Tetanus and diphtheria


Abstract

Diphtheria and tetanus have been brought under control in many areas of the world through mass immunisation programmes. Consequently, they are becoming forgotten infectious diseases. As diseases gradually disappear from the general population, more people come to regard them as diseases of the past, and no longer feel the need to maintain immunity through vaccination. As vaccination levels drop, diseases that were once under control begin to reappear, sometimes resulting in severe complications that can lead to permanent injury or death.

Tetanus

Tetanus, commonly called lockjaw, is caused by the bacterium Clostridium tetani. Among the vaccine-preventable diseases, tetanus is unique in that it is not transmitted from person to person, but enters the body through a wound. Tetanus bacteria can be found everywhere, particularly in environmental sources, such as soil, dust, or faecal matter from animals with spores in their intestines.

Bites or scratches from animals, burns, puncture wounds, or scratches from contaminated objects are the most common causes of tetanus. Tetanus bacteria are most often found in soil. Tetanus can also occur following surgical procedures, dental infection or an abortion carried out in unhygienic conditions. Tetanus can also occur following surgical procedures, dental infection or an abortion carried out in unhygienic conditions.

Although treatment for tetanus infection is available, it often involves a lengthy hospital stay as well as frostbite wounds, however small, can lead to tetanus in people without immunity. In recent years, minor wounds have resulted in a higher proportion of tetanus cases, particularly as a severe wound is more likely to be properly managed in a healthcare setting; whereas a smaller wound might not be taken as seriously and, therefore, might be neglected by an injured person. Tetanus can also occur following surgical procedures, dental infection or an abortion carried out in unhygienic conditions.

Complications

About 30 per cent of tetanus cases result in death (CDCP 2001), mostly in older adults who are not adequately immunised. Tetanus complications result from a toxin produced by the bacteria, which first affects the muscles of the jaw, face and neck, and progressively spreads to the muscles of the arms and legs. This type of generalised tetanus is the most frequent form of the disease, and is potentially fatal. Muscle spasms can be so powerful as to cause muscle tears and fractures of the vertebrae. Respiratory muscles can also be affected, resulting in airway obstruction and suffocation. Other potentially fatal complications include pneumonia, septicaemia and cardiovascular instability.

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(between one and two months) in an intensive care setting. Tetanus can still be fatal following treatment. People who survive the disease might develop lasting side effects, including muscle fatigue, and damage to the nervous system that can result in urinary incontinence and difficulties with speech, memory and mental performance. Tetanus prevention The best means of prevention is the tetanus toxoid vaccine, one of the safest and most effective vaccines available. In addition, immediate treatment of wounds is vital. All wounds require first aid treatment, including thorough cleansing and removal of dead or devitalised tissue. Professional medical care should be sought for serious wounds – those that are deep and/or dirty (animal bites, puncture wounds and other broken skin that might be contaminated by soil or manure), and wounds with dead tissue that have not been cleaned for several hours, a situation greatly increasing the risk of infection.

Herd immunity (protection of an individual from direct exposure to a disease because others in the population are immune) does not play a role in tetanus prevention. Because tetanus is an environmental organism, and not transmissible from person to person, all humans need to have tetanus antibodies in their blood at the time of exposure to be protected and, unless vaccinated, remain at risk of infection. A previous tetanus infection does not provide immunity to the disease. Therefore, vaccination with tetanus toxoid should be considered following recovery.

Epidemiology The efficacy of the tetanus toxoid vaccine was clearly demonstrated during World War II when it was used in an active immunisation programme for UK and US armed forces, virtually eliminating the disease. Among the 288,936 British Army battle casualties during the second world war, there were only 35 cases of tetanus (Sachs 1952). Only 12 cases of tetanus occurred among the 2.73 million US Army personnel serving on all fronts during the war, compared with 70 cases of tetanus among 520,000 wounded in the first world war (Long and Sartwell 1947).

Today, tetanus in industrialised countries is rare, due to routine childhood immunisation programmes and improved wound management. Industrialised farming practices that rely on chemical fertilisers rather than animal manure have also contributed to reduced incidence of tetanus infection in rural populations (Cate 1990). In Germany, fewer than 15 cases of tetanus occur a year; most are in older people who are not fully adequately vaccinated. Although NT is rare in industrialised countries, it is the second-highest cause of death among children worldwide from vaccine-preventable diseases (WHO 1999).

Neonatal tetanus Neonatal tetanus (NT) occurs among babies who are born under unhygienic conditions to mothers who have not been adequately vaccinated. Although NT is rare in industrialised countries, it is the second-highest cause of death among children worldwide from vaccine-preventable diseases (WHO 1999).

Diphtheria

Diphtheria is an acute bacterial illness caused by Corynebacterium diphtheriae. The name of the disease comes from the Greek word diphthera, which means leather hide, in reference to the thick, leathery membrane that can develop in the nose, throat and tonsil areas of infected patients. Diphtheria only occurs in humans, and is easily spread through coughing or sneezing, or by touching the open sores of infected persons. Symptoms, which usually appear two to five days after infection, include sore throat, fever and chills, swollen neck glands, headache, breathing difficulties, nausea and vomiting.

