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Tuberculosis and Anaesthesia

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ABSTRACT *India accounts for one fifth of the global incidence of TB. Although contaminated milk was once a common source of tuberculosis, almost all infections seen today result from the inhalation of droplet nuclei from an infected individual. Patients with TB who need surgical or endoscopic procedures may have several underlying risk factors along with TB. Therefore, nurses must have a basic knowledge of the immune system and TB. Care begins with a thorough and accurate assessment. It is imperative that perioperative personnel and other patients are protected from thetubercle bacillus, which can remain air borne for hours. . Patients with TB who must undergo surgery,however, are at particular risk for hyperthermia, hypothermia, deficit oxygenation, and decreased inspiratory and expiratory effort. Postoperative care should, if possible, take place in a room with negative pressure that provides some isolation from outside hallways.*

EPDEMIOLOGY AND GENERAL CONSIDERATION

Tuberculosis is an infection, primarily of the lungs, caused by two species of mycobacteria, Mycobacterium tuberculosis and Mycobacterium bovis. Although the concept that tuberculosis was caused by an infectious agent has been credited to Aristotle[1], It was not until the discovery of the tubercle bacillus by Koch in1882 that the true nature of the disease and its pathogenicity was understood.

India accounts for one fifth of the global incidence of TB. The annual global incidence is estimated 9 million out of which 1.98 million cases are from India. It is also estimated that 40% of adult population in India is infected with TB and 10% of them will have TB in their lifetime. The link between TB and HIV is quite significant as the HIV infection increases the progression of TB from 10% to 60% amongst TB infected HIV positive persons.

In india Directly observed treatment , short course(DOTS) strategy is the accepted standard comprehensive strategy for the diagnosis,treatment and monitoring of TB worldwide, known as Revised national TB control programme(RNTCP). This was pilot tested in 1993 and after rapid expansion since 1998 the entire country was covered by march 2006[2].

DOTS is a major plank in the WHO global TB eradication programme.The DOTS strategy focuses on five main points of action. These include government commitment to control TB,diagnosis based on sputum smear, microscopy tests done on patients who actively report TB symptoms, direct observation short course chemotherapy treatment, a definite supply of drugs and standardized reporting and recording of cases and treatment outcomes[3].

TRANSMISSION

Although contaminated milk was once a common source of tuberculosis , almost all infections seen today result from the inhalation of droplet nuclei from an infected individual[4]. Although a single infectious unit is capable of causing infection in a susceptible individual, prolonged exposure in a closed environment is optimal for transmission of infection[4].

Generally, the infectiousness of a patient with tuberculosis depends on a number of factors including the anatomic site of infection,e.g., pulmonary or laryngeal tuberculosis, the presence of cough or sneezing, the presence of cavitation in the lungs, the presence of acid-fast bacilli (AFB) in the sputum, time on antibiotic therapy and the duration of symptoms[5]. Often,patients who acquired the infection early in life do not become symptomatic until much later. Patients who are HIV-positive, however, tend to acquire 'active tuberculosis soon after infection.

COURSE OF TUBERCULOSIS

The development of TB involves three phases. These are
1) transmission and acquisition of infection
2) latency, and
3) progression of latent infection to active disease[6].

Transmission of TB occurs primarily via airborne route but also can occur via absorption through the gastrointestinal tract.[7] Typically transmission occurs when one person coughs or sneezes, Aerosolized droplets containing infectious organisms that can remain suspended in the air for several hours and then get inhaled by another person. Contact with an