The Libyan International Medical University

Faculty of Basic Medical Science

Management of Tuberculosis Infection An Evidence-Based Approach

إسراء احمد محمود حنفي

Supervised by: **Dr. Rashad Shawgi**

Assisted by: **Dr. Mohamed Elkawafi**

Report Submitted to fulfill the requirements for Scientific Research Activity

Date of Submission: 18/2/ 2019

Abstract:

Tuberculosis (TB) is a disease caused by bacteria called Mycobacterium tuberculosis, which is transmission from infected person to another and develop within they're body if not diagnostic and treated early. Although, the treatment is available TB drug-resistant occurs when bacteria that cause TB develop resistance to the antimicrobial drugs. Moreover, TB is one of the top 10 deadliest diseases in lots of countries especially U.S. The Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO) developed a strategy to elimination the TB in early 20th century by the early diagnostic with a several tests and TB drugs treatment with Directly observed treatment (DOT) method a strategy adopted by the World Health Assembly. In May 2014 DOT strategy led to a reduction in the number TB infected people, until the number of TB patients slightly increased again in 2015. The hold on in this strategy has decreased the number again. The global health organizations targets to reduce TB deaths by 90% and to cut new cases by 80% between 2015 and 2030 it's important to make those strategies one of the Annual TB testing and treatment globally not only in the most affected country to eliminate it completely.

Introduction:

Tuberculosis (TB) is a disease caused by bacteria called Mycobacterium tuberculosis the bacteria usually attack the lungs due to inhaling bacteria-carrying air droplets but they can also damage other parts of the body by development of this bacteria in the lung from primary (latent TB) to secondary (active TB) to miliary (systemic infection) this development only will occur when the person has weak immune system (those with HIV/AIDS, those receiving chemotherapy, or children under 5 years old for example).[(1)] In other people who are healthy and with good immune systems at the time of they are infected with latent TB ,active TB disease may not develop until months or years later.[(1)]

TB spread when an infected person cough, sneezes, or talks and the other person has breathed in droplets that contain TB and travel through trachea then reach the lung where they collect in alveolar sacs once in the alveolar sacs. The bacteria begin to multiply, which activates the immune system and starts working and macrophages begin to surround the bacteria then a granuloma is formed to keep the bacteria from spreading the TB bacteria remain in the lung but the body is protected from disease by the granuloma -primary TB-. The primary site of TB infection in the lung is known as ghon's focus and its often seen in the upper part of the lower lobe and symptoms will not occur so the person most test for latent TB infection to find out, in 8 to 10 week the person will most likely test positive for latent TB infection and ghon's focus will appears on chest x-ray. The progression from latent TB infection to active TB occurs when granuloma break open and TB bacteria multiply when TB escape from the granuloma and begins to destroying a person lung it's called pulmonary TB -secondary TB-. TB bacteria can also Enter the blood stream and travel to other part of the body and especially the lymph node, kidney, brain or bone causing systemic infection -miliary TB- the condition is known as extra-pulmonary TB. [(1)(2)(3)]

In most cases, TB is treatable and curable for initial empiric treatment of TB, start patients on a 4-drug regimen: isoniazid, rifampin, pyrazinamide, and either ethambutol or streptomycin. [(3)] However, sometimes drug-resistant TB occurs when bacteria that cause TB develop resistance to the antimicrobial drugs that used to cure the disease. This means that the drug can no longer kill the TB bacteria and there's two types of drug resistant TB. the first type is Multidrug-Resistant TB (MDR TB), which is caused by TB bacteria that is resistant to at least isoniazid and rifampin, the two most potent TB drugs. The second type is Extensively Drug-resistant TB (XDR TB), which is a form of TB which is resistant to at least four of the core anti-TB drug Patients with XDR TB can be cured, but with the current drugs available, the likelihood of success is much smaller than in patients with ordinary TB or even MDR-TB. Cure depends on the extent of the drug resistance, the severity of the disease and whether the patient's immune system is compromised. [(1)(3)]

Whether the patient has primary (latent TB), secondary (active TB), miliary (systemic infection by active TB) or has developed MDR TB or XDR TB, the patient will be at risk and this might lead to death if not treated or diagnosed early. [(2)]**.** That's for outstrips that TB it's important among the major microbial enemies of humankind it's known as one of the top 10 deadliest

disease in the world as a lower respiratory tract infection and it's an important health problem in some major U.S cities recently.[4][5]

