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Tuberculosis - General Facts - Historical Background

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Abstract

Aim. A thorough investigation of tuberculosis as well a historical investigation of the disease. **Material and Methods**. We retrospectively investigated the appearance of tuberculosis. The research material was accumulated by research in the Internet, the archives, and the official webpage of the World Health Organization (Google, official web page of WHO), from the Hellenic Ministry of Health. **Results**. Although the number of tuberculosis cases has decreased over the past decades, mainly in economically prosperous countries, it is still a major public health problem, especially in low- and middle-income countries. **Conclusions**. The current study has concluded that there has been significant progress in diagnostic methods, but logistical and financial barriers to their widespread adoption remain. Countries with high TB rates should establish and maintain accurate diagnostic methods and strategies to manage large numbers of drug-susceptible and MDR-TB Major advances in vaccines and drugs are needed to achieve European and global control of the disease. Further research is needed to identify markers of the condition, which will help predict the success of new treatments and vaccines.

Keywords: *TB, Vaccines; WHO; Public Health*

Introduction

Tuberculosis has occurred in humans since ancient times. The first clear detection of "mycobacterium tuberculosis" includes evidence of the disease in bison remains dating back as far as 17,000 years ago. However, it is not clear whether tuberculosis originated in cattle, and was then transmitted to humans, or whether it broke out from a common ancestor. Scientists previously believed that the mycobacterium tuberculosis mycobacterium (MTBC) was transmitted to humans from animals when they were domesticated. However, the Mycobaterium tuberculosis complex (MTBC) genes in humans have been compared to MTBC in animals, and the theory has been shown to be incorrect. Both strains of TB bacteria have a common ancestor that may have infected humans as early as the Neolithic revolution. Skeletal fossils show that prehistoric humans (4000 BC) had tuberculosis. Researchers have found tuberculosis sepsis on the spine of mummies from Egypt dating from 3000-2400 BC. "Fthisi" is the Greek word for "saraki," an older term for pulmonary tuberculosis. In 460 BC, Hippocrates identified

wasting as the most widespread disease of the time. Phthisis sufferers had a high fever and coughed up blood.

In most cases the wasting was fatal. Genetic research indicates that tuberculosis had appeared in the Americas by the year 100 AD. Before the Industrial Revolution, beliefs often linked tuberculosis to vampires. If one family member died from TB, the other infected members would see their health gradually deteriorate. There was a belief that the person who initially contracted tuberculosis was sucking the life out of the rest of the family.

The pulmonary form associated with tubercles was established as a condition by Dr. Richard Morton in 1689.However, tuberculosis had a number of symptoms, and thus was not recognized as a disease until the 1820s. It was named tuberculosis in 1839 by J. L. Schönlein.During the years 1838-1845, Dr. John Croghan, owner of Mammoth Cave, brought TB sufferers to the cave in the hope that they would be cured of the disease by the constant temperature and purity of the air in the cave They died in a year. Hermann Brehmer opened the first tuberculosis sanatorium in 1859 in Sokołowsko (Poland).

The bacillus that causes tuberculosis, the "mycobacterium tuberculosis," was identified and described on 24 March 1882 by Robert Koch. He was awarded the Nobel Prize in 1905 for this discovery. Koch did not believe that the disease of tuberculosis was similar for cattle and humans. This belief has been a barrier to the identification of contaminated milk as a source of contamination. In later years, the risk of disease transmission from this source was dramatically reduced with the discovery of the pasteurisation process. As a treatment for tuberculosis, Koch announced in 1890 the glycerol extract of the tuberculosis bacillus. He called it "tuberculin".

"Tuberculin" was not effective, but was adopted as a TB screening test. Albert Calmette and Camille Guérin achieved the first success for immunisation against tuberculosis in 1906. They used an attenuated strain of bovine mycobacterium and called the vaccine BCG (Calmette and Guérin bacillus). The BCG vaccine was first used in 1921 in humans in France. However, it was only widely accepted in the United States, the United Kingdom, and Germany after World War II.

