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Review article

A review article on knowledge of tubercular adolescent regarding Anti-tuberculosis therapy (ATT)

P. N. Pimpalkar*, Bharti P. Pimpalkar

Government College of Nursing, Aurangabad, Maharashtra, India.

Abstract

Abstract: Worldwide many infections are harmful and pathogenic to animals and humans. Tuberculosis (TB) remains one of the most common and leading deadliest diseases, and is one of the most ancient diseases of humankind and has co-evolved with humans for many thousands of years or perhaps for several million years. A group of closely related bacterial species termed Mycobacterium tuberculosis complex causes tuberculosis. Humans become infected by M. bovis, usually via milk, milk products or meat from an infected animal. In spite of newer modalities for diagnosis and treatment of TB, unfortunately, millions of people are still suffering and dying from this disease. The review focus on various aspects of antituberculosis therapy and related therapeutic potential.

Keywords: Tuberculosis, Anti-tuberculosis therapy, Mycobacterium, M. bovis

***Corresponding author:** **Mr. P. N. Pimpalkar,** Government College of Nursing, Aurangabad, Maharashtra, India. Email: pimpalkar10@gmail.com

1. Introduction

Tuberculosis (TB) is one of the most ancient diseases of mankind and has co-evolved with humans for many thousands of years or perhaps for several million years.[1] The oldest known molecular evidence of TB was detected in a fossil of an extinct bison [Pleistocene bison), which was radiocarbon dated at 17,870±230 years [2]; and in 9000, year old human remains which were recovered from a neolithic settlement in the Eastern Mediterranean.[3] Although as early as 1689, it was established by Dr. Richard Morton that the pulmonary form was associated with "tubercles," due to the variety of its symptoms, TB was not identified as a single disease until the 1820s and was eventually named "tuberculosis" in 1839 by J. L. Schönlein.[4] In 1882, the bacillus causing tuberculosis, Mycobacterium tuberculosis, was discovered by Robert Koch; and for this discovery, he was awarded Nobel prize in physiology or medicine in 1905.[5]

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Tuberculosis is caused by a group of closely related bacterial species termed Mycobacterium tuberculosis complex. Today the principal cause of human tuberculosis is Mycobacterium tuberculosis. Other members of the M. tuberculosis complex that can cause tuberculosis include M. bovis, M. microti, and M. africanum. M. microti is not known to cause TB in humans; infection with M. africanum is very rare, while M. bovis has a wider host range and is the main cause of tuberculosis in other animal species. Humans become infected by M. bovis, usually via milk, milk products or meat from an infected animal. [6, 7] It is estimated that in the pre-antibiotic era, M. bovis was responsible for about 6% of tuberculosis deaths in humans. [8, 9]

In spite of newer modalities for diagnosis and treatment of TB, unfortunately, millions of people are still suffering and dying from this disease. TB is one of the top three infectious killing diseases in the world: HIV/AIDS kills 3 million people each year, TB kills 2 million and malaria kills 1 million. [10] Even though tubercle bacilli were identified nearly 130 years ago, a definitive understanding of the pathogenesis of this disease is still deficient. [11, 12]

Although it can affect people of any age, individuals with weakened immune systems, e.g., with HIV

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infection, are at increased risk. Since the immune system in healthy people walls off the causative bacteria, TB infection in healthy people is often asymptomatic. This bacterium lives and multiplies in the macrophages, thus avoiding the natural defense system in the patient's serum. Infection with TB can result in two stages: asymptomatic latent tuberculosis infection [LTBI) or tuberculosis disease. If left untreated, the mortality rate with this disease is over 50%.

Global scenario

According to WHO, TB is a worldwide pandemic. Among the 15 countries with the highest estimated TB incidence rates, 13 are in Africa, while half of all new cases are in six Asian countries, viz., Bangladesh, China, India, Indonesia, Pakistan, and Philippines. A WHO fact sheet dated March 2010[10) on tuberculosis stated that overall one-third of the world's population [over 2 billion) is currently infected with the TB bacillus. According to it, every second, someone in the world is newly infected with TB bacilli and 1 in every 10 of these newly infected people will become sick or infectious later in life. Since concurrent infection with HIV weakens the immune system, people with co-infection of HIV and TB are much more likely to develop TB; it is a leading cause of death among HIV-positive people. In Africa, HIV is the single most important factor contributing to the increase in the incidence of TB since 1990. The same fact sheet [10) stated that in 2008, globally speaking, there were 9.37 million new cases of TB, with the African region and the Southeast Asian region [SEAR) having a share of 30% and 34%, respectively.

Indian scenario

In India, TB has been mentioned in the Vedas and the old Ayurvedic scriptures. Historically speaking, fight against TB in India can be broadly classified into three periods: the early period, before the discoveries of x-ray and chemotherapy; post-independence period, during which nationwide TB control programs were initiated and implemented; and the current period, during which the ongoing WHO-assisted TB control program is in place.

