

EPIDEMIOLOGICAL CHARACTERISTICS OF THE WHOOPING COUGH IN SERBIA AND SUMADIJA REGION

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Whooping cough – pertussis - is an acute, infective disease caused by sensitive gram negative pleomorphic bacterium *Bordatella pertussis*. The source of the infection is an infected person with typical or atypical clinical picture. Once recovered, patients are usually immune, with a long-term, but not a life-long immunity. Vaccination is a method of choice in the prevention of the disease.

The main aim of the study was to present the spread of the disease and death toll from pertussis in Serbia and the Sumadija region, depending on vaccination.

The following data were considered: the number of the affected patients, the number of deaths and death toll, incidence, lethality and mortality rates in relation to the administration of three doses of DTP vaccination. There is a difference in the disease rate and vaccination status in the regions of central Serbia, Kosovo and Metohija and Vojvodina.

The results from central Serbia and Vojvodina indicate that the number of the affected persons in 1993 trippled, after which it was lower and relatively stable until 1997 when it started to decrease rapidly together with the incidence. Mortality, however, has not been recorded since 1985. In recent years in the Sumadija region there have been some sporadic cases of the disease in infants up to one year of age, mostly in non-vaccinated ones.

As the only disease preventable by a vaccine with an increasing rate worldwide, it is quite interesting from our standpoint, since we are also faced with the possibility of an increased incidence in our country. Vaccinated children older than ten years of age will be at the highest risk. A booster dose administration should be considered after ten years of age. *Acta Medica Medianae* 2009;48(1):31-36.

Key words: Pertussis, cough, vaccination

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Introduction

Whooping cough-pertussis (MKB-10: A37) is an acute, infective disease caused by the sensitive gram negative pleomorphic bacterium *Bordatella pertussis*. There are other organisms like *Bordatella parapertusis*, *mycoplasma pneumoniae* that can cause pertussis-like syndrome (1,2,3).

The causative agent is very sensitive to disinfectants and antibiotics in the outer environment. This disease, which has been known since the 11th century, commonly affects children and is characterized by a distressing coughing. Characteristic paroxysm of coughing is not developed in all affected school children and adults. A persistent cough can be present for more than three months alongside vomiting that commonly follows the episodes of coughing. Bordet and Gengou first isolated the causative bacillus of whooping cough in 1906. Leslie and Garner established four antigen phases of the

causing agent in 1931, and in the same year Kendrick developed the first potential whooping cough vaccine (4,5).

The source of infection is an infected person with typical or atypical clinical picture. Infected people are contagious the most from the last stage of incubation up to about 3 weeks after the cough begins. In the untreated children contagiousness may last four to five weeks, and in treated children a week or two. Contagiousness decreases during the course of the disease. Healthy germ carriers do not exist after the disease has been cured. The bacterium *B. pertussis* enters mucosis of the middle and the lower parts of the airways. The causative agent multiplies on the hair-like projections of the epithelial cells in the respiratory tract and by its breakdown toxins are produced locally, then sistemically, and neurotoxically. Incubation period is from one to three weeks, most commonly from 7 to 10 days (6).

Once recovered, patients are usually immune on the large scale but not immune for life. It can happen that the elderly experience recurrence. Laboratory diagnostics of the disease is based on the isolation of selective nutritive media or on polymerase chain reaction (PCR) that can detect genomic sequences of *Bordatelle pertussis* or on serologic tests. Complications after recovery are

numerous: bronchopneumonia, middle-ear infection, bronchiectasis, different types of bleeding, atelectasis, pulmonary emphysema, pneumothorax, umbilical and inguinal hernias, large intestine prolapse, encephalitis etc (7,8,9).

Vaccination is a method of choice in the disease prevention. The first monocomponent pertussis vaccine was introduced in the Faroe Islands in 1923 and 1924 representing a combination of diphtheria and tetanus toxoids, whereas a pertussis vaccine (the DTP combination vaccine) was introduced in 1943. DTP vaccine has been commercially used in the world since 1955; in Serbia since 1961. Immunisation is practised in infants from 2 to 12 months. Vaccination in toddlers of one year of age to pre-schoolers of five years of age is administered in those children who have not been immunised or those partially immunised. Immunisation consists of three 0,5 ml doses of the vaccine in the intervals of 1 to 3 months to 5 months between the second and the third dose. If the interval between the last two doses is longer than 5 months, the DTP vaccine therapy should be continued but not repeated. The first revaccination is also carried out by the DTP vaccine, usually one year after the third dose of the vaccine has been administered. Current version of the vaccine is acellular monopertussis vaccine that is not reactogenic (10,11).