Tuberculosis caused a more widespread public concern in the 19th and early 20th centuries as the endemic disease of the urban poor. In 1815, one in four deaths in England was due to "consumption". By 1918, tuberculosis caused one in six deaths in France. Researchers in the 1880s defined tuberculosis as an infectious disease, and it was subsequently placed on a list of compulsory reporting diseases in Britain. Campaigns were launched urging the public to avoid disrobing in public places and "urging" the destitute who had contracted the disease to be admitted to prison-like sanatoria. (Sanatoria for the middle and upper classes offered a high level of care and constant medical supervision. Sanatoria were said to provide the benefits of "fresh air" and work ,but even in the best conditions, 50% of the patients admitted to them died after five years ("around" 1916).

Tuberculosis rates began to rise in Europe in the early 1600s. The number of cases of tuberculosis soared in the 1800s in Europe, accounting for about 25% of all deaths. Mortality then fell by about 90% by the 1950s. Improvements in public health have significantly reduced TB rates even before the use of streptomycin and other antibiotics. However, the disease continued to pose a significant threat to public health. The Medical Research Council was established in Britain in 1913, with an initial focus on tuberculosis research. In 1946, the development of the antibiotic streptomycin made it possible to effectively treat and cure tuberculosis. Before the invention of this drug, the only treatment (apart from sanatoria) was surgery.

The "pneumothorax technique" led to the collapse of the affected lung to "rest" it and help the tuberculous lesions heal. The emergence of multidrug-resistant tuberculosis (MDR-TB) has again led to the adoption of surgery as an option within the acceptable level of care for the treatment of TB infections.

Recent surgical procedures include the removal of abnormal chest cavities (bubbles) in the lungs to reduce the number of bacteria and increase the exposure of the remaining bacteria to drugs in the bloodstream. This procedure simultaneously reduces the total bacterial load and increases the effectiveness of treatment with systemic antibiotics. Experts had hoped to completely eradicate tuberculosis (like smallpox), but the rise of drug-resistant strains in the 1980s made eradication of the disease less possible.

The subsequent re-emergence of TB resulted in the declaration of a global health emergency by the WHO in 1993. Tuberculosis, TB or MTB (short for tubercle bacillus) is a common and in many cases fatal, infectious disease. This disease is caused by various strains of mycobacteria, usually the mycobacterium tuberculosis. Tuberculosis usually affects the lung, but it can also affect other parts of the body. TB is spread when people with TB cough, sneeze or spread their saliva through the air. Most infections are asymptomatic and latent. However, about one in ten latent infections eventually develops into active disease. Unless TB is treated, it is fatal for more than 50% of people infected. The classic symptoms of an active TB infection are chronic cough with traces of blood in the sputum, fever, night sweats and weight loss. (Tuberculosis (TB) was previously called "junk" because of the weight loss suffered by sufferers). Infection of other organs causes a wide range of symptoms. The diagnosis of active TB is based on a TB X-ray, (commonly a chest X-ray, and a microscopic examination and microbiological culture of body fluids. The diagnosis of latent TB is based on tuberculin skin test (TST) and blood tests. Treatment of TB is difficult and requires the administration of multiple antibiotics over a long period of time. Contacts with other people are also investigated and treated if necessary. Antibiotic resistance is a growing problem in multidrug-resistant tuberculosis (MDR-TB).

To prevent TB, people should be screened for the disease and vaccinated with the Calmette-Guérin bacillus vaccine. Experts believe that one third of the world's population is infected with the mycobacterium tuberculosis, and new infections are being recorded at a rate of one per second. It is estimated that in 2007 there were approximately 13. 7 million chronic patients suffering from the active form of the disease. It is estimated that in 2010 there were about 8. 8 million new cases and 1. 5 million deaths, mostly in developing countries. The total number of TB cases has decreased since 2006, while new cases have decreased since 2002. TB is not evenly distributed across the globe. In many Asian and African countries about 80% of the population tests positive for tuberculin, while in the United States only 5-10% of the population is positive. Most people in developing countries get TB because of reduced immunity. Usually, these people get TB because they are infected with HIV and develop AIDS.

The research includes data for the afore mentioned search on the tuberculosis. Our research was based on material accumulated from research on the Internet, the archives, and the official webpage of the WHO (Google, official web page of WHO).

About 5-10% of people who are not infected with HIV but are infected with TB will develop active disease in their lifetime. In contrast, 30% of people infected with HIV and TB develop active disease. TB can infect any part of the body, but usually affects the lungs (known as pulmonary TB). Extrapulmonary TB occurs when TB develops in organs other than the lungs Extrapulmonary TB, however, can coexist with pulmonary TB.In general, symptoms include fever, chills, night sweats, loss of appetite, weight loss and fatigue. Severe keyboarding may also occur.