In the United States, public health authorities provide a range of services to people with TB. At the heart of these programmes are: i) Directly Observed Treatment (DOT): is a specific strategy, endorsed by the World Health Organization requires at least six months of treatment by TB drugs treatment to achieve cure a Failure to complete the treatment can lead to development of drug resistance [6][2] ii)and Early TB detection and diagnosis: there's many ways to diagnosis the TB in infected person and these several worldwide known tests like :i)TB screening "TB skin test and a TB blood test its only show if the patient is Infected by TB bacteria but it's doesn't show if the person got latent or TB disease" ii) Chest X-ray and a sample of sputum "are needed to see whether the person has Active TB".[7]

The aim of this report is to discuss and illustrate the two essential elements of early diagnosis and treatment of a tuberculosis elimination strategy that are provided by public health authorities with WHO in management of TB globally especially United states in early 20th century.

Material and methods:

Even where safe and effective treatment is still available, tuberculosis is among the world top 10 killer as a lower respiratory tract infection till now [4] ,globally, beginning in the 1980s, the HIV epidemic led to a major upsurge in TB cases and TB mortality in many countries. [5] However, in the early 20th century Tuberculosis was a leading cause of death especially in the United States. [8] In the United States, public health authorities provide a range of services to people with TB in a challenge to end TB infection by 2030. At the heart of these programmes is the Early TB detection and diagnosis and Directly Observed Treatment (DOT). [2] [6][7]

First for the early detection for TB Several tests are used to diagnose tuberculosis (TB):like Chest x-ray: chest radiographs can be used to rule out pulmonary TB; and Skin test: Is based on skin hypersensitivity to a specific bacterial protein antigen by injecting a small amount of fluid (called tuberculin) into the skin ; and Sample of sputum: One of the best ways to diagnose TB is through a sputum culture, A sample of sputum is added to a substance that promotes the growth of bacteria [7] . The second specific strategy is the Directly Observed Treatment (DOT): [6][2] According to WHO it's the best method of drug administration in which a health care professional follows the patient as the patient takes each dose of a medication; the two major drugs are used to treat tuberculosis are isoniazid and rifampin, the other drugs are pyrazinamide, and either ethambutol or streptomycin.[3][7]

The following statistic were obtained from the WHO and CDC web sites: i) it's estimated that about 2 billion people -one third of the world population- are currently infected with M.tuberculosis and leading to death for people with weak immune system ,ii) nearly 1%of the world's population is newly infected with tuberculosis each year -someone in the world became infected with tuberculosis each year and kill 2million people per year ,iii)estimated 10 to 15 million American are infected with M.tuberculosis.

In addition to textbooks, PubMed Central (PMC) was used to collect all studies and reviews used in this report. The used keyword is; Tuberculosis: A New Screening Recommendation and an Expanded Approach.

Results:

As result of tuberculosis appearance in the United States has now stalled at approximately three cases per 100,000 persons. In fact, after having declined yearly from 1993 to 2014, the overall number of tuberculosis cases in the United States increased slightly in 2015 (See figure 1) [8], so WHO's post-2015 End TB Strategy, adopted by the World Health Assembly in 2014, aims to end the global TB eliminate catastrophic costs for TB-affected households by 2030.[6]

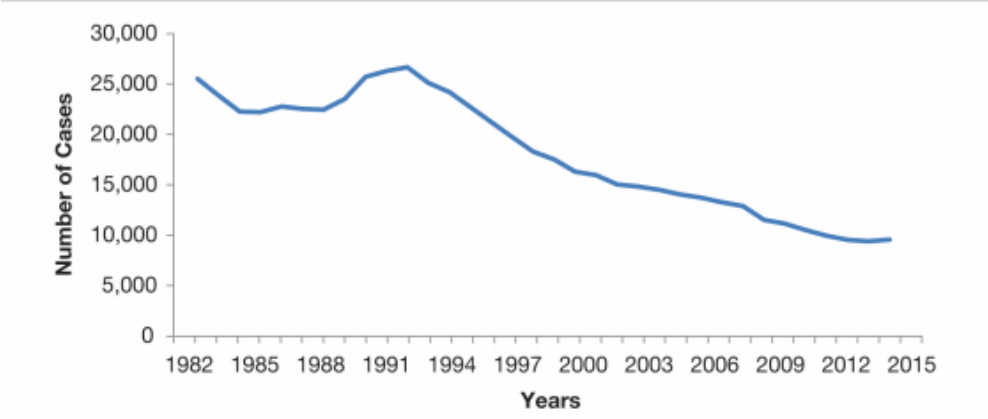

Figure 1: Reported Tuberculosis Cases in the United States, 1982–2015 [8]

