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Varicella — a potential threat to maternal and fetal health

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ABSTRACT

Objectives: The aim of the study was to evaluate the following: i) number of midwives and nurses at risk for contracting varicella; ii) effectiveness of infectious disease prevention among healthcare personnel; iii) attitude of healthcare personnel towards immunization.

Material and methods: A total of 524 midwives and nurses from obstetric, neonatal, and pediatric wards were investigated. Quantitative data analysis was performed.

Results: Overall, 14.7% potentially seronegative respondents were identified. Out of those with a positive history of varicella, 6.56% contracted the disease after starting work, and > 70% had contact with the varicella-zoster virus. Overall, 9.54% of the respondents had a history of varicella, 3.12% were informed about the possibility of immunization, and 1.56% of those with a negative history of the disease were offered a state-funded vaccine. In the same group, the number of vaccinated people amounted to 13.28%, and 26.13% would accept a state-funded vaccine.

Conclusions: Varicella may constitute a significant threat to maternal and fetal health at obstetric, neonatal, and pediatric wards, which must be considered when providing care to women in the reproductive age. Occupational health physicians should confirm the immunity status of the patients and suggest immunization to seronegative subjects. Regular workshops are necessary to update the knowledge of medical professionals and patients in order to shape their attitudes and beliefs about immunization.

Key words: varicella, infection, obstetric care, healthcare personnel

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INTRODUCTION

Despite great advances in the field of infection control, preventive vaccination, and a broad spectrum of preventive measures, infectious diseases continue to pose a serious threat to healthcare personnel and patients. Healthcare professionals with no history of infectious diseases, which offers permanent disease immunity, and those who had not been vaccinated may be both, at risk for contracting the disease and also a source of infection for their seronegative patients [1].

Varicella

Varicella is a highly contagious, although vaccine-preventable, disease caused by the varicella-zoster virus (VZV) — a member of the α-herpes subfamily. The primary infection causes varicella, whereas reactivation of the latent virus leads to the development of herpes zoster. Disease presentation in children includes a characteristic rash, with high fever, while in adults it may be accompanied by the general feeling of fatigue, headaches, and muscle ache. The incubation period lasts from 10 to 21 days and patients become contagious 1 day before rash onset until the lesions have crusted [2]. In Europe, over 90% of children will have contracted varicella by the age of 10–12. In Italy and Turkey, the rates in the same age group are slightly lower, which is probably associated with higher average temperatures and different model of childcare [3]. Varicella is frequently portrayed as a mild and 'compulsory' childhood disease. However, cases of severe disease course and even death have been reported. Adults, patients with primary or secondary immunodeficiency, and pregnant women are at high risk for severe disease course. Typically, medical history and the characteristic rash are sufficient to confirm varicella, although speedy diagnosis of an acute infection is

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also possible using PCR amplification of VZV DNA obtained from a pustule or the throat. Serological diagnosis of past infection is usually performed using ELISA to measure the level of specific IgG antibodies against VZV, with the result of ≥ 5IU/mL to confirm immunity [4].

Varicella in pregnancy

Varicella during pregnancy is extremely rare and, despite being described as a serious infection by most obstetric handbooks, complex disease prevention leaves much to be desired in many countries. Maternal varicella is associated with higher risk for varicella pneumonia with a severe course, while fetal risk is associated with congenital varicella syndrome (CVS) and neonatal varicella. CVS develops in fetuses born to mothers who contracted varicella until 28 weeks of gestation. It presents as scarring skin lesions, malformations of the lower limbs, defects of the central nervous system and eyes, and psychomotor retardation. It is connected with a 30% mortality rate in the first months of neonatal life and a 15% risk of developing herpes zoster between 2 and 41 months of life. Congenital varicella is caused by transplacental transmission or the neonatal respiratory route after birth. Regardless of the fact that varicella-related mortality has lowered over the recent years, neonates born < 28 weeks of gestation or with birthweight of < 1000 g are at particularly high risk for severe disease course. Infection during the perinatal period (from 5 days before up to 3 days after birth) poses a difficult obstetric-neonatal problem but maternal herpes zoster during the perinatal period offers no immediate threat, owing to the transplacental mother-to-fetus passive transfer of immunity [5].

