Tuberculosis Among Diabetic Patient

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Abstract

Tuberculosis is the leading killer among bacterial disease worldwide and World Health Organization (WHO) suspects that TB control is being undermined by the growing number of patients with diabetes mellitus in the world. Diabetes depresses the immune response, which in turn facilitates infection with Mycobacterium Tuberculosis. Diabetes patient has two or three times risk toward the tuberculosis compared to others who do not have diabetes. Signs and symptoms of active Tb include a persistent cough, night sweats, breathlessness or pain while breathing, weight loss, loss of appetite and fever while the signs and symptoms of diabetes are severe frequent thirst, lack of energy, fatigue and blurred vision. The problem of this disease is the clinicians do not routinely screen for this disease and they are unaware of this essential link. Some of the diabetic drugs to treat diabetes are insulin, sulfonylureas, metformin and many more whereas drugs use to treat tuberculosis are isoniazid, rifampin, pyrazinamide and ethambutol. There are fist line drugs. When diabetes is diagnosed with tuberculosis, the probability of drug interactions between anti-diabetic drug and anti-tuberculosis drug will occur. Drug interaction occurs when isoniazid is given to patient who taking metformin. This will lower hypoglycemic metformin with interrupting the control of blood glucose. There are many effective ways in preventing the infection of TB such as not always to get close to people who are coughing or wear a mask. The Bacillus Calmette-Guerin (BCG) vaccination can provides protection against TB. Patient who has diabetic and tuberculosis can cause death if they are not treated immediately so to prevent it from happen, patients have to go through treatment to stop the tuberculosis. People are advised to take serious precaution about this disease to make sure they are not infecting with TB that can cause fatal to those who get it.

Introduction of Tuberculosis Among Diabetic Patient

Tuberculosis (TB) is one kind of potentially fatal contagious disease that will affect most of the body part but mainly an infection of the lungs. It is caused by Mycobacterium tuberculosis, a bacterial microorganism. Although it can be cured, treated, and can be prevented if persons at risk take certain drugs, scientists have never come close to wiped it out (TheFreeDictionary 2011). In the late 19-century, there still did not have any known antibiotic that could treat the tuberculosis. The only way to control the spreading of infection was to isolate patients in private sanitaria or hospitals limited to TB patients. Nowadays, this practice is still continued in many countries. Tuberculosis is the leading killer among bacterial disease worldwide. In 2009, more than 9 million new cases were reported and 1.7 million people died from that. World Health Organization (WHO) suspects that TB control is being undermined by the growing number of patients with diabetes mellitus in the world. The amount of diabetes patient currently is 285 million and anticipated to reach 438 million by 2030. (Blanca I Restrepo, Aulasa J Camerlin et al. 2011). Diabetes depresses the immune response, which in turn facilitates infection with Mycobacterium tuberculosis and progression to symptomatic disease. (Blanca I Restrepo, Aulasa J Camerlin et al. 2011). However, most studies regarding differences between TB patients with or without diabetes should be done in order to develop guidelines to prevent co-morbidity. (Dr. Lawrence Broxmeyer 2011). A person may become infected with Mycobacterium tuberculosis when he inhales minute particles of infected sputum from the air. The bacteria get into the air when someone with tuberculosis lung infection coughs, sneezes, shouts, or spits. People nearby can possibly breathe the bacteria into their lungs. People won’t get TB by simply touching the clothes or shaking hands with someone who is infected. Tuberculosis is transmitted primarily from person to person by breathing infected air during close contact. When the inhaled tuberculosis bacteria enter the lungs, they can multiply in minutes and cause pneumonia. The local lymph nodes associated with the lungs will be infected and become enlarged. Besides that, TB can spread to other parts of the body. The body’s immune system will fight off the infection and stop the bacteria from spreading. The immune system will form scar tissue around the TB bacteria and isolate it from the rest of the body. Tuberculosis that occurs after the initial exposure to the bacteria is called primary TB. If the body is able to form scar tissue around the TB bacteria,
the infection is contained in an inactive state. The person will not have any symptoms and cannot spread TB to other people. The scar tissue formed may become hard due to the process of calcification of scars. These scars often appear on X-rays as round marbles that called granuloma. Sometimes, the body immune system may become weakened and the TB bacteria will break through the scar causes active disease called reactivation tuberculosis or secondary TB. The lungs, kidneys, bone, and lining of the brain and spinal cord are the most common sites affected by the spread of TB. (MedicineNet.com 2011). At the end of the 2nd World War, tuberculosis become the biggest single killer and causes the most suffering in our country. For the next 15 years tuberculosis continued to be the biggest health problem in Malaya. Tuberculosis is usually a disease of townsfolk or urban communities, but in Malaya the rural areas were affected almost as seriously as the towns. The prevalence of tuberculosis even among the aboriginal population was found in surveys to be as high as in towns. Rural folk particularly in Kedah and east coast states had an incidence almost as high as was found in slum areas of our cities and towns. More than a quarter of the hospital beds were occupied by tuberculosis patients. In the absence of any effective Government action, a band of civic minded community leaders decided to take upon themselves the task of starting a country-wide anti-tuberculosis movement, and formed the Malayan Association for the Prevention of Tuberculosis (MAPTB). (MAPTB Info 2011).

