immunization of Health Care Personnel According to the ACIP-Recommended Vaccine Schedule. December 2013.

Acceptance for editing: 2016-1-20
Acceptance for publication: 2017-03-27

Correspondence address:
Maria Biskupska
Department of Preventive Medicine
Poznan University of Medical Sciences
11 Smoluchowskiego Street, 60-179 Poznań, Poland
phone/fax: +48 618612243
email: maria.biskupska@pwsz.edu.pl