Prevention

Immunization, recommended by the World Health Organization (WHO) since the 90s, remains the gold standard for varicella prevention. Monovalent and multivalent (MMR-V) vaccines are currently registered in a one or two-dose schedule and contain a live, attenuated VZV. The one-dose schedule lowers the mortality rates and the severity of the disease course, whereas the two-dose schedule additionally decreases the incidence and the number of disease centers. Seronegative young adults and adults, groups at risk for severe course, selected groups with lowered immunity and people from their surroundings should be vaccinated. WHO emphasizes the importance of medical history of varicella and immunization of seronegative women who plan to conceive. Vaccination during pregnancy is not recommended but the literature lacks reports about neonates with CVS born to women who were immunized during pregnancy. WHO recommends immunization of all healthcare workers or at least those who provide care to high-risk groups, including neonates born < 28 weeks of gestation and with birth weight of < 1000 g [6].

Varicella at hospital wards

Recently, only one account of an infection at an obstetric ward has been reported in Poland. Varicella was diagnosed in one parturient and forced the hospital management to seal the ward and refuse admissions. Due to the lack of effective screening, three employees whose immunity status was unclear were not allowed to work. Additional costs were connected with the necessity of using varicella zoster immune globulin (VZIG) in four neonates, and the need to monitor women and children who had contact with the infected woman during hospitalization [7]. Another case, avoidable if adequate measures had been applied, took place a few years earlier in Australia. A pregnant woman in the early phase of varicella spent an hour in the waiting room with other gravidas and oncologic patients. As a result, 105 patients had to be followed, out of them 26 required serological testing and 4 had to receive VZIG [8]. The costs of varicella infection at an intensive care unit were similar [9]. Notably, varicella infection in healthcare centers may be associated with severe consequences, financial burden, and possible litigation claims from the exposed patients.

OBJECTIVES

The aim of the study was to evaluate the following: i) number of midwives and nurses potentially at risk for contracting varicella; ii) effectiveness of medical care as far as infectious disease prevention among healthcare personnel is concerned; iii) attitude of the healthcare personnel to immunization.

MATERIAL AND METHODS

Based on the available literature and our experience, an original questionnaire has been designed. It included eight close-ended questions about: exposure to varicella (3), care and prevention provided by occupational health physician (3), and decision to undergo immunization (2). Demographic data were also collected.

The study was conducted between September 1, 2014 and December 30, 2014 in ten state hospitals from the Wielkopolska Region among nurses and midwives who have direct contact with women during the perinatal period, neonates and infants. Written informed consent was obtained. The response rate was 536 out of 580 anonymous questionnaires; 524 properly completed questionnaires were further processed.

Respondent characteristics

Overall, 197 (37.59%) respondents worked at obstetric wards which are classified as tertiary, 91 (17.37%) — second-

Table 1. Characteristics of the study population

Total number of the respondents	N = 524
Sex	Women 97.14% (n = 509) Men 2.86% (n = 15)
Ward	Neonatal — 34.73% (n = 182) Pediatric — 13.93% (n = 73) Obstetric — 15.8%) (n = 79) Delivery — 20.61% (n = 108) Pathology of pregnancy — 9.16% (n = 48)
Age	20–30 — 16.03% (n = 84) 31–40 — 22.14% (n = 116) 41–50 — 39.93% (n = 204) > 50–22.90% (n = 120)
Work experience (in years)	< 10–23.47% (n = 123) 10–20 — 24.05% (n = 126) 21-30 — 33.01% (n = 173) > 30–19.47% (n = 102)
Education	secondary 41.03% (n = 215) B.A. 27.67% (n = 145) M.A. 31.30 % (n = 164)

ary, and 212 (40.46%) — primary referral centers, whereas 24 (4.58%) worked at pediatric hospitals. Demographic data are presented in Table 1.

RESULTS

Exposure (see: Table 2)

Healthcare (see: Table 3)

Attitude towards immunization among respondents with negative varicella history (see: Table 4)

DISCUSSION

Based on the analysis, the characteristic of the study group, i.e. the fact that over 60% of the respondents were > 40, and > 50% had and > 20-yearwork experience, constitute an important factor to consider. In other words, most respondents completed their education during the time when facts about immunization against varicella were not included in the school curriculum, and vaccines were either not yet introduced or even unavailable in Poland.

Exposure

Analysis of the medical history detected 14.7% of respondents who either never had varicella or had no recollection of having contracted the disease, thus being potentially seronegative, at risk of infection, or a possible source of the virus. Importantly, out of the 396 subjects with positive history of varicella, 26 (6.56%) contracted the disease after starting work. Numerous respondents had contact with VZV after starting work: > 30% with varicella, > 25% with varicella and herpes zoster, and > 30% with herpes zoster. Taking into account a small number of vaccinations in Poland, the probability of contact with the virus is considerable, especially in home environment.

Analysis of the incidence of varicella in Poland presents a challenge due to the fact that the member states of the EU, Lichtenstein, Norway and Island (EU/EEA) are not obligated to monitor these rates, thus lacking a unified system of data collection. The passive surveillance model, also applied in Poland, may result in underestimation of the incidence rates [2].

