
PROTECTIVE EFFECT OF NEONATAL BCG VACCINES AGAINST TUBERCULOUS MENINGITIS

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ABSTRACT

Neonatal BCG vaccination reduces the risk of tuberculosis and provides protection higher than 80% against the development of meningeal and miliary tuberculosis in newborns.

Tuberculosis meningitis remains a major problem and also an important cause of death in some countries.

In countries with high and moderate incidence of tuberculosis, prevention from the most severe complications of tuberculosis can be achieved only with a high coverage of the universal BCG neonatal immunization, being higher than 98% in the cohort of newborns.

The decrease in BCG immunization coverage within immunization program during the year 2003 in Bosnia and Herzegovina influenced the increase in tuberculous meningitis.

During 2002, when coverage with BCG vaccination in cohort of newborns was 90%, the incidence rate of tuberculous meningitis was 19.04‰.

With the 68% decrease in BCG immunization coverage in the cohort of newborns in Bosnia and Herzegovina during the year 2003, the incidence of tuberculous meningitis raised to 33.33‰.

It has been proven that the 22% decrease of the neonatal BCG immunization coverage in the cohort of newborns /vaccination program of children/ caused 175 times higher number of the tuberculous meningitis cases.

Newborns affected by the tuberculous meningitis were not BCG vaccinated.

BCG vaccine provided effective protection against tuberculous meningitis, as well against the death of newborns caused by tuberculosis.

Key words: BCG neonatal vaccine, protective efficacy, newborns.

INTRODUCTION

Cases of the active tuberculosis and asymptomatic tuberculosis infections in children are of a great concern. They indicate that transmission of the tuberculosis has occurred recently.

Many adults who have active tuberculosis were infected several years ago, when their immune system was

stronger and able to protect them.

Children, particularly infants, could have been infected only recently because of their age.

When a child is diagnosed with active tuberculosis, it means that someone close to it, an adult in almost all cases, must have active tuberculosis and is possibly transmitting the disease to others, as well. (1)

Nearly all cases of the upper respiratory tract tuberculosis are the complication of pulmonary disease.

Tuberculosis in a childhood is different from the adult tuberculosis and requires different expertise.

Tuberculous meningitis remains a major problem and an important death cause in some countries. As a result of the spread from the primary tuberculous focus, or as part of miliary tuberculosis spread, tiny tubercles are seeded into brain and meninges.

The tubercles may rupture into the subarachnoid space and they cause three processes: inflammation of the tuberculous meninges, formation of a grey jelly-like mass of the base of brain and inflammation and narrowing of the arteries leading the brain which may cause local brain damage. (2, 3)

PROTECTIVE EFFECT OF NEONATAL BCG VACCINATION

BCG vaccination is the only possible method of the discontinuation, or at least, transmission slowing down, since BCG is expected to prevent multiplication of Bacilli in the body and development of the new cases of tuberculosis, even though it cannot prevent primary infection.

The vaccine from the Bacillus Calmette-Guerin has been in use for over 5 decades in the prevention of tuberculosis and indeed has been routinely used for the control in several countries. It is not only an extensively used, but also the most extensively studied vaccine and has been the subject of prolonged and bitter converse over its efficacy. (4)

The strategic Advisory Group of Experts strongly endorsed the continuation BCG vaccination in national immunization programs in the aim to minimize the harmful effects of tuberculosis infection during the first year of life. (5)

Vaccination of uninfected (tuberculin-negative) person

induces tuberculin sensitivity in > 90% of cases. Unfortunately, post-vaccination tuberculin skin test conversions or reaction sizes do not correlate with the protection.

BCG tuberculin reactivity wanes with time and it is unlikely that BCG clinical and immune effects, not necessarily Mycobacterium tuberculosis specific, are unclear. (7)

BCG vaccine is more effective when administered in childhood, compared with the vaccination of adolescents and adult populations (8, 9).

BCG neonatal vaccine is moderately effective, recent meta-analysis proved its protective efficacy as 50% against any TB disease, 64% against tuberculosis meningitis and 71%, against death from tuberculosis. (10)

Occasional cases of TB meningitis occur in children in Australia and might be prevented by BCG vaccination. (8) Japan has had a policy of universal BCG vaccination of infants against tuberculosis since 1951. (11)

Children aged from 6 to 12 years also undergo BCG revaccination, although the effectiveness of this practice is not well-established.

The average incidence of TBC has decreased from 698 per 100 000 in 1951 to 33.7 per 100 000 in 1996 (12). The paediatric incidence in Japan is much lower, at 2.1 per 100 000 compared with 3.1 per 100 000 in the USA (13).

The evaluation of BCG vaccination of Japanese infants based on an assumption of flexible vaccine efficacy /40-80%/ provided an estimation that 111-542 TB, including 10-27 of the TB meningitis, would be prevented during the 10 years of BCG vaccination among cohort of infants born in 1996.

The efficacy of BCG vaccination in newborns is well recognised and that topic has been recently reviewed by Colditz at al. (14)

It is particularly useful in the protection against the TB disseminated such as TB meningitis and miliary TB (15). In Hong Kong, BCG vaccination was introduced in 1952 as an organized campaign by the Government (16).