Causes and Mechanism of Tuberculosis Among the Diabetic Patients

Tuberculosis (TB) is a diseases that cause by infection of the bacterium mycobacterium tuberculosis, which spreads in microscopic droplet that are released into the air when someone with untreated, active TB coughs, speaks, sneezes or spits. However, despite the fact that the TB bacterium enters the air almost any time someone with the active disease opens their mouth, the disease is not that easy to catch. Mycobacterium tuberculosis acts inside the macrophage. Macrophages function as infection fighting cells in the body’s immune system. Macrophage cells' tools include the production of special proteins called cytokines to attack foreign invaders. Infected macrophages can also initiate a self-destruction mechanism called apoptosis, which signals other immune system cells to mount a defense against the infection. TB bacteria are able to disable the macrophage defenses by secreting virulent factors into the host. The actions of a particular virulent factor, a protein phosphatase enzyme called mPTPB blocked both the production of the infection-fighting cytokines, and the macrophage’s self-destruct system. (Indiana University School of Medicine 2010). Tuberculosis first will infect the lungs. Inside the body, when a person breathes in infected air, the bacilli go to the lungs through the bronchioles. At the end of bronchioles are alveoli. TB bacilli infect the alveoli and the body’s immune system begins to fight them. Macrophages started to surround the wall of TB bacteria in the lungs. Then special immune cells surround and separate the infected macrophages. The mass resulting from the separated infected macrophages are hard, grayish nodules called tubercles. Active TB spread through the lymphatic system to the other part of body. In these other parts, the immune system kills bacilli, but immune cells and local tissue die as well. The dead cells from masses called granulomas, where bacilli survive but don’t grow. As more lung tissues are destroyed and granulomas expand, cavities develop in the lung, which causes more coughing and shortness of breath. Granulomas can also eat away at blood vessels which causes bleeding in the lungs, and bloody sputum. Diabetes is a disease that is characterized with the hyperglycemia (high blood glucose) especially after the patient taking the meals. It is a group of metabolic diseases in which the body cannot produce enough insulin, or because the cells do not response to the insulin that is produced (Diabetes Care 2004). This disease is influence or can be induced by many factors. For example immune-mediated, infections, drugs or chemical induced diabetes, the genetic defect in insulin action. Diabetes can be divided into two categories which is type 1 and type 2. Type 1 diabetes mellitus is characterized by loss of the insulin-producing beta cells of the Islets og Langerhans in the pancreas leading to insulin deficiency. This type of diabetes can be further classified as immune-mediated or idioopathic. The majority of type 1 diabetes is of the immune-mediated nature, where beta cell loss is a T-cell mediated autoimmune attack (Diabetes Care 2004). Type 2 diabetes mellitus is characterized by insulin resistance which may be combined with relatively reduced insulin secretion. The defective responsiveness of body tissues to insulin is believed to involve the insulin receptor. Type 2 diabetes is the most common type. Individual that have low immune system caused by chronic diseases such as diabetes face high risk to get tuberculosis infection. Diabetes
patient has two to three times risk toward the tuberculosis compared to the others who do not have diabetes (The Stop Tb Department 2011). Uncontrolled diabetes can cause other diseases complication by many mechanisms. The mechanism is including directly related to the hyperglycemia and insulinopenia. On the other hand, indirectly are cause by the lowering function of the macrophages and lymphocytes which also contribute to the Mycobacterium tuberculosis infection (Diabetes Care 2004). Effector cells that mostly contribute to Mycobacterium tuberculosis are the phagocytes that are macrophages alveoli and monocytes precursor. Diabetes has been known to influence the chemotaxis, phagocytosis, and antigen presenting of the phagocytes in stimulation toward the Mycobacterium tuberculosis. This monocytes chemotaxis not occurs among the diabetes patient and this defect cannot be treated by insulin therapy (Lawrence Broxmeyer 2005). In recently study, specific tuberculosis and mycobacteria protein directly caused insulitis, hyperglycemia, and diabetes of the mouse through the anti-insulin antibody production. This problem causes the pancreas tissue damage and the diabetes condition more critical (Catherine R. Stevenson et al. 2007).