Between 2010 and 2015, the incidence in Poland ranged from 448.67/100 000 in 2011 to 575.9/100 000 in 2014, and was high as compared to other countries of the Eastern Europe. The incidence ranged from 164/100 000 in Latvia

Table 2. Exposure to varicella among nurses and midwives

History of past infection					
Positive		Negative		Uncertain	
Number	%	Number	%	Number	%
396	75.57	77	14.70	51	9.73

Time of infection			
Before starting work		After starting work	
Number	%	Number	%
370	93.44	26	6.56

Contact with VZV after starting work									
With varicella		With herpes zoster		With varicella and herpes zoster		Do not remember		No contact	
Number	%	Number	%	Number	%	Number	%	Number	%
164	31.30	69	13.17	136	25.95	1	0.19	154	29.39

Table 3. Healthcare

History of varicella collected during the first occupational health appointment					
Yes		No		Do not remember	
Number	%	Number	%	Number	%
50	9.54	166	31.68	308	58.78
Varicella vaccine recommended by an occupational health doctor to patients with negative history of varicella					
Yes		No		Do not remember	
Number	%	Number	%	Number	%
4	3.12	93	72.66	31	24.22
Employer-funded vaccine offered to patients with negative history of varicella					
Yes		No		Do not remember	
Number	%	Number	%	Number	%
2	1.56	103	80.47	23	17.97

Table 4. Attitude towards immunization

Varicella immunization					
Yes		No		Do not remember	
Number	%	Number	%	Number	%
17	13.28	109	85.16	2	1.56
Willingness to undergo state-funded vaccination (if appropriate)					
Yes		No		Undecided	
Number	%	Number	%	Number	%
29	26.13	36	32.43	46	41.44

(mass immunization against varicella) to 481/100 000 in Poland (immunization only in selected groups) [10]. The WHO-approved herd immunity for varicella occurs when 91% of the population is immune. In practice, most neonates are seropositive due to the antibodies from their seropositive mothers, which do not guarantee protection from the disease. At one year of age, the level of disease immunity reaches the lowest values, only to increase later. In Poland, studies on immunity against varicella are scarce and were conducted only in young populations. Their results have indicated a low level of immunity, e.g. 97.31% among subjects aged 18–19, or 95% and 98% among children and teenagers (aged 1–19), respectively [11, 12].

A review of the serologic studies on the immunity to varicella in the European countries among various age groups confirms the existence of considerable differences. Data on immunity to varicella among women are vital from the obstetric point of view. Studies in pregnant women revealed a relatively high level of immunity (93–99%), but the rate was significantly lower in inhabitants of London originally from Bangladesh (88%). Research among women in the reproductive age from Croatia, Tuscany, and Amsterdam found their immunity against varicella to be 84%, 82%, and 100%, respectively. Women from tropical and subtropical countries are more often seronegative [13]. Particularly low level of immunity (73.2%) was observed in studies carried out in a large group of patients of all ages in Norway. Low level of immunity to varicella was detected in all age groups for children, while, in comparison, the immunity among 15–19-year-olds in Poland was 89.5%. A satisfactory level of immunity (91.9%) was not found in the age group of 30–34, and a similar level (> 91%) persisted in older age groups [14]. In Israel, mean level of immunity to varicella was 87.6%, but a statistically significant difference was detected between individuals born in (87.7%) and outside (91.7%) Israel. The highest level of immunity (97.2%) was noted among the Eastern populations (Africa, Asia, Middle East) [15]. In light of the immigration waves in Europe, the study from Lower Saxony in all immigrants aged > 12, carried out between 2014 and 2015, seems particularly valuable. Most participants (87.5%) turned out to be seropositive, butthe immunity level was statistically significantly different between immigrants from various countries (Sudanese — only 64%). What is important for the organization of the obstetric care, immunity against varicella was different for various age groups, with the lowest scores in the group of 12–29-year-olds (reproductive age) — 84.9%, and the highest among people aged > 45 years — 94.3% [16]. The

literature offers no studies on the level of immunity among healthcare personnel in Poland, although the results of several studies from various parts of the world have been published. In Asia, disease immunity among healthcare personnel varies considerably, e.g. 71% in Iran, 91% in Singapore, and 95% in Laos [17–19]. In Jordan, mean levels of immunity were 92.1% and 92.5% for doctors and nurses, respectively [20]. Similarly high level (98.2%) was observed for healthcare personnel in Turkey [21]. Despite the lack of data from Europe, studies about Belgium and Italy immunity rates revealed high scores as well (98.5% and 97.9%, respectively) [22, 23]. Almost all of the above mentioned reports emphasize the effect of positive and negative history of varicella on immunity. Most authors believe that negative history does not necessarily signify seronegativity but positive history does not guarantee seropositivity. Since the levels of detectable antibodies have decreased, more sensitive diagnostic tests are needed.

