

CLINICAL STUDY

Pneumococcal meningitis – comparison of therapy and vaccination costs

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Abstract: The authors analysed the direct cost associated with treatment of IPI in 156 patients hospitalised with the diagnosis of pneumococcal meningitis at the tertiary care Teaching Hospital. The total direct cost for 156 patients was 22,180,080 CZK (Czech Crowns). The average length of hospital stay for the patient with invasive pneumococcal meningitis (IPM) was 23 days. It was possible to conclude, that the direct financial expenses in 156 patients with pneumococcal meningitis would enable 88,337 people to be vaccinated. This is 6.2 % of all people in 65+ age group living in the Czech Republic, 54.8 % of all people in 65+ age group living in the Morava-Silesia Region with 1,250,800 inhabitants, or all inhabitants below 14 and above 65 years in Ostrava city (total population 312,000). The cost of pneumococcal polysaccharide vaccine and its administration was 566 times lower compared to the average cost of treatment for one IPM case (*Ref.21*). Full Text (Free, PDF) www.bmj.sk.

Key words: pneumococcal meningitis, invasive infection, treatment, vaccination, cost.

Gram-positive bacteria *Streptococcus pneumoniae* colonizes the respiratory tract in 5–70 % of healthy individuals (1). The ease of respiratory transmission and high occurrence of asymptomatic carriers facilitates the spread of this bacteria especially in collective settings e.g. homes for retired and infirm people, schools, university hostels etc. In the individuals with an impaired immunity, elderly people, newborns and toddlers, pneumococci may spread from the nasopharynx and cause an invasive infection (2, 3). A previous viral upper respiratory tract infection, allergy problems, inhalation of toxins (e.g. smoking) and infections comprise risk factors enabling pneumococcal invasion. A decreased function of phagocytes, complement system disorder (especially C5a), absence of IgG antibodies against capsular pneumococcal antigens, malnutrition and asplenia facilitate the occurrence of an invasive infection. The invasive pneumococcal infections (IPI), especially meningitis and pneumonia, are associated with a high fatality rate. In surviving patients, commonly the irreversible post-infection consequences occur. Though IPI are preventable by vaccination to high extend, the vaccination coverage in the Czech and Slovak populations is still quite low and similarly in many developed countries. In the USA, pneu-

mococcal infections claim the lives of more than 40,000 people each year and this is more than for the all other vaccine preventable diseases combined (4, 5). One dose of polysaccharide pneumococcal vaccine (PPV) provides solid protection for up to 5 years. Although many scientific studies have proved the positive effect of PPV on the improvement of the public health (3, 6–8), primary care physicians do not make much effort to offer this type of vaccination to their patients and, as a consequence, general population is not adequately informed about the health benefits. At present, the healthcare systems in many European countries are being reformed in order to stop an unnecessary draining of financial resources. As an early vaccination of individuals at IPI risk is not only life saving but also cost-saving, it would help to save many financial expenses.

Methods

The authors calculated the direct cost associated with invasive pneumococcal disease in 245 subjects hospitalised with bacterial meningitis between 2000–2006 at the Department of Infectious Diseases of the tertiary care Teaching Hospital in the Czech Republic. The direct cost, including the cost of treatment and hospital services (accommodation and full-board), of all cases of pneumococcal meningitis was compared with the cost of pneumococcal polysaccharide vaccine and vaccination procedure.

Data sources consisted of case records of the Department of Infectious Diseases and the available information from the Czech Statistical Office.

The indirect costs associated with IPI cases that would include sick leave benefit given to the patient and the loss of Gross

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National Product (GNP) for each person for every day that they remained ill were not included because the individuals at risk of IPI are especially the minors and the elderly that do not receive sick leave benefit and do not contribute to the GNP.

Results

Between 2000–2006, a total of 245 patients were hospitalised with bacterial (purulent) meningitis. The aetiology was confirmed in 96 cases, out of which the majority (63.5 %) were invasive pneumococcal infections. Based on that, 63.5 % of the total of 245 patients, including those without a known causative agent, were considered to have pneumococcal meningitis, creating 156 cases.

The direct cost for all selected patients ranged from 10,231 CZK (Czech Crowns) to 464,436 CZK with an average cost of 142,180 CZK for each patient with pneumococcal meningitis. The total direct costs for all 156 patients amounted to 22,180,080 CZK. The average length of hospitalisation of a patient with pneumococcal meningitis was 23 days, ranging from 9 to 63 days.