Sign and Symptoms of Tuberculosis Among Diabetic Patient

Tuberculosis patients usually will not show any sign and symptoms until the bacteria Mycobacterium Tuberculosis reach the target organ. In the latent TB, the bacteria will remain inside the body in an inactive form and no symptoms can be recognize but different in active TB where it will shows the symptoms. Tuberculosis usually attacks parts of human organ such as lungs. Tuberculosis can also affect other parts of the body including brain, spine and kidneys (MayoClinic 2011). The symptoms vary according to the organ that involved. Diabetes has been identified as a condition that may cause previous TB patient or people with latent TB to reactivate the infection. An elevated level of ketone bodies in the blood because of the diabetes will provide a suitable condition for the reactivation of TB (Tatar D et al. 2009). About 20% of TB patients are diabetes patients. Signs and symptoms of active TB include a persistent cough that brings up thick phlegm which also may be bloody, night sweats, breathlessness or pain while breathing, weight loss, loss of appetite, fever (a high temperature of 38C or above), extreme tiredness and a sense of feeling unwell. These are the symptoms for the pulmonary TB. Pulmonary tuberculosis frequently goes away by itself, but in 50%-60% of cases, the disease can return. In certain cases, TB infection can spread from the lungs to other parts of the body known as extrapulmonary TB. For example, tuberculosis of the spine may give you back pain, and tuberculosis in your kidneys might cause blood in your urine. TB infection in the lymph nodes can show the symptoms such as swelling of the lymph nodes which usually affects nodes in the neck that causes a discharge of fluid through the skin. TB also can infect gastrointestinal tract which lead to the symptom such as diarrhea and bleeding from anus (NHS Choices 2011).Symptoms of genitourinary TB include a burning sensation when urinate, blood in your urine and groin pain. On the other hand, the symptoms that people have diabetes are frequent trips to the bathroom because there is too much glucose in the blood, severe frequent thirst, lack of energy and fatigue, blurred vision and tingling or numbness in your hands, legs or feet.

