Healthy diphtheria carriers in two students in the Eastern Province

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ABSTRACT

While most of the world’s countries were progressing towards the elimination of diphtheria, a striking resurgence of the disease took place in several countries of Eastern Europe. The main reasons for this were the decreasing immunization coverage between infants and children as well as waning immunity in adults. This case report discusses the accidental discovery of two healthy diphtheria carriers (from the same family) among school children in Al Khobar City, Eastern Province, Kingdom of Saudi Arabia. It also discusses the preventive measures for the contacts and highlights the importance of booster doses of Diphtheria Tetanus Toxoid.

Keywords: Diphtheria, carriers, diphtheria tetanus vaccination.

In the past, diphtheria was considered one of the most serious childhood diseases because it took a heavy toll in health and life among pre-school aged children. Prior to the widespread availability of diphtheria toxoid, nearly 70% of cases were among children younger than 15 years of age. In the industrialized countries, immunization against diphtheria became widespread in the 1940s and 1950s. In developing countries, immunization of infants with diphtheria toxoid was introduced in the expanded programme of Immunization in the late 1970s. Diphtheria Immunization coverage rose slowly to 46% in 1985 and 79% in 1992. In 1995 the national immunization coverage rate for the triple vaccine Diphtheria Tetanus and Pertussis (DTP) in Saudi Arabia was 93.1%, while that for the Eastern Province was 94.7%. On the other hand, the incidence rate of diphtheria in Saudi Arabia have been maintained at 0.01/100,000 population since 1994 with an exception of 1996 where no cases of diphtheria were reported.

Widespread immunization has not only lead to a marked decrease in the incidence of diphtheria, but also to a decrease in circulating toxigenic Corynebacterium diphtheriae organisms, resulting in less natural boosting of antibody levels. This had led to gaps in the immunity of the adult population who did not receive booster doses of the toxoid. Also, immunization with toxoid is generally thought to attenuate the local and systemic effects of toxins without preventing local colonization with the organism. Accordingly, carriage is expected to remain high and epidemics should be expected in the proportion of population who have low level of immunity. A good example of this is the recent diphtheria outbreaks in several European and developing countries in 1990. These outbreaks have been characterized by high case fatality rates and a large proportion of patients with complications, in both young and older age groups. Also there has been an increased carriage of and infection with Non-toxigenic Corynebacterium diphtheriae in countries with high immunization rates, including the United Kingdom and Australia over the last five years.
Case Report. T.H. is an 11 year old female referred from her school to the Primary Care Clinic for a complete examination before being allowed to work in the school canteen. The physical examination was normal as were the chest X-ray and the laboratory investigations of urinalysis and stool analysis for ova and parasites, and stool culture, but a throat swab showed a heavy growth of streptococcus group A, and Corynebacterium diphtheriae varmitis. A toxigenicity test was not carried out, as neither the hospital laboratory nor that of the Ministry of Health was equipped to do that test. The patient was admitted in the hospital, under an isolation precaution in a single room, and another throat swab was taken for culture on a tellurium containing medium (modified Tinsdale medium) to confirm the diagnosis. Later, the second culture grew the same organisms and the diagnosis was confirmed. A complete history was taken from the patient and it was not contributory. The standard vaccinations had been completed including the booster dose of DTP at the age of 6 years. The patient was put on erythromycin treatment for 10 days. On the same day of admitting the index case, throat swabs were taken from all her family members for culture and they were all given prophylactic erythromycin for ten days as well as Td or TD according to their age. The throat swab cultures were negative for the family except for the patient's sister H.H. (13 years old) who had the same organisms. She was admitted to the same isolation room with her sister and continued on the erythromycin treatment, which was already started. The history was not contributory, vaccination had been completed up to the age of 6 years and no booster shot of the triple measles, mumps and rubella vaccine (MMR) or Td was given at the age of 12 years. The two cases were kept under isolation for the whole length of treatment and were only discharged from the hospital when two cultures from their throats (taken 48 hours after completing the treatment and with 48 hours duration in between) showed no growth. An extensive contact tracing was carried out for all of the family neighbors living in the same building together with all of the school contacts of the two cases namely the students, teachers and administrative staff. Throat swabs were taken from all contacts for culture and they were all given erythromycin prophylaxis together with Td vaccination. Also a vaccination history was taken and none of the contacts had been given a booster shot at the age of 12 years or later in life. All throat cultures of the contacts were negative for Corynebacterium diphtheriae.

Discussion. Since Ramon developed the antitoxin in 1924 widespread vaccination has almost eliminated diphtheria, but since the acquired immunity is antitoxic and not antibacterial, carriage of the causal agent Corynebacterium diphtheriae remains possible. The huge epidemic, which started in 1990 in the New Independent States (NIS) of the former USSR, culminating in 1994-5 (with respectively 47,802 and 50,412 notified cases) has shown that diphtheria could still be a threat to health. As a result of this epidemic many serological surveys were done in several European countries to determine the immunity to diphtheria in the adult population. These studies showed inadequate immunity levels (concentrations of 0.1 - 0.01 international units are generally thought to confer protection) in the absence of a routine revaccination programme for more than half of the adult population. This lack of protection in a large proportion of any population might result in a major outbreak of the disease. Data recorded from one of the outbreaks showed that 90 percent of clinical cases had antitoxin levels below 0.01 IU/ml, whereas 92 percent of asymptomatic carriers had titers above 0.1 IU/ml. Following immunization, antitoxin levels decline slowly over time so that as many as 50 percent of individuals over age 60 have serum titres below 0.01 IU/ml. For this reason, booster doses of toxoid should be administered at 10 year intervals, to maintain antitoxin levels in the protective range.

This report highlights the possibility of the presence of diphtheria carriers among an immunized population with a high coverage rate (94.7%). It also shows the absence of a programme for booster doses in adults who become more susceptible to infection with age.

In conclusion, the present situation with the absence of adult immunization clearly demonstrates the risk of importing diphtheria and the possibility of epidemics among the unprotected age groups. This could justify a revaccination programme for the adult population, involving a regular booster, at 10 year intervals, of a reduced dose of diphtheria toxoid (d), and using the combined toxoid Td in the wounded, or both, instead of tetanus toxoid alone. Routine screening of throat swabs should also be stressed especially among certain groups e.g. food handlers and people coming from high-risk areas.

References


