Managerial Briefing on Tubercolosis

Definition: Tubercolosis (TB) is a potentially deadly infectious disease generally caused by M*ycobacterium tuberculosis*, a bacterium that predominantly attacks an person's lungs and more rarely the brain, the kidney and the bones (McKinley Health Center 2008).

Disease contraction and progression

TB is contracted by inhaling TB-causing bacteria. These germs can be released in droplets in the air when a person who is infected by TB coughs, spits or sneezes (WHO Media Center 2013). There are two main phases of the disease following a person's contraction of the germs:

- Latent Phase: During this first stage, the disease-causing bacteria are latent because the body's immune system combats the infection by building a 'fibrous capsule' around the infected area. This stage generally involves no symptoms or mild, flu-like symptoms. This phase can last multiple months (McKinley Health Center 2008).
- Active Phase: If the condition is not treated and the immune system fails to combat the infection the disease will escalate to Active TB. During this phase the bacterial population increases quickly and damages the tissue of the lungs or of any other organ it affects (McKinley health Center 2008). Injured pulmonary tissue results in reduced respiratory capacity, fever, night sweats, weight loss and fatigue. When the lungs are infected the patient usually has a dry cough and chest pains which can evolve into a cough with sputum containing blood. During this phase of the disease, the patient is contagious. (McKinley health Center 2008). Infected individuals with healthy immune systems have a 10% chance of developing active tuberculosis (WHO Media Center 2013)

HIV/AIDS Comorbidity

Given the heavy reliance on the immune system to maintain TB bacteria in the latent phase, immuno-compromised individuals have a 21 to 34 times higher chance of developing active TB (WHO Media Center 2013). The combination of these two diseases prevents the fight of either one resulting in 25% of deaths of HIV-infected individuals being caused by TB (WHO Media Center 2013).

MDR TB and XDR TB

MDR TB or multidrug-resistant TB is caused by a form of TB bacteria that is resistant to isoniazid and rifampin: the two most common and potent drugs against TB.

XDR TB or extensively drug resistant TB is a rare form of MDR TB that is additionally resistant to fluoroquinolone and at least one of three other drugs (amikacin, kanamycin or capreomycin) that are usually injected (CDC 2012).

Drug resistance is prevented by prescribing good treatment regimens and assuring patience compliance. Resistance usually occurs when the treatment is inadequate (wrong doses or length of time), when patients stop taking medications before their treatment is complete or when the quality of the drugs is not good (CDC 2012). MDR TB and XDR TB can be transmitted by patients once they reach their active form (WHO 2013).

Demographics and Market Size

WHO statistics on TB are updated to 2011. About 8.7 million people contracted tuberculosis that year, 1.4 million of whom died of it. Out of the 8.7 million people affected, 1.1 million were also infected with HIV/AIDS. According to estimations, there was a 2.2% decrease in the TB infected population between 2010 and 2011. The decrease in the number of TB infected people declining is in accordance with the UN Millennium Development goal to reduce the spread of infectious diseases (WHO: Global Health Observatory 2013)

More than 650,000 people developed or contracted MDR TB in 2010 according to WHO estimations (NIAID 2012). Out of the more than 8 million people infected with TB, it is estimated that the incidence is of about 2.3 million people in Africa, 3.5 million in South East Asia and 1.7 million in the Western

Pacific (GHE). In 2011, Sub-Saharian Africa had the highest number of new cases of TB per population, with 260 TB infected individuals for every 100,000 people (WHO 2013). Overall, 95% of all tubercolosis deaths occur in low and medium income countries (WHO Media Center 2013)

Costs

In consideration of the prevalence of TB and that most of the infected population is between 15 and 54 years of age (the most productive age), the World Bank has estimated that TB is responsible for a loss of productivity equivalent to 4-7% of some countries' GDP.

In many developing countries, TB treatment-related infrastructure is the costliest burden of healthcare (around 4 billion dollars annually). The frequent doctor visits required to sustain the treatment regimen render the treatment very costly, allowing for less funds to be invested in TB control and prevention.

(Global Alliance for TB Drug Development 2013)

Prevention

Avoiding contact with infected people and ensuring good ventilation are the best practices for TB prevention. A vaccine does exist (Bacille Calmette-Guérin (BCG) vaccine) but its efficacy appears to be limited and is not recommended in many countries including the US (NIAID, 2012)

Diagnosis and Current treatments

There are multiple ways to test for Tubercolosis, some of the most common include:

- The Mantoux tuberculin skin test (TST) – results can be generated within 48 to 72 hours
- TB blood test
- Chest Radiograph to detect pulmonary lesions
- Acid-fast-bacilii (AFB) test to detect presence on a sputum smear/culture (to confirm bacilii type)

Isolated M. tuberculosis from tests should always be tested for drug resistance- early detection of MDR TB enables to adjust the therapy to the specific strain of drug-resistant bacterium (CDC 2011).

Though specific conditions such as simultaneous HIV infection and MDR TB might require personalized treatments, generally TB treatment falls into two specific categories:

- Treatment of Latent TB Infection is a treatment regimen that people with latent TB should undergo to prevent developing active TB. It usually involves taking isoniazid daily for 9 months. Patients should undergo monthly check-ups to monitor drug side effects. Alternatively, patients can take rifampin for 4 months.
- Treatment of Active Tubercolosis requires a treatment regimen lasting a minimum of 6 months. Generally patients take a combination of four drugs: isoniazid, rifampin, pyrazinamide and ethambutol. Drug susceptibility tests can be used by clinicians to modify the treatment according to bacteria resistance. To avoid drug resistance, TB must be treated with a minimum of two drugs. To enforce patient compliance, directly observed therapy (DOT) measures have been designed and are recommended by the WHO. Clinical and bacterologic evaluations (and sometimes X-rays) should be done frequently during treatment to observe progress.

(New Jersey Medical School Global Tubercolosis Institute)

What is needed?

- A constant supply of potent first and second line medicines (to respectively avoid the development of MDR and XDR TB and treat it if there is immunity to first line drugs).
- Trained medical personnel who must be capable of prescribing efficacious treatment regimens and check for patient compliance to prevent drug resistance development. Personnel should operate in accordance with DOT procedures.
- Availability of testing kits and facilities to characterize bacilli type and resistance thereby allowing for the design of a more efficacious treatment regimen.
- Strong TB control and ventilation systems within facilities.

- A system to recognize high-risk individuals to diagnose for latent TB before the patient becomes contagious.
- A system to isolate infected individuals or prevent them from spreading TB to others around them.
- Perhaps the costliest aspect is given by the frequent interactions with a doctor and long periods of therapy. Given the high risk of developing worse conditions (MDR TB) by not terminating the therapy and not receiving sufficient surveillance, it is very hard to develop an effective solution that is not expensive.

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