Suppression of the disease includes obligatory reports about the affected and the deceased from whooping cough, early diagnosis, treatment, hospitalization in case of complications, epidemiologic examinations and detection of the incubated patients.

Aims

The main aim of the study was to present pertussis disease rate and death toll in relation to the vaccination administration.

Material and methods

The data from the Public Health Institute of Serbia „Dr Milan Jovanović – Batut“ were considered, as well as the reports from the Public Health Institute Kragujevac dealing with the health care protection program for infectious and parasitic diseases in the Sumadija region. The time period considered was from 1981 to 2005.

The following data were considered as well: the number of the affected patients, the number of the deceased, incidence, lethality and mortality rates and in relation to the administration of three doses DTP vaccination. The number of the affected persons in the Sumadija region with incidence and their vaccinal status and age during the period from 1991 to 2007 is presented here.

Results

Disease rates and death toll, as well as DTP3 vaccination administration with the accompanying rates of morbidity, mortality and lethality in Serbia, central Serbia, Vojvodina, and Kosovo and Metohija until 2005 are shown in Tables 1, 2, 3 and 4.

Table 1. Rates of the affected and deceased persons from pertussis in Serbia (1981-2005)

Year	Number of the diseased	Number of the deceased	inc. rate/100 000	Mortality/100 000	Lethality	Administration of DTP3 (%) vaccination
1981	2462	17	26,5	0,18	0,69	91
1982	2848	23	30,6	0,25	0,81	89
1983	3690	35	39,7	0,38	0,95	93
1984	3100	11	33,2	0,12	0,35	91
1985	2310	7	24,1	0,07	0,30	91
1986	1812	10	18,6	0,10	0,55	92
1987	2722	25	28,1	0,26	0,92	91
1988	1049	6	10,8	0,06	0,57	91
1989	757	2	7,7	0,02	0,26	89
1990	1346	5	13,6	0,05	0,37	84
1991	1059	21	10,9	0,21	1,98	79
1992	232	3	2,4	0,03	1,29	84
1993	426	5	4,3	0,05	1,17	85
1994	436	3	4,4	0,03	0,68	85
1995	439	3	4,5	0,03	0,68	88
1996	261	3	2,66	0,03	1,14	91
1997	205	3	2,10	0,07	1,46	94
1998	115	2	1,18	0,10	1,73	89
1999*	20	0	0,26			97
2000	23	0	0,24			97
2001	5	0	0,06			97
2002	4	0	0,05			97
2003	13	0	0,17			97
2004	14	0	0,19			98
2005	4	0	0,05			97

* Since 1999 there is no evidence in Kosovo and Metohija

Annotation: There are no data for the period between 1981 and 1985 in the empty columns

Table 2. Rates of the affected and the deceased from pertussis in central Serbia (1981- 2005)

Year	Number of the diseased	Number of the deceased	inc. rate/100 000	Mortality/100 000	Lethality	Administration of DTP3 (%) vaccination
1981	816	0	14,4			
1982	1273	1	22,4	0,02	0,08	
1983	831	3	14,6	0,06	0,37	
1984	1672	1	29,0	0,02	0,06	
1985	951	0	16,4			
1986	419	0	7,2			97
1987	881	0	15,1			97
1988	308	0	5,3			97
1989	310	0	5,3			97
1990	213	0	3,6			97
1991	139	0	2,4			97
1992	84	0	1,5			96
1993	142	0	2,4			96
1994	95	0	1,6			96
1995	50	0	0,8			97
1996	70	0	1,2			98
1997	41	0	0,71			98
1998	25	0	0,4			98
1999	17	0	0,3			97
2000	20	0	0,3			97
2001	5	0	0,06			97
2002	4	0	0,07			98
2003	12	0	0,2			97
2004	3	0	0,05			98
2005	2	0	0,04			97

Annotation: Data for the period between 1981 and 1985 are not available in the empty columns

Table 3. Rates of the affected and the deceased from pertussis in Vojvodina (1981-2005)