The coverage for the newborn babies has been persistently over 98% since the year 1980 significantly contributing to the low rate of TB among the young people. (UNICEF/WHO)

Tuberculosis remains one of the major health problems in developing countries.

WHO estimated that in the year 1990, 7.5 millions new cases of tuberculosis were registered, 1.3 million were children under 15 years of age, of whom 450 000 died.

MATERIAL AND METHODS

In Bosnia and Herzegovina, as a country with the high tuberculosis incidence, BCG vaccination is being performed immediately after the birth and has the most

important role in the prevention of TB meningitis in newborns.

The prospective research performed during the period from 2002 to 2003 monitoring the motions of coverage of the BCG neonatal vaccination in the Federation Bosnia and Herzegovina and tuberculous meningitis in two groups of the newborns.

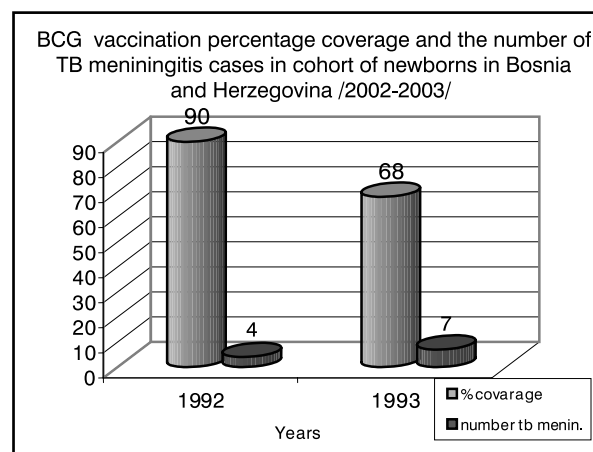
The aim of research was to determine, on the basis of epidemiological and clinical methods, relation between BCG neonatal vaccination coverage and the number of tuberculous meningitis cases, in two cohort groups of newborns with the different vaccination percentage.

RESULTS

During the year 2002, the neonatal immunization coverage in cohort of newborns was about 90%. Tuberculous meningitis was registered in four BCG unvaccinated newborns.

The incidence rate of tuberculosis meningitis in the year of research was 19.04‰.

In the year 2003, there was a decrease in the BCG neonatal immunization coverage influencing an increase in the TB meningitis cases in newborns. (Graph 1)



During the year 2003, BCG neonatal vaccination was reported to be about 68%-decreased on the territory Bosnia and Herzegovina. The number of newborns with tuberculous meningitis increased for 7 cases in 2003.

The incidence rate of TB meningitis during the 2003 reached 33.33‰ in Bosnia and Herzegovina. This incidence rate is very high and among the highest in Europe. The results of these researches show the importance of the high coverage with neonatal BCG vaccination in Bosnia and Herzegovina - a country with the high tuberculosis incidence, with aim to achieve the protective efficacy against tuberculous meningitis.

In the year 2003, a decrease in neonatal BCG immunization coverage in newborns /22%/ caused the increase /175 times/ in number of tuberculous meningitis cases in the cohort of newborns in Bosnia and Herzegovina.

DISCUSSION

Among transmissible diseases, tuberculosis is the second leading death cause in the world.

Most cases are registered in less-developed countries, due to socioeconomic changes and decline in the health-care system. The World Health Organization (2002) has estimated that eight million people get TB every year, of which 95% live in developing countries. Approximately two to three million people die from TB every year (17). Almost 80% of children in developing countries receive BCG vaccination by the age of two years (18).

BCG vaccination reduces the risk of tuberculosis and the effectiveness of protection last about 9 to 10 years (19). Immunization with BCG vaccine lowers the risk of serious complications of primary TB in children. The practice of BCG vaccination varies widely in different parts of the world.

The efficacy of BCG vaccination in newborns is well recognized and that topic has been reviewed frequently.

It is particularly useful in the protection against disseminated TB such as meningitis and miliary tuberculosis (20, 21, 22).

BCG vaccine is more effective when administered during newborn period assuring >80% protection against the

development of meningeal and miliary tuberculosis (23). Protective effects against meningeal and miliary TB were higher than against pulmonary disease. Summary of the BCG protective effect against miliary or meningeal TB in randomised, controlled trials was 86%. (24)

CONCLUSION

The protective effect of BCG vaccine against meningitis and miliary tuberculosis was higher than against pulmonary disease.

BCG neonatal vaccination lowers the risk of serious TB complications in newborns.

BCG vaccine showed its effectiveness in reducing both mortality and long-term sequels from disseminated meningeal and miliary tuberculosis in newborns.

Decrease in the BCG neonatal immunization coverage from 90 % to 68% in cohort of newborns influenced the increase in tuberculosis meningitis incidence rate from 19.04‰ to 33.33‰ in Bosnia and Herzegovina.

Universal neonatal BCG vaccination with immunization coverage of more than 90% induced the protective effect against meningeal and miliary tuberculosis in cohort groups of newborns in developing countries.

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