Treatment of Tuberculosis Among Diabetic Patient

The clinicians in charge of TB patients should also routinely screen for diabetes, because diabetes can complicate the presence of tuberculosis treatment. Diabetes is an important risk factor for tuberculosis which is still ignored by clinicians. They do not do routinely screen for this disease and many clinicians who treat tuberculosis are completely unaware of this essential link (Gavin CKW Koh et al. 2009). Many studies have shown that patients with both diabetes and tuberculosis may indicate the difference from patients with tuberculosis alone, and they may have a different prognosis. Diabetes also can complicate the management of tuberculosis. In the pre-insulin era, diabetes patients who do not die from diabetic coma often die because of tuberculosis. Uncontrolled diabetes is associated with cardiovascular disease, retinal disease and increased risk of other infections. All these complications can be prevented by achieving good glycemic control, and this depends on early recognition and treatment. Treatment failure is more common in diabetic patients and mortality is higher. Diabetes medicines can interact with tuberculosis treatment, rifampicin example is the same complications in glycemic control. Patients with diabetes and TB take longer to respond to anti-TB treatment. Patients with tuberculosis and diabetes
mellitus showed no response to tuberculosis therapy as patients who do not have diabetes. (OURJEET 2009). Insulin was the first drug, and remains the primary method of treatment for type 1 diabetes and is administered by subcutaneous injection. This method was necessary because the insulin is destroyed by gastric stomach secretions when it is taken by mouth. Insulin injections must be balanced with food and daily activities, and glucose levels should be monitored closely through regular blood sugar testing. Many diabetics need to inject insulin only once a day, others require two or more injections. The ordinary time for insulin dose is before breakfast. (Diana Fan, Yvonne 2010). Other drugs that treat diabetes are Sulfonylureas. Its primarily lower the blood glucose level by increasing the release of insulin from the pancreas. Older generations of these drugs include chloropromazine and tobutamide, while the newer one includes glyburide, glipizide and gimpiride. These drugs are effective in rapidly lowering the blood sugar level but it can cause hypoglycemia. They are sulfa-containing drugs and should be avoided by patients who allergic to sulfa. There is also drug that decreases the glucose production by the liver. It is called biguanide metformin (Glucophage). Metformin does not increase insulin levels when it is used alone so it does not usually cause hypoglycemia. It has an effect whereby it tends to suppress appetite which may be beneficial in diabetics who tend to be overweight. It may be used by itself or together with other oral drugs or insulin. It should not be used in patients with kidney impairment and should be used with caution in those with liver impairment. There are many other drugs that can treat diabetes such as Troglitazone, Precose, and Pramlintide and so on. (Ruchi Mathur 2011). Tuberculosis treatment usually combines with several different antibiotic medications that are given for at least 6 months, and sometimes for as long as 12 months. This is because there are many tuberculosis bacteria (Mycobacterium tuberculosis) that need to be killed. Taking several medicines will do a better job of killing all of the bacteria, and will also help prevent them from becoming resistant to the medicines. Drugs that used to treat tuberculosis are ethambutol, isoniazid, pyrazinamide, rifampin and streptomycin. They are first line drugs. There are also directly observed treatment (DOT). DOT is the process during which the TB patient takes every dose of the medication under the direct observation of health-care staff. DOT is strongly recommended by authoritative bodies like the World Health Organization (WHO) and the International Union Against Tuberculosis And Lung Diseases (IUATLD) as a most effective measure in the control of tuberculosis. By using DOT, TB patients can be provided the necessary support to complete the whole course of treatment, so that the treatment failure, emergence of drug resistance and spread of the disease can be avoided. If not treated, active TB can be fatal, killing up to 60% of patients. When treated, a cure can be achieved in 90% of all cases. People who have been treated for at least 2 weeks are usually no longer contagious because TB bacteria grow slowly but for treatment for an active infection are lengthy, usually six to 12 months. After a few weeks, you won’t be contagious and may start to feel better, but it’s essential that you finish the full course of therapy and take the medications exactly as prescribed by your doctor. If you stop the treatment too soon or skipping doses can create drug-resistant strains of the disease that are much more dangerous and difficult to treat. Drug-resistant that isn’t treated quickly can become