The areas most commonly infected are the tonsils and throat, where a tough, greyish, fibrous membrane develops, which can completely cover the infected areas. Swallowing becomes difficult and can lead to suffocation. Nasal diphtheria is often very mild, and in its early stages appears much like the common cold. In some cases, infected persons might not exhibit any symptoms, but can pass the disease on to others. Cutaneous diphtheria is spread by touching the open sores of an infected person and, more rarely, through articles that are soiled with the discharge of sores of infected persons. Other areas of the body that might be affected are the genital areas and the mucous membranes of the eyes and ears.

Complications About one in ten people infected with diphtheria dies, with higher fatality rates (up to 20 per cent) in children under five and in adults over 40 years (CDCP 2001). There are several strains of diphtheria bacteria – those that produce a toxin, and milder strains that do not.

If the disease has not been accurately diagnosed or properly treated, the toxin might spread throughout the body via the bloodstream and lymph vessels. It is the toxin that causes most of the disease complications of the disease, and death.
The diphtheria toxoid vaccine allows the body to neutralise the toxin, preventing the development of potentially fatal complications. The heart, kidney and nervous system are most frequently affected and, if infected early in the disease, this can result in death. Other complications can lead to permanent muscle damage, pneumonia, otitis media (middle ear infection) and breathing difficulties.

**People most at risk** Travellers are at risk for diphtheria when visiting areas where epidemics still occur. Diphtheria epidemics have occurred in Algeria (Patey and Dellion 1999), Russia and other former Soviet Union states (CDCP 1996). Approximately 97,000 cases were reported in the Russian Federation between 1990 and 1995, resulting in 2,500 deaths. By 1994, the epidemic had spread to all 15 newly independent states of the former Soviet Union. In some, up to 80 per cent of the cases occurred among adults. A number of factors might have contributed to resurgence of the disease, including a drop in routine childhood immunisation as a result of changes in healthcare infrastructure, as well as population migration, hygiene conditions in the build-up and spread of the epidemics, and other socio-economic changes following the break-up of the former Soviet Union.

With international travel on the increase, the likelihood of foreign strains of diseases being introduced into other European countries also increases, leaving unprotected individuals at greater risk. Cases of diphtheria have also been reported in Finland, Germany, Belgium and the UK due to imported infection (Aventis Pasteur MSD 2001).

Recent studies have shown that a substantial proportion of western Europeans are not protected against diphtheria. For example, 32 per cent of the population in Flanders, Belgium, is susceptible, and for 25 per cent protection is uncertain (Mathéi et al 1997). In France, 20 per cent of adults have insufficient levels of antibodies to protect them against diphtheria (Vincent-Ballerau et al 1995). In Italy the figure is 36 per cent (Wirz et al 1995) and in the UK 38 per cent (Miller et al 1994). Continued outbreaks of diphtheria highlight the importance of maintaining immunity against this disease throughout life.

**Combined tetanus and diphtheria vaccines**

For children under seven years of age, a vaccine containing diphtheria toxoid, tetanus toxoid, and pertussis (whooping cough) is nearly always given as a combined vaccine in the primary vaccination series in most countries (WHO 2001a). However, in the UK, which has different recommendations, after the first three doses are given at age two, three and four months, a DT vaccine (containing diphtheria toxoid and tetanus toxoid) without pertussis toxoid is currently given. In other countries, the DT vaccine is also indicated for children under age seven who, for underlying medical reasons, are unable to receive the pertussis vaccine.

The Td vaccine contains tetanus toxoid (T) and reduced amounts of the diphtheria toxoid (d). In most countries, the Td vaccine is indicated for children aged seven years and older, and for adolescents and adults. In the UK, the Td vaccine is recommended for children aged over ten years. A series of Td vaccines is also indicated for adults who did not receive a primary course of immunisation against diphtheria and tetanus in childhood.

Booster doses of the Td vaccine are administered according to national healthcare policy. In some countries, such as Belgium, Germany, Luxembourg, Switzerland and the US, the Td vaccine is recommended every ten years. However, in the UK, additional boosters are not usually given to those who have had five doses of tetanus vaccine at appropriate age and time intervals.

In view of the upsurge of diphtheria in industrialised countries, the WHO recommends replacing the single vaccine for tetanus toxoid with the combined Td vaccine (WHO 2001b), particularly in countries that recommend booster doses throughout life. WHO immunisation policy also states the importance of Td immunisation for high-risk groups in industrialised countries, such as military personnel, healthcare staff, kindergarten, and daycare workers, teachers, students, alcoholics, injecting drug users and travellers to areas where diphtheria is prevalent.

In Europe, immunisation recommendations vary from country to country because of national healthcare policies and priorities. For this reason, it is always best that individuals consult a GP for advice regarding their healthcare needs.

**Conclusion**

Tetanus poses special health risks to adolescents and adults who have not kept up to date with boosters, adults who have never been vaccinated against the disease, and those whose vaccination histories are unknown or uncertain. It is therefore recommended that review of patients’ vaccination status should be routine in all healthcare settings.

Although diphtheria is rare in western Europe, cases still occur among insufficiently immunised individuals because of imported disease. Recent epidemics in certain areas of Europe and North Africa point to the need for maintaining immunity to diphtheria through booster doses of the vaccine. Adolescents and older adults who were immunised in childhood might have decreased protection from the disease in later years and could be at risk when travelling to areas where the disease is highly prevalent, or when in direct contact with infected persons or carriers of the disease in their own country.