Pulmonary

If an infection becomes active, it affects the lungs in 90% of people. Symptoms may include chest pain and a prolonged cough that produces sputum. About 25% of people have no symptoms at all (i. e. , they remain "asymptomatic"). Occasionally, people spit up blood in small amounts. In rare cases, the infection can erode the pulmonary artery, causing massive bleeding called Rasmussen's aneurysm. TB can develop into a chronic disease and cause extensive scarring of the upper lobes of the lungs. The upper

lungs are most often affected. The reason is not entirely clear. Perhaps the upper lobes are more affected because of better airflow or poor lymph drainage.

Exopulmonary

In 15-20% of active cases, the infection spreads outside the respiratory organs, and this causes other forms of TB. Tuberculosis that affects organs of the body other than the respiratory system is called "extrapulmonary tuberculosis".Extrapulmonary tuberculosis occurs most often in immunosuppressed individuals and young children. Extrapulmonary tuberculosis occurs in more than 50% of people infected with HIV. The sites most commonly affected by extrapulmonary TB are the pleura (in tuberculous pleurisy), the central nervous system (in tuberculous meningitis) and the lymphatic system (in strep throat). Extrapulmonary TB also occurs, among other things, in the urogenital system (in urogenital tuberculosis) and in the bones and joints (in Pott's disease, in tuberculous spondylitis).

When dissemination to the bones occurs, it is known as "tuberculosis of the bone",which is a form of osteomyelitis. A potentially more severe, widespread form of TB is called "diffuse" TB and is commonly known as cecal TB. Cecchronic tuberculosis accounts for about 10% of cases of extrapulmonary tuberculosis.

In the research period we have found the following data:

The main cause of tuberculosis (TB) is the mycobacterium tuberculosis, a small, aerobic, immobile bacillus. Many of the unique clinical features of this pathogen are caused by its high lipid content. The mycobacterium divides every 16-20 hours. This rate is slow, compared to other bacteria, which usually divide in less than an hour. Mycobacteria have an outer membrane made of a lipid bilayer. If Gram staining is performed, the mycobacterium tuberculosis either stains lightly and is classified as "Gram positive" or does not stain because its cell wall is high in lipids and mycolic acid. Mycobacterium tuberculosis (MTB) is resistant to mild disinfectants and can survive in a dry environment for weeks.

In nature, the bacterium can only grow within the cells of a host organism, but the mycobacterium tuberculosis can be cultured in the laboratory. By using histological staining on discoloured samples of the flukes, scientists can identify the mycobacterium tuberculosis mycobacterium (MTB) under a normal (natural light) microscope. (The phlegm is also called "sputum") Mycobacterium tuberculosis retains a specific staining even after treatment with an acidic solution, which is why it belongs to the acid-fast bacillus (AFB) class. The two most common techniques for staining acidophilic organisms are: the Ziehl-Neelsen stain, which stains acidophilic bacilli (AFB) with a bright red that stands out in a cyan environment,and the auramine-rhodamine stain followed by fluorescence microscopy.

The Mycobacterium tuberculosis bacillus complex (MTBC) includes four other mycobacteria that cause tuberculosis (TB): 'M. bovis', 'M. africanum', 'M. canetti', and 'M. microti'. "M. africanum" is not widespread, but is an important cause of tuberculosis in parts of Africa. "M. bovis" was a common cause of tuberculosis, but the introduction of pasteurized milk has largely reduced this mycobacterium from being a public health problem in developed countries. "M. canetti" is rare and appears to be restricted to the Horn of Africa, although some cases have been recorded in African migrants. "M. microti" is also rare and usually occurs in immunocompromised individuals, but this pathogen may be more common than we think.

Other known fungal pathogens include "M. leprae", "M. avium", and "M. kansasii". The last two species belong to the category of "atypical mycobacteria" (NTM). NTMs do not cause tuberculosis or leprosy, but they do cause tuberculosis-like lung diseases.