fatal, especially in people with impaired immune system. Isoniazid is a synthetic analogue of pyridoxine. Monotherapy with isoniazid is not recommended due to high rates of resistance. Its introduction revolutionized the treatment of tuberculosis. It is available in tablet, syrup and injectable form. Isoniazid has to be taken all even if you begin to feel better. Your symptoms may begin to improve before the infection is completely treated. Alcohol may increase the risk of damage to the liver during isoniazid treatment (Vitaly Rogalsky 2006). Within 1 to 2 hours after oral administration, isoniazid produces peak blood levels which decline to 50% or less within 6 hours. It diffuses readily into all body fluids, tissues, organ and excreta. The drug also passes through the placental barrier and into milk in concentrations comparable to those in the plasma. From 50 to 70% of a dose of isoniazid is excreted in the urine within 24 hours (Asocella G 1978). Isoniazid inhibits the synthesis of mycolic acid in the mycobacterial cell wall by inhibiting different enzymes. Mycolic acids are long fatty acids found in the cell walls of Mycobacterium tuberculosis. Rifampin is a semi synthetic compound derived from Streptomyces mediterranei. It is never given as a single agent due to rapid emergence of resistance. Rifampin inhibits DNA-dependent RNA polymerase in bacterial cells by binding its ? subunits, thus preventing transcription of messenger RNA (mRNA) and subsequent translation to proteins. After oral administration on an empty stomach, the absorption of rifampin is rapid and practically complete. Approximately 80% of rifampin is transported in blood bound to plasma proteins, mainly albumin. Rifampin is well distributed in the various tissues of the human body. This drug can make you drowsy and do not take alcohol because it can add to the drowsiness caused by this drug (RxList
2008). Pyrazinamide is a synthetic and orally effective. It is an antitubercular agent use in combination with isoniazid and rifampin. Its mechanism of action of this drug is they stop the growth of Mycobacterium tuberculosis. This bacterium has the enzyme pyrazinamidase which is only active at acidic pH. Pyrazinamidase converts pyrazinamide to the active form, pyrazinonic acid. This acid inhibits the enzyme fatty acid synthetase 1, which is required by the bacterium for the synthesis of fatty acid. Pyrazinamide should always be administered with other effective antituberculous drugs. It is administered for the initial 2 months of a 6 month or longer treatment regimen for drug susceptible patients. Patients who are known or suspected to have drug-resistant disease should be treated with regimens individualized to their situation. Pyrazinamide frequently will be an important component of such therapy. Pyrazinamide is distributed throughout the body, including CSF. It undergoes extensive metabolism. Other drug to treat tuberculosis is Ethambutol. It is a bacteriostatic antimycobacterial drug prescribed to treat tuberculosis. It is usually given in combination with other tuberculosis drugs. It works by obstructing the formation of cell wall. It inhibits arabinosyltransferase, an enzyme required for all the synthesis of mycobacterial arabinogalactan cell wall. Thus it halts the growth of bacteria. It is useful to treat TB in combination with isoniazid, pyrazinamide and rifampin. In patients who have received previous antituberculous therapy, mycobacterial resistance to other drugs used in initial therapy is frequent. Consequently, in such retreatment patients, it should be combined with at least one of the second line drugs not previously administered to the patient. Ethambutol should be administered on a once every 24-hours basis only. Absorption is not significantly altered by administration with food. It is well distributed throughout the body. Penetration into the CNS is therapeutically adequate in tuberculosis meningitis. Altered pharmacokinetics of antituberculosis drugs may contribute to an increased risk of tuberculosis treatment failure for diabetic patients. There is a study that found rifampin exposure was 2-fold lower in diabetic than in nondiabetic tuberculosis patients during the continuation phase of treatment. Diabetes exerts a negative effect on TB treatment, especially among patients with poor glycemic control with more treatment failure and more relapse than among TB patients. Lower concentrations of anti-TB drugs in plasma have been associated with clinical failure and acquired drug resistance. The presence of diabetic, higher body weight and higher blood glucose level contributed to lower plasma rifampin concentrations. These show that heavier diabetic TB patients may need to be treated with a higher dose of rifampin and that glycemic control may increase drug concentration (Rovina Ruslami et al. 2010). Several reviews of clinical studies show that TB patients with diabetes are more likely to have delayed smear and culture conversion, are more likely to get hepatotoxicity, and suffer a much higher case fatality rate (Dr Richard J. Brostrom 2010).