The early period of TB control

It was marked with non-availability of any chemotherapeutic agents, the absence of diagnostic x-ray facilities and lack of any TB control program. This period lasted around the middle of the 20th century. During this period, as no drug or treatments with combinations of drugs were available/ effective against TB, a sanatorium movement originated in Europe and quickly spread worldwide. The popular rationale for sanatoria was that a regimen of rest, good nutrition, open fresh air and high altitude offered the best chance that the sufferer's immune system would “wall off” pockets of pulmonary tuberculosis [TB) infection. In 1863, for the treatment of tuberculosis, Hermann Brehmer opened the world's first sanatorium named Brehmerschen Heilanstalt für Lungenkranke in the city of Görbersdorf [Sokołowsko), Silesia [now Poland).[15]
In India, the first open-air sanatorium for treatment and isolation of TB patients was founded in 1906 in Tiluania, near Ajmer city of Rajasthan, followed by the first TB dispensary in Bombay in 1917.[16] By 1925, chest radiology started playing a diagnostic role in detecting deep-seated areas of TB consolidation. By 1945, the capability of this apparatus was enhanced to embody the MMR [mass miniature radiography) version. The first genuine success against TB was in immunizing against tuberculosis. Developed from the attenuated bovine strain of tuberculosis by Albert Calmette and Camille Guerin in 1906 was BCG [bacillus of Calmette and Guerin); it was first used on humans in France on July 18, 1921. In 1948, with support from WHO and UNICEF, a BCG vaccine production center in Guindy, Madras [now Chennai), was set up. In 1951, India started a mass BCG campaign to control TB. This was the first nationwide campaign against TB [17]; and for the first time in the history of India, message of health and prevention of disease was taken to the remotest parts of the country.

Post-independence initial nationwide TB control programs

This period can be conveniently subdivided into the following two phases:

District TB program

In 1961, District Tuberculosis Program was prepared by the Indian government, and Anantapur district in Andhra Pradesh state was the first model district TB center (DTC). This program was aimed at the integration of TB control schemes with the existing government health services to reduce the TB problem in the community as economically as possible.[18] Shortly after establishing the Anantapur DTC, it became evident that although case-finding could be done at any place without difficulty, the major problem in the fight against TB was that of keeping the patients on continuous treatment until a cure was achieved.[19] Using this district TB center model, in 1962, the Indian government launched the National TB Control Program (NTCP).

The era of short-course chemotherapy

In the middle of the 20th century, around the time India gained independence in 1947, effective drugs against TB started becoming available [Streptomycin: 1944, PAS: 1946, Thiacetazone: 1950, Isoniazid: 1952 and

Rifampicin: 1966).[20) In 1956, under the auspices of the Indian Council of Medical Research [ICMR), the government of Chennai state, the WHO and the British Medical Research Council [BMRC), the Indian government established the Tuberculosis Research Center [TRC) in Chennai. This center provided information on the mass domiciliary application of chemotherapy in the treatment of pulmonary TB. In 1959, National Tuberculosis Institute [NTI) was established at Bangalore to evolve, through research, a practicable TB program that could be applied in all parts of the country by training medical and paramedical workers to efficiently apply proven methods in rural and urban areas.[21)

Chemotherapy for TB underwent revolutionary changes in the seventies owing to the availability of two well-tolerated and highly effective drugs, Rifampicin, and Pyrazinamide. These drugs allowed short-course chemotherapy [SCC) and made it possible to simplify treatment and reduce its duration. Discovery of Rifampicin in 1967 is considered to be one of the greatest achievements in the history of the development of anti-TB drugs. Since its discovery, no new drug has been discovered yet that is as efficacious as Rifampicin against TB.

Current WHO-assisted ongoing TB control program

In 1992, Government of India, together with the WHO and the Swedish International Development Agency (SIDA), reviewed the national program and concluded that it suffered from managerial weaknesses, inadequate funding, over-reliance on x-ray, nonstandard treatment regimens, low rates of treatment compliance and completion and lack of systematic information on treatment outcomes.[22] Around the same time, in 1993, WHO declared TB to be a global emergency and devised the DOTS strategy and recommended that all countries adopt this strategy. This strategy was built on five pillars, viz., political commitment and continued funding for TB control programs, diagnosis by sputum smear examinations, uninterrupted supply of high-quality anti-TB drugs, drug intake under direct observation and accurate reporting and recording of all registered cases.

World Bank acknowledged that the DOTS strategy was the most economical health intervention and agreed to provide credit assistance for the NTCP, initially for the coverage of a population of 271 million persons, which was later revised to cover a population of 730 million persons. Presently, other bilateral and multilateral agencies, Danish International Development Agency (DANIDA), Department for International Development (DFID), US Agency for International Development (USAID), Global Fund to Fight HIV/AIDS, Tuberculosis and Malaria (GFATM), Global Drug Facility (GDF) and WHO are providing invaluable support to the program. The Global Fund to Fight HIV/AIDS, Tuberculosis and Malaria is the single biggest source of external funding for TB control. [23]

To give a new thrust and to revitalize the NTCP, with assistance from the above-mentioned international agencies, in 1997, the Revised National TB Control Program [RNTCP) was launched.[24] It formulated and adopted the internationally recommended DOTS strategy, as the most systematic and cost-effective approach to revitalizing the TB control program in India. Political and administrative commitment to ensure the provision of organized and comprehensive TB control services; reliable and early diagnosis through smear microscopy; an uninterrupted supply of good-quality anti-TB drugs; effective and patient-friendly treatment with short-course chemotherapy (SCC) given under direct observation; and accountability through proper reporting and recording and through effective supervision was heavily emphasized.[25] Today, India's DOTS program is the fastest-expanding and the largest program in the world in terms of patients initiated on treatment; and the second largest, in terms of population coverage.