The cost of pneumococcal polysaccharide vaccine (PPV) is 200 CZK, and the cost of its administration (including a material used) is 51 CZK, making a total of 251 CZK for each vaccinated person. By comparing the direct cost of pneumococcal meningitis against the cost of vaccination it is possible to conclude, that the financial expenses associated with IPI in 156 patients with pneumococcal meningitis would enable 88,337 people to be vaccinated with PPV which is 6.2 % of all people in the 65+ age group living in the Czech Republic, 54.8 % of all people in the 65+ age group living in the Morava-Silesia Region with a population of 1,250,800 inhabitants, or all inhabitants below 14 and above 65 years of the Ostrava city (population 312,000). The cost of pneumococcal polysaccharide vaccine and its administration was 566 times lower compared to the average cost of treatment for one patient with an invasive pneumococcal meningitis.

Discussion

Invasive infections caused by *Streptococcus pneumoniae* are an important cause of severe community as well as nosocomial diseases. The World Health Organization estimates that pneumococcal infections are the number one killer of the all vaccine preventable diseases in the world (9). Despite the fact that polysaccharide pneumococcal vaccine has been available as a public health protection tool for quite a long period, public awareness of this prevention remains quite low. Even more surprising was the fact that almost 95 % of general practitioners in certain regions of Slovakia feel that they do not have sufficient information about this kind of vaccine (3). General practitioners also complain of monthly financial restrictions imposed on them by health insurance companies that may lead to limited number of individuals being vaccinated. This is a very paradoxical situation as the calculated cost of vaccination with PPS vaccine is 556 times lower compared to the direct cost of treatment for a one case of pneumococcal meningitis. It is the money of health

insurance companies that would be saved by this cheap and effective prevention. By limiting the number of vaccinations given through their fixed monthly budgets, the health insurance companies could be metaphorically shooting themselves in the foot.

The great advantage of PPV is not only the positive effect on protecting human health and life but also dramatically reducing the cost of IPI. The proposed analysis shows, that the cost of 156 IPI patients hospitalised in the infectious diseases department of one teaching hospital with one form of IPI (meningitis) would enable preventive vaccination against pneumococcal infections for more than 88,000 individuals at risk. Bearing in mind that pneumococcal meningitis makes only one third of all IPI cases, the total number of lives and financial means saved would be even greater.

The diagnosis of pneumococcal pneumonia is rather difficult to establish and the course of the illness in immunocompromised and/or elderly individuals is usually fast and lethal, often within the first 48 hours from the first onset of clinical symptoms. Microbiological investigations are not very sensitive and take critical time. Empirical antibiotic treatment is not always successful and may deteriorate an already unfavourable situation with respect to microbial resistance to antibiotics. These factors are amongst those that are responsible for the high annual death toll due to pneumococcal infections. At the same time, they are responsible and lead to the underreporting of IPI as a cause of death. The primary cause of death of a patient may frequently be given as cardio-pulmonary failure – a generally convenient term that obscures the actual IPI primary cause of death. Population studies focusing on the true incidence of IPI are demanding especially due to a high number of subjects required and the low number of autopsies performed nowadays does little help to gather precious information from cases of unknown aetiology.

Christenson et al (10) vaccinated with PPV and influenza vaccine 124,702 people in the 65+ age group and subsequently compared them with a group of 134,045 individuals in the same age group that refused vaccination against IPI and influenza offered to them free of charge. A reduction in the rate of hospital admissions due to IPI was found to be 44 % for the vaccinated individuals. The mortality of the hospitalised patients dropped by 35 % in the vaccinated group. The length of hospital stay was cut down by 38 % in pneumonia patients thanks to the vaccination while in patients with an invasive disease it was as high as 48 %. It is very interesting to note that there was also a statistically significant decrease of mortality in the vaccinated group irrespective of the cause of death (including myocardial infarction, brain stroke etc.). This supports the idea that many lethal pneumococcal infections may be hidden under the diagnosis of cardiac or unspecified pulmonary failure.

Many published studies (5–20) have proven efficacy and safety for the use of the PPV and there is no reason to think otherwise in evidence-based medicine. An administration of PPV to individuals at risk and children over 2 years has been recommended by the World Health Organization as well as by the Advisory Committee on Immunisation Practices (ACIP) (21). The PPV is expected to become one of the biggest lifesavers in the

forthcoming decades and the sooner we realise this fact, the better it will be for the benefit of patients. The analysis clearly shows that the potential financial gains possible in both fiscal and health provision costs are promising. Anything less than a high profile campaign to improve the vaccination coverage is unreasonable and the consequences of failing to deliver such a successful campaign will be a continued loss of human lives and the wasteful erosion of precious financial resources.

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