Year	Number of the diseased	Number of the deceased	inc. rate/100 000	mortality/100 000	lethality	Administration of DTP3 (%) vaccination
1981	228	0	11,2			
1982	300	0	14,7			
1983	214	0	10,6			
1984	216	0	10,6			
1985	105	0	5,2			
1986	63	0	3,1			91
1987	128	0	6,2			91
1988	45	0	2,2			91
1989	29	0	1,4			93
1990	39	0	1,9			94
1991	15	0	0,7			95
1992	26	0	1,1			95
1993	48	0	2,3			96
1994	5	0	0,2			94
1995	10	0	0,5			94
1996	7	0	0,3			96
1997	8	0	0,4			96
1998	1	0	0,0			97
1999	3	0	0,1			97
2000	3	0	0,1			97
2001	0	0	0			97
2002	0	0	0			97
2003	1	0	0,0			98
2004	11	0	0,5			97
2005	2	0	0,10			97

Annotation: Data for the period between 1981 and 1985 are not available; therefore, some columns are left empty

Table 4. Rates of the affected and the deceased from pertussis in Kosovo (1981- 2005)

Year	Number of the diseased	Number of the deceased	inc. rate/100 000	Mortality/ 100 000	Lethality	Administration of DTP3 (%) vaccination
1981	1418	17	89,5	1,07	1,2	
1982	1275	22	80,5	13,9	1,73	
1983	1645	32	167,0	2,02	1,21	
1984	1212	10	70,3	0,58	0,83	
1985	1254	7	70,8	0,40	0,56	
1986	1330	10	71,4	0,53	0,73	84
1987	1713	25	95,6	1,40	1,46	83
1988	696	6	39,5	0,34	0,86	85
1989	418	2	22,2	0,10	0,47	79
1990	1094	5	56,7	0,25	0,45	64
1991	905	21	46,3	1,07	2,32	57
1992	122	3	6,2	0,15	2,45	70
1993	236	5	11,7	0,24	2,11	71
1994	336	3	16,6	0,14	0,89	79
1995	379	3	19,3	0,15	0,79	78
1996	184	3	9,4	0,15	1,63	82
1997	156	3	7,97	0,36	1,92	89
1998	89	2	4,5	0,1	2,24	75
1999*						100
2000						96
2001						
2002						
2003						
2004						
2005						

Since 1999 data from Kosovo and Metohija are available

Annotation: Data for the period between 1981 and 1985 are not available; therefore some columns are left empty

Table 5. Rates of the affected and the deceased from pertussis in Sumadija region from 1991 until 2007

Year	Number of diseased	inc.rate/100 000	Age	Vaccinated
1991	2	0,64	1:6Y; 2:12Y	Yes Yes
1992				
1993		0,33	3M	No
1994				
1995				
1996				
1997				
1998				
1999				
2000				
2001				
2002				
2003	1	0,33	2M	No
2004				
2005				
2006				
2007	1	0,33	1M	No

Table 5 shows the number of the diseased with their vaccinal status and age in the Sumadija region from 1991 until 2005.

Discussion

It is obvious that there was a four digit number of the affected and a two digit number of death cases with corresponding rates in Serbia up to 1991. Since 1999, the number of the diseased patients has rapidly decreased since there is no data feedback from Kosovo. It is obvious from Table 4 that the majority of the diseased patients were only from Kosovo and Metohija.

More precise data can be obtained from the results from central Serbia and Vojvodina. It can be seen that the number of the diseased patients tripled until 1993; afterwards the situation was relatively stable until 1997, when it started to decrease rapidly together with incidence. Mortality, however, has not been recorded since 1985.

The situation is similar in Vojvodina, except for the fact that the decrease occurred a few years before. Vaccination of the children in central Serbia has always been excellent, over 97%, whereas such data have been recorded in Vojvodina for the past ten years. In Kosovo and Metohija, vaccination has never been satisfactory. It is interesting that despite better vaccinal status of the population in central Serbia than in Vojvodina, a small number of the affected was reported in Vojvodina. This could be explained by the fact that up to 1999 the population fluctuation in Serbia was very high on the whole territory, whereas a poor vaccinal status in the southern Serbian province was an overall picture of Serbia on the whole, with its consequences more obvious in central Serbia, due to the vicinity of Kosovo and Metohija. This fact confirms the fact that a high vaccine-induced collective immunity is the main factor that decreases the incidence of all infectious vaccine preventable diseases, including *pertussis*.

In recent years in the Sumadija region, there have been some sporadic cases of the disease in infants up to one year of age, mostly in the non-vaccinated ones, which is the consequence of their age, since they were too young to have been administered the full course of vaccination due to medical or non-medical reasons. To this end, the increased vaccination in the Sumadija region could decrease the disease rate accordingly.