Treatment of tuberculosis

The goal of treatment of tuberculosis is to ensure high cure rates, prevent the emergence of drug resistance, minimize relapses and cut the chain of transmission through early diagnosis and treatment. Treatment of tuberculosis is not only a matter of individual health; it is also a matter of public health. All practitioners who undertake to treat a patient with tuberculosis must not only prescribe a standard regimen but also have the means to assess adherence to the regimen and address poor adherence in order to ensure that treatment is completed.

Regimen for new cases

For the purpose of treatment, tuberculosis patients are classified into two groups, namely, “New” or “Previously Treated”, based on the history of previous treatment. All patients (including TB-HIV co-infected) who have not been treated previously should receive 2 months of isoniazid (H), rifampicin (R), pyrazinamide (Z) and ethambutol (E), i.e. intensive phase (IP). The continuation phase (CP) consists of isoniazid and rifampicin given for 4 months. All drugs used for the treatment of tuberculosis should have a known bioavailability. When a second individual observes a patient swallowing medications, there is greater certainty that the patient is actually receiving prescribed drugs. This approach results in high cure rate and a reduction in risk of drug resistance. Intermittent administration of anti-tuberculosis drugs enables supervision to be provided more efficiently and economically with no reduction in efficacy.

Knowledge of tubercular adolescent regarding ATT

Kulkarni et al assessed baseline knowledge of new smear-positive TB patients about their disease and treatment and find out its impact on treatment adherence. New sputum-positive TB patients initiated directly observed treatment short-course in ward E of Mumbai district in first two quarters of the calendar year were enrolled in the study. They were interviewed by the trained interviewer as per pretested semi-structured interview schedules to collect socio demographic information and to assess their knowledge after verbal consent. Treatment adherence was noted by screening treatment cards after any final outcome of the treatment as per Revised National Tuberculosis Control Program. Out of 157 patients enrolled, 150 could be interviewed. The majority were in reproductive age group and from class IV and V socioeconomic class. There was good knowledge about infectiousness, reasons behind TB, its spread, curability, and treatment duration was found in 29.5%, 28.8%, 16%, 59%, and 22.3%, respectively. 72/150 were treatment-adherent and good knowledge about all these aspects was significantly associated with treatment adherence. The most significant association was found with good knowledge about infectiousness of TB (odds ratio: 1.764, $P < 0.001$). It was concluded that thorough knowledge regarding TB and its treatment should be given to the TB patients at the initiation of the treatment may help to improve treatment adherence.[26]
Sah et al conducted a study to assess the knowledge on tuberculosis among students of the higher secondary school, Lalitpur, Nepal. The analysis of the data revealed that all the respondents had little knowledge about tuberculosis. Among those, 92% respondents got information from media and teachers, 90% respondents received from newspaper and health-worker. Majority of the respondents (80%) said that tuberculosis is the communicable bacterial diseases whereas 12% said that it is hereditary diseases, the majority of the respondents (80%) said that bacteria are the causative organism of tuberculosis. The entire respondent knew that TB is a curable disease but they lack knowledge about diagnostic feature of TB and DOTS treatment therapy and its duration. In regard to the detection of tuberculosis, the majority (94%) of the respondents said sputum test and chest X-ray help to detect tuberculosis, 90% said on the basis of sign and symptoms. Only 10% respondents had heard about mount test. Among them, 40% said skin is taken as the sample unit for mounts test as well as 20 (40%) said that blood as a sample. More than two third (78%) knew that the patients should not be admitted in the hospital to receive treatment. More than half (56%) had heard about DOTS for the treatment of tuberculosis. Among those, 28% knew that DOTS is taken for 6-8 months. It was concluded that knowledge on TB among students of higher secondary school should be promoted through enhancement of relevant health education. The knowledge should be raised through media, various awareness programs through the involvement of parents, teachers and health personnel. Proper knowledge about tuberculosis will provoke a way to prevent the spread and management of TB through proper treatment in this developing world [27].

Conclusion

A lot of measures can be undertaken to improve baseline knowledge of TB in general population like adolescent sensitization, may require revision of school/college curriculum, entertainment channels. Old movies like Sharabi used TB for its devastating outcomes. Now, movie-makers are contributing to social change by creating awareness of medical conditions like blindness, schizophrenia, dyslexia, etc. However, till today, no Sharabi II with a pleasant outcome of TB and its treatment in the main character. Lacking is… intersectoral coordination.

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