Result of TB common tests that used to diagnose tuberculosis i)chest x-ray :chest films disclose disease in almost all cases , a small parenchymal lesion which heals with calcification, and other may show a cavitation, or shown a miliary lesions ; ii)skin test: reading the result is depends on the size of the raised, hard area or swelling positive reaction (induration 10mm or more in diameter) ,negative reaction (induration less than 5 mm in diameter) ;doubtful reaction (induration of 5-9 mm) ,conversion reaction (is a positive reaction that has developed within a year after a known negative reaction). iii) Sample of sputum: Photomicrograph of a sputum sample will be containing a high Mycobacterium tuberculosis as positive reaction [7]; if the patient got a positive reaction in any of these tests most be treated with anti-TB drugs and most recommended method for drug administration is Directly observed treatment (DOT). [6][2]

And as a result, after those strategy Globally the early detection and treatment strategy has the TB mortality rate fell by 42% between 2000 and 2018. [6]

Discussion:

tests showing a different reaction depend on the stage of TB in i)chest x-ray the healed up calcification small parenchymal lesion is the usual picture of primary infection the apical and subapical infiltration are the usual presenting x ray feature of primary TB in adult, and cavitation is an evidence or a result for tuberculosis activity secondary TB, or Miliary deposits appear as a cause of miliary TB; ii) skin test will show only if the patient have TB or not without showing its stage by showing a swelling on the skin in the injection site cause of skin hypersensitivity to a specific bacterial protein antigen iii)sample of sputum positive reaction by growth of organisms on culture[7] ; and directly observed treatment used after the early diagnosis positive reaction to control up the TB.

the main reason for those strategy that the WHO End TB Strategy, adopted by the World Health Assembly in May 2014, is a blueprint for countries to end the TB epidemic by driving down TB deaths [6] although it has been slightly increase in 2015 but the hold on in this End TB strategy has decrease the number again; global impact targets to reduce TB deaths by 90% and to cut new cases by 80% between 2015 and 2030 [6] .

Conclusion:

TB it's important among the major microbial enemies of human kind and as one of the deadliest diseases in the world could be controlled up and be eliminated with a strategy using several diagnosis and treatments and the important of early diagnosis is to detect TB in its early stage before it too late and use the right treatment for it with a follow up with the doctor to not develop TB drug resistant ; For future work it's important to make those strategies of early detection for TB and DOT strategy one of the Annual TB testing and treatment globally not only in the most affected country to eliminate it completely.

Reference:

1) Kumar, V., & Robbins, S. (2007). *Robbins basic pathology*. Philadelphia, PA: Saunders/Elsevier.
2) Owen, J., Punt, J., Stranford, S., Jones, P., & Kuby, J. (2013). *Kuby immunology* (6th ed.). New York: W.H. Freeman.
3) Brooks, G. (2007). *Jawetz, Melnick, and Adelberg#x92;s Medical Microbiology (24th Edition)*. Blacklick, USA: McGraw-Hill Professional Publishing.
4) Greenwood, D. (2008). *Antimicrobial drugs*. Oxford: Oxford University Press.
5) Farmer, R., & Lawrenson, R. (2004). *Lecture notes epidemiology and public health medicine*. Malden, Mass: Blackwell.
6) Tuberculosis (TB), W. (2020). Fact sheets on tuberculosis: WHO fact sheet no. 104. *World Health Organization*
7) Krupp, M., & Chatton, M. (1978). *Current medical diagnosis & treatment, 1978*. Los Altos, Calif.: Lange Medical Publications.
8) Parmer, J., Allen, L., & Walton, W. (2020). Tuberculosis: A New Screening Recommendation and an Expanded Approach to Elimination in the United States. *HHS Public Access Author Manuscript Am J Nurs. Author Manuscript; Tuberculosis: A New Screening Recommendation and An Expanded Approach to Elimination in The United States*, 20. doi: 10.1097/01.NAJ.0000521946.45448.90