Pertussis is a highly contagious bacterial infection that affects respiratory passages, and is respiratory-transmitted through droplets with 70-100% transmission at home and 50-80% at school settings (9).

General mortality rate from *pertussis* is 0.03%. However, mortality rate in hospitalized infants under six months of age is higher - that is 3.5% in the developed countries. These rates have been recorded in our country since 1992. The disease poses serious risk to prematurely

born infants where the clinical picture can show no characteristic symptoms, which is often wrongly determined as Sudden Infant Death Syndrome. *Pertussis* causes *hypoxic encephalopathy* that can lead to brain damage and death. The most common complication is a bacterial infection which is the cause of most Bordetella pertussis-related deaths - that is pertussis pneumonia with complications such as seizures and encephalopathy (1,8).

Periodic epidemics of pertussis occur every 3-4 years. In non-vaccinated population they can be very high. In vaccinated population, periods of epidemics are shorter with reduced morbidity and mortality (11,12).

Maternal antibodies do not provide adequate protection against *pertussis*, so infants can be infected before they are old enough to be vaccinated. In the USA in 2003, there were 17 notified cases of deaths, all in infants younger than 4 months of age. In recent years, due to the high level of immunisation, numerous *pertussis* cases have been detected in adults and adolescents with weak immunity who can be serologically diagnosed and represent a source of infection. The situation is similar in many developed countries (13,14,15).

Pertussis kills about 350.000 people annually worldwide. Incidence of pertussis in the USA is 5.5/100.000 and it is the only vaccine-preventable disease with the ever increasing rate in the USA. Pertussis infection causes brain damage in lot of children. Periods of epidemics in the Western developed countries have been noted every 3 to 4 years, with the most common cases of mortality in infants up to one year of age. In Russia, for instance, the number of vaccinated school children affected by the disease is increasing. Currently, there are over 60% *pertussis* cases notified in persons older than ten years of age. It implies that a booster dose in ten-year-old children should be administered. In France, for instance, a booster dose has already been administered in children aged 11 to 13. In such a way, the risk of school children transmitting the disease to infants younger than 6 months could be decreased and the most sensitive ones could obtain greater health benefits (16,17,18,19).

Conclusion

As the only infectious vaccine preventable disease with the increasing rate worldwide, this disease is interesting from our point of view, since we are also faced with the possibility of the increased incidence in our country. Vaccinated children older than ten years of age will be at the highest risk. Hence, a booster dose administration after 10 years of age should be taken into consideration.

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EPIDEMIOLŠKE KARAKTERISTIKE VELIKOG KAŠLJA U SRBIJI I ŠUMADIJSKOM OKRUGU

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Veliki kašalj, pertussis, akutno je infektivno oboljenje uzrokovano osetljivim gram negativnim pleomorfim bacilusom *Bordetella pertussis*. Izvor zaraze je oboleli čovek sa tipičnom ili atipičnom kliničkom slikom. Nakon preležane bolesti ostaje solidan, dugotrajni, ali ne i doživotni imunitet. Vakcinacija predstavlja metod izbora u prevenciji obolevanja.

Osnovni cilj istraživanja bio je da prikažemo kretanje obolevanja i umiranja od pertussis-a u Srbiji i Šumadijskom okrugu u zavisnosti od vakcinacije.

Razmatrani su sledeći podaci: broj obolelih, broj umrlih, stopa incidence, mortaliteta, letaliteta i obuhvat DTP vakcinacijom sa tri doze. Postoji razlika u obolevanju i vakcinalnom statusu u centralnoj Srbiji, Kosovu i Metohiji i Vojvodini.

Rezultati iz centralne Srbije i Vojvodine pokazuju da je broj obolelih do 1993. godine bio trocifren, a nakon toga manji i relativno stabilan do 1997. godine, kada počinje dramatično da pada zajedno sa incidencom, a mortalitet se ne beleži od 1985. godine. U Šumadijskom okrugu se poslednjih godina beleže sporadični slučajevi obolevanja, sa starošću obolelih do godinu dana i najčešće kod nevakcinisane odojčadi.

Kao jedina zarazna, vakcinom preventabilna bolest koja je u porastu u svetu, zanimljiva je sa našeg stanovišta, jer je moguće povećanje incidence obolevanja i kod nas. Najrizičnija populacija su deca stara preko 10 godina, vakcinisana. Trebalo bi razmotriti mogućnost primanja booster doze posle desete godine života. *Acta Medica Medianae* 2009;48(1):31-36.

Ključne reči: Pertussis, kašalj, vakcinacija