Risk

There are several factors that make people susceptible to TB infections. The most important risk factor worldwide is the human immunodeficiency virus, or HIV. 13% of all cases of TB are infected with HIV. The problem is often found in sub-Saharan Africa, where HIV rates are high. Tuberculosis is closely linked to overpopulation and poor nutrition. This link makes TB one of the main diseases of poverty.

The following groups of people are at high risk of TB infection: people who inject illicit drugs, people living and working in places where vulnerable people congregate (for example, in prisons and homeless shelters), poor people who do not have adequate medical care, high-risk ethnic minorities, children who have close contact with high-risk people, and caregivers in the health care sector who serve these people customers. Chronic lung disease is another important risk factor. Pneumoconiosis increases the risk by about 30 times.

People who smoke cigarettes face almost twice the risk of TB than non-smokers. Other morbid conditions may increase the risk of TB, including alcoholism and diabetes mellitus (three times the risk). Some drugs, such as corticosteroids and infliximab (monoclonal antibody against TNF) are increasingly important risk factors, especially in the developing world. Also, a genetic predisposition exists, but scientists have not determined whether this is important.

It is difficult to diagnose active TB based on symptoms alone. It is also difficult to diagnose the disease in people who are immunosuppressed. However, people who have symptoms of lung disease, general symptoms lasting more than two weeks, may have TB. A chest X-ray and multiple sputum cultures for acid-fast bacilli are usually part of the initial assessment. Interferon-gamma release assays (IGRAs) and cutaneous tuberculin response tests are not useful in the developing world. IGRAs have similar limitations in people with HIV.

A definitive diagnosis of TB is made when the mycobacterium tuberculosis is identified in a clinical specimen (for example, in sputum, pus, or tissue biopsy). However, the difficult culturing process for this slow-growing organism can take two to six weeks to culture sputum or blood. Therefore, treatment is usually started before the culture is confirmed.

Molecular detection tests and measurement of adenosine deaminase levels can quickly diagnose TB. However, these tests are not usually recommended, as they rarely change the way the person is treated. Blood tests to detect antibodies are not specific or sufficiently sensitive and are therefore not recommended.

Latent Tuberculosis

The Mantoux skin reaction is often used to screen people at high risk of developing TB. In people who have been previously immunized, the tuberculin reaction may give false-positive results. In people with sarcoidosis, Hodgkin's lymphoma, and malnutrition, the results may be false negative. Most importantly, people with active TB can give a false negative TB reaction. Interferon-γ release detection (IGRA) methods in blood samples are recommended in individuals who test positive for Mantoux. Immunization and most environmental mycobacteria do not affect IGRA methods, so they give fewer false-positive results.

Prevention efforts to prevent and control tuberculosis rely on vaccination of infants and detection and appropriate treatment of cases of active tuberculosis.The World Health Organization (WHO) has achi eved some successes through improved treatment regimens. There has been a slight decrease in the numb er of cases.

Vaccines

As of 2011, the only vaccine available is the Calmetten Guérin bacillus (BCG). The antituberculosis vaccine (BCG) has been shown to be effective against cerebroid tuberculosis in childhood, but does not provide adequate protection against transmissible pulmonary tuberculosis. However, it is the most widely used vaccine worldwide. More than 90% of children are vaccinated, but immunity wanes after about a decade. TB is rare in most parts of Canada, the UK and the US, so BCG is only given to high-risk individuals.

One reason not to use the vaccine is the fact that the cutaneous tuberculin reaction gives false posi tive results. Consequently, the disease cannot be detected through this test New vaccines are under develo pment.

Public Health

In 1993, the World Health Organization (WHO) declared tuberculosis a "global health emergency." In 2006, the Stop TB Partnership developed a global plan to eradicate tuberculosis which aims to save 14 million lives by 2015. Some of their targets are likely not to be met by 2015, mainly due to the increase in tuberculosis linked to human immunodeficiency virus (HIV) and the emergence of multidrug-resistant tuberculosis (MDR-TB). TheAmerican Thoracic Society developed a tuberculosis classification system used in public health programs.

In the treatment of tuberculosis, antibiotics are used to kill bacteria. Effective treatment of the dis ease is not easy due to the unusual structure and chemical composition of the cell wall of mycobacterium. The cell wall blocks the absorption of drugs and makes antibiotics ineffective.