Care

Only 9.54% of the respondents confirmed, 31.68% denied and 58.78% did not remember whether their varicella history was collected during the first occupational health appointment. Only 4 people were informed about the possibility of immunization, and even fewer were offered state-funded vaccination by their employers. Patient age also seems to be important — vaccines have been available in Poland since 2004. In Europe, only 13 countries (but not Poland) recommend immunization against varicella to seronegative healthcare personnel [2]. Varicella vaccination program has been implemented in the USA since 1996, which makes it the longest program on record. According to the American recommendations, all healthcare personnel should have documented immunity against varicella, including confirmation of a 2-dose vaccination for varicella or laboratory-confirmed immunity, or doctor-confirmed history of varicella or herpes zoster [24]. In Poland, the latest recommendations advise an accelerated vaccination schedule, which includes obligatory vaccination of people at particular risk for the disease, whereas recommended vaccination includes children, teenagers, and adults who had no history of the disease or varicella immunization, children who received only 1 dose of the vaccine with the varicella component, who did not have varicella without age limitations, and individuals >9 months of life after exposure to varicella, up to 72 hours since contact, and women who wish to conceive and have no history of varicella infection [25].

The vaccination schedule for 2016 was based on the above mentioned recommendations but, despite efforts to make it more detailed, it also failed to include healthcare personnel [26]. Recommendations and standards of preventive measures in pregnant women include a number of recommendations for the pre-conceptual and pregnancy care. Regardless, medical history to establish pregnancy risk does not include varicella [27, 28]. Employment laws concerning medical care also do not mention history of varicella, including serological testing and immunization of the healthcare personnel [29]. Possible changes in the prevention of varicella programs should take into account the above mentioned studies on disease immunity among the immigrants and recommendations issued by the European Centre for Disease Prevention and Control in 2015 [30].

Attitude to immunization

Analysis of the attitudes to immunization against varicella among patients with negative history of the disease has revealed that 13.28% of them were vaccinated — the number being relatively high for a country without any social campaigns supporting immunization. Surprisingly, only a small number of the respondents (26.13%) would accept state-funded vaccine, and > 70% either oppose immunization or have no opinion about that matter. Undoubtedly, age and knowledge have both played an important role in the decision-making process. Regardless, it seems prudent to follow the studies on anti-vaccination movements, attitudes to vaccination among patients and personnel, and measures which ought to be undertaken to improve the situation. Despite successful immunization programs, the number of people refusing vaccination remains high. Fear of the disease has been replaced with fear of adverse effects, which contributes to anti-vaccination movements [31].

A review of the literature about the willingness of healthcare personnel to undergo vaccination, emphasized three key elements of the decision process: knowledge, attitude, and beliefs [32]. In a study from Holland, a small number of professionals and patients supported the notion of introducing mass vaccination schedule against varicella (21% and 28%, respectively), but most physicians opted for immunization in groups at risk for severe course. Reluctance to vaccinate has its roots in the perception of varicella as a childhood disease with a mild course [33]. In Holland, a study has been conducted about the decision to immunize immigrants, the majority of which were willing to vaccinate their children. However, they pointed to the existence of a language barrier, insufficient amount of information, and problems in reaching vaccination centers [34]. Obviously, lack of sufficient knowledge about immunization among the respondents is the priority concern, and thus studies on varicella in pregnancy conducted by French gynecologists and obstetricians ought to be mentioned. Their unsatisfactory results seem to confirm the need to constantly update the information about vaccines [35].

CONCLUSIONS

Taking into account various arguments in favor of changes in varicella prevention in the obstetric care, it is important to bear in mind that scientific evidence opposing immunization is scarce, whereas the amount of data supporting vaccination is considerable. Varicella may constitute a serious threat to maternal, fetal, and neonatal health, and there is no possibility of post-exposure immunization of pregnant women. Thus, it is vital to focus on women who plan to conceive and medical personnel in contact with pregnant patients, newborns and infants. All these efforts require cooperation in the following areas: modification of the immunization schedule, occupational medicine care, recommendations for obstetric care, as well as regular trainings for professionals and patients to update their knowledge and shape their attitudes and beliefs. In the absence of simple solutions, it is necessary to establish a dialogue with people who oppose immunization, express understanding, get to know their arguments and present contra-arguments, but most importantly to not leave them without specialist care.

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