**Drug Resistance in Tuberculosis**

Knowledge of molecular genetic basis of resistance to anti-tuberculosis agents has known since we done a research about this topic three years ago. There are two type of drug resistant in tuberculosis. Multidrug-resistant TB (MDR-TB) is caused by bacteria that are resistant to the most effective anti-TB drugs which are isoniazid and rifampicin. The results of MDR-TB from either primary infection with resistant or may develop in the course of a patient’s treatment. Extensively drug-resistant TB (XDR-TB) is a form of TB caused by bacteria that are resistant to isoniazid and rifampicin and also any of second-line anti-TB injectable drugs (amikacin, kanamycin or capreomycin) and fluoroquinolone (Media centre 2010). A drug-resistant strain of Mycobacterium tuberculosis means that one differing from the tight distribution of wild strains that have come into contact with the drug concerned (D. A. Mitchison 2005). Ohno et al. states that drug-resistance of M. tuberculosis was caused by point mutations in chromosomal gene (Ohno H et.al 1998). Drug-resistance is established only by drug-susceptibility testing. Treatment of TB caused by drug-resistant organisms should be done in close consultation with an expert. Patient not on directly observed therapy (DOT) in the past or who had irregular treatment are at risk of drug resistance. The raise of drug-resistance strains makes strain identification necessary for the selection of the proper pharmacological treatment. Several genes have been found to confer specific drug-resistances. Genes are now readily identified using molecular techniques (most of them PCR-amplification based), at least for the already sequenced drug-resistance associated genes. Identification and characterization of unknown types of resistance requires de-novo studies. Almost all isolates resistant to rifampin and related rifamycins have a mutation that alters the sequence of a 27-amino-acid region of the beta subunit of ribonucleic acid (RNA) polymerase. A large number of RNA polymerases with various degrees of sensitivity...
increased incidence of TB outcomes are the increased risk of secondary transmission and research article reports that poor individual outcomes, 20.2% of infectious TB. (Catherine R. S et al. 2007) A to incidence of TB with 14.8% of pulmonary TB and showed that diabetes make a substantial contribution to incidence of TB with 14.8% of pulmonary TB and 20.2% of infectious TB. (Catherine R. S. et al. 2007) A research article reports that poor individual outcomes, increased risk of secondary transmission and increased incidence of TB outcomes are the implications of the negative effects of diabetes mellitus on TB outcomes. (Meghan A. B et al. 2011). There are others reasons for the number of deaths associated with TB. This includes late diagnosis and co-infection with HIV. Besides, people with poor nutrition and not taking medications as prescribed are more likely to die from TB. In fact, TB is the primary cause of death for people with HIV. This is because the TB infection is more difficult to treat and control due to the weakened immune system in TB patient co-infection with HIV. On the other hands, the earlier you start TB treatment, the better your prognosis. Bacteria may spread throughout the lungs and other parts of the body if treatment is received at a later stage. Furthermore, people who stop taking their medications early or taking their medications not as prescribed are at a much higher risk of death from TB. Taking medications as prescribed is to ensure that antibiotics keep working to destroy all the bacteria in your body. (Diana Rodriguez 2009). Hence, it is important to raise awareness about tuberculosis and how to prevent its spread can help decrease TB rates around the world. An organized system can be set up for recognizing, treating and preventing TB infection. The more people know about TB and the importance of preventing the spread of TB, the more focus can be shift toward stopping it in a more effective way. (Diana Rodriguez 2009) In addition, it is important that TB control programs are not solely focus on TB patients but need to expand efforts to focus on treatment and monitoring patients with diabetes mellitus, HIV and TB disease.