The two most commonly used antibiotics are isoniazid and rifampicin. Treatment can take months . A single antibiotic is usually used in the treatment of latent tuberculosis. Active tuberculosis is best treate d with a combination of antibiotics to reduce the risk of bacteria developing antibiotic resistance.People w ith latent infections are also given treatment to prevent the future development of active tuberculosis.

The WHO recommends supervised treatment in which the patient takes their medicines under the direct supervision of a healthcare professional, with the aim of reducing the number of people who do not take antibiotic medicines appropriately. However, there is little evidence to support treatment under direct monitoring. The implementation of measures reminding us of the importance of treatment brings positive results.

Prognosis

Mycobacterium tuberculosis infection develops into an obvious disease when the bacteria overco me the immune system's defenses and begin to multiply. In primary infection (about 15% of cases) this oc curs shortly after initial infection.

However, in most cases it is a latent infection with no obvious symptoms. These inactive bacteria lead to active tuberculosis in 10% of latent cases. Many times this happens several years after infection.

The risk of reactivation increases in people with immunosuppression, such as that caused by HIV infection. In people who are simultaneously infected with Mycobacterium tuberculosis and HIV, the risk o f reactivation of the disease increases by up to 10% each year. Studies dealing with the genetic fingerprint of mycobacteria strains show that reinfection causes, more than previously thought, the recurrence of the disease.Reinfections are responsible for more than 50% of cases of reactivation of the disease in areas wh ere it occurs frequently. The probability of death due to tuberculosis decreased in 2008 from 8% ─ in 1995 ─ to 4%.

Epidemiology

About a third of the world's population is infected with M. tuberculosis. A new case of infection occurs worldwide every minute. However, most infections with M. tuberculosis do not progress to disease and 95% of those infected remain asymptomatic.It is estimated that in 2007 there were 13.7 million peopl e living in the EU. chronic cases of active tuberculosis.

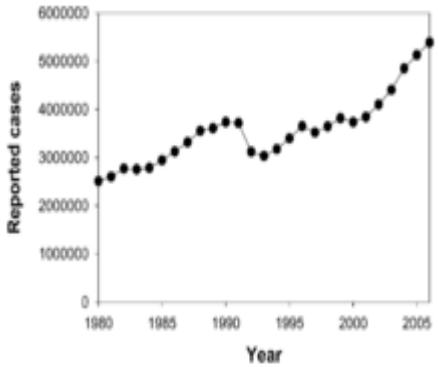
In 2010,8.8 million people were diagnosed. new cases and 1.45 million were recorded. deaths, m ost in developing countries. Of the €1.45 million, of people who die, about 0.35 million. are concomitantl y infected with the AIDS virus (HIV).

After AIDS, tuberculosis is the second leading cause of death among infectious diseases.Since 2005 the absolute number of TB cases ('prevalence') has been falling. Since 2002, the number of new cases ("incidence") has decreased. China has made particularly significant progress: from 1990 to 2010 it managed to reduce the death rate by about 80%. Tuberculosis is common in developing countries. About 80% of the population of many countries in Asia and Africa have a positive TB reaction while in the USA the percentage is only 5–10%.

Medical experts had hoped for the possibility of total control of tuberculosis, but there are several factors that make this possibility unlikely: the development of an effective vaccine has proven difficult, the cost of the vaccine is high and the time to diagnose the disease is long, the treatment takes many months and more people with HIV become infected with TB. Drug-resistant disease emerged in the 1980s.

In 2007 the country with the highest estimated incidence rate of the disease was Eswatini with 1200 cases per 100,000 people. India, with an estimated 2 million new cases, had the highest overall incidence rate. In developed countries, tuberculosis is not so common and is found mainly in urban areas. In 2010 the rates of tuberculosis per 100,000 people in different regions of the world were: 178 worldwide, 332 in Africa, 36 in the Americas, 173 in the Eastern Mediterranean, 63 in Europe, 278 in Southeast Asia and 139 in the Western Pacific regions.

In Canada and Australia tuberculosis is many times more common among indigenous peoples, particularly in remote areas. Tuberculosis death rates among Native Americans are five times higher. The incidence of the disease varies with age. In Africa it primarily affects people between the ages of 12 and 18 and young adults. However, in countries where incidence rates have fallen significantly (such as the US), tuberculosis mainly affects the elderly and people with weakened immune systems.



Annual number of new cases of tuberculosis. Data source WHO

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