**The Importance of Knowing Tuberculosis Among Diabetic Patient**

Tuberculosis is a preventable disease. However, tuberculosis infection remains a real threat in some countries and the death rate is significant. Currently used medications and treatments become less effective with the emergence of resistant strains of TB. In fact, not all infected people are sick with active TB, only 10 percent will develop active and contagious tuberculosis. TB is all about human contact, it is transmitted only from humans to humans. TB can be easily spread when a person with active TB cough. (Diana Rodríguez 2009). Diabetes increases the risk of TB. A study done by Catherine R Stevenson, Nita G Forouhi, Gojka Roglic, Brian G Williams, Jeremy A Lauer, Christopher Dye and Nigel Unwin in India showed that diabetes make a substantial contribution to incidence of TB with 14.8% of pulmonary TB and 20.2% of infectious TB. (Catherine R. S et al. 2007) A research article reports that poor individual outcomes, increased risk of secondary transmission and increased incidence of TB outcomes are the opposite of stigma. Supportive attitudes, trusting and openness form the basis of interaction between TB patients and their environments. TB patients’ experience and relationship with their social networks are critical to issues of adherence to treatment and care-seeking behavior. (Sengupta S et al. 2006). In the same study, there are several factors are found to be associated with the social outcome of TB. The first
factor concerned with the severity of symptoms or disease. TB patients who suffer from more severe symptoms such as coughing that can produce blood experienced greater stigma. Religion is another factor associated with the social outcome of TB. Attitudes toward TB patients are influenced by religion. From the study, Muslims are the one who tends to be more supportive; they expressed less stigmatizing attitudes towards TB patients. Apart from the factors above, knowledge of TB could lead to both social support and stigma. A more positive outlook is contributed by increasing the knowledge about TB. (Sengupta S et al. 2006). Other social impacts experienced by TB patients include TB patients are ashamed of their disease and refused to go out. They refused to consult for treatment because of being afraid that people will isolate or avoid them. Other than that, TB patients normally do not finish their medication due to lack of social support from their family members and friends. As a result, this may leads to emerge of resistant TB strains. (Yahoo! Answers 2011). There is a study showed that TB patients rate their quality of life lower compared to non-infected people. Female TB patients felt that they are not able to have a romantic live as well as their abilities to nurture their children. This is because they fear their children will be infected. (Elizabeth Hartsock 2010). The economic cost for TB to the nation is high because TB affects the economically most productive groups of individuals. If the patient is a wage earner, households face substantial expenditure due to TB. The expenditure for diagnosis, privately purchased drugs and money spent on care received in the private sector worsens the problem. In order to avoid the economic loss, many patients tend to postpone their visit to diagnosis or treatment facility especially among women. This is because in the point of view of them, they are primary care givers in a household and their domestic responsibilities. Delay in getting medical care may leads to severe adverse effects and TB may become more difficult to treat and control. (Geetharamani S et al. 2010). Financial well-being of individuals diagnosed with TB can be affected because they have to be medically quarantined for a period of time. TB patients are often unable to be productive workers. Since they are unable to contribute financially, they encounter financial problems in their families. This in turn generates economic impact on their countries’ national economies. (Elizabeth Hartsock 2010) A study done by Guy Harling of McGill University in Montreal showed that countries with a lower burden of TB grew faster than those countries which are heavily infected. This proves that better health leads to higher productivity and higher levels of economic well-being. (Franque G and Guy H n.d.)

Prevention

There are many effective ways in preventing the infection of TB such as not always to get close to people who are coughing or wear a mask. Wearing a mask when around other people can prevent and lessen the risk of transmission of TB. Wearing a mask is a must when visiting a patient that suffers from TB. Use a tissue or handkerchief to cover mouth when sneeze or cough and always throw it away (MayoClinic 2011). Next, do not sleep in the same room as other people that have TB. If travel in countries where tuberculosis is a problem, get vaccinated and avoid socializing with people who have a persistent cough. For most people, the Bacillus Calmette-Guerin (BCG) vaccination can provides protection against TB (eMedicineHealth 2011). However, for people that over 35 years old, the BCG vaccine is not usually offered. This is because there is little evidence that it provides protection for these people (NHS Choices 2011). Before the vaccination, a Mantoux skin test is given to check whether you have latent TB. For people with latent TB, vaccination is not recommended because it will have no benefit and could cause unpleasant side effects. Other preventative measures against TB are by having a TB skin test. A TB skin test will tell you if you have ever had TB germs in your body. Additional tests including a simple chest x-ray will help show if you have a latent TB infection or active TB. For diabetes patient, the preventative ways for tuberculosis infection is by the prevention of diabetes itself. Blood sugar levels should always be monitor time by time. The risk of tuberculosis goes up when hyperglycemia is uncontrolled. People with diabetes who have good glucose control are less likely to develop tuberculosis (MayoClinic 2011). Next is by regular exercising. Studies of both men and women have shown that exercise has a protective effect against diabetes. Exercise not only promotes weight loss but lowers blood sugar as well. Exercise also help in preventing diabetes by enhancing immune system (Thilaka Ravi 2009). Eat lots of fiber that can be found in raw fruits and vegetables. Fiber will go a long way in preventing diabetes because it helps to buffer high amounts of sugar or carbohydrates in the diet.

Role of Pharmacist

Nowadays, pharmacists in hospitals and community
pharmacies are not only playing their role in preparation, dispensing and sale of medications. This traditional role is changing to one in which pharmacists assist the public to achieve the optimum therapeutic outcomes from medications. (Patrick O.E 2003). There are several roles of pharmacists in management of TB among diabetic patients.

**Availability of anti-TB or anti-diabetic medicines**
Development of drug-resistant TB and therapy failure are commonly due to inconsistent and partial treatment. Hence, pharmacists have to play a key role in drug procurement, distribution, provision of drug information and ensuring rational use of drugs. Pharmacists should ensure the medications are available in sufficient amount and are of good quality. Besides, pharmacists should ensure the correct storage of medications at each facility and check for the expired medications as well. (Gail Mkele. 2010)

**Patient education**
Pharmacists can act as the patient’s source of information on their disease condition and treatments they have been prescribed. Pharmacists are not only educating patients on the treatment of disease but also on preventive measures and side effects they might encounter. (Gail Mkele. 2010) A study showed that there was an improvement in patient’s adherence to TB treatment when pharmacists provided patient education and counseling on medical use or patients' pharmaceutical care issues. (Philip M.C et al. 2007)

**Treatment and care**
TB treatment needs to be taken regularly and usually for a prolonged period of time. Directly observed treatment (DOT) is a good way for physicians, health care staffs and pharmacists in monitoring TB patients. It is necessary to ensure the patients take each dose of anti-TB medications in order to prevent emergence of drug resistant. Besides, pharmacists should monitor drug interactions between anti-TB and anti-diabetic drugs which can interfere with the desired therapeutic goals. (Gail Mkele. 2010) AADE7TM is necessary for diabetes self-management. This includes healthy eating, physical activity, medication taking, monitoring, problem solving, healthy coping and reducing risks. Pharmacists play a vital role in helping diabetic patients to achieve therapeutic goals based on these seven key self-behaviors. (Laura S.M et al. n.d.)

Private-public sector collaborationTB patients are either managed in government or private healthcare facilities. In fact, all patients are required to be entered into a TB register which assist government in TB control. Therefore, a close collaboration between healthcare professionals in the private and the public sector should be established. Community pharmacists are often the first choice of patients seeking healthcare. Hence, pharmacists should encourage and assist patients in identifying TB control centers to ensure that TB cases are recorded. It is important in providing the information needed to plan and controlling TB. (Gail Mkele. 2010)

**Conclusion**

Tuberculosis will infect someone with low immune system. They are vulnerable to infection compare to those who have high immune system level. Diabetic patient is very vulnerable to tuberculosis infection because they have very low immune system and has two to three times risk toward the tuberculosis compared to the others who do not have diabetes. But physicians or health care professional do not routinely screen this disease and they are unaware of this essential link. So, patient with diabetic will not know if they are infect with this tuberculosis or not until they show the symptoms of tuberculosis such as perpetual cough, fever, weight loss, blood stained sputum and loss of appetite. Patient who has diabetic and tuberculosis can cause death if they are not treated immediately so to prevent from it to happen, patients have to go through treatment to stop the tuberculosis. When treated, a cure can be achieved in 90% of all cases. People who have been treated for at least 2 week are usually no longer contagious. But patient are advised to finish the full course of therapy and take the medication exactly as prescribed by your doctor. People are advised to take serious precaution about this disease to make sure they are not infect with tuberculosis than can cause fatal to those who get it.

**References**


51. Laura S.M, Becky A, John T.J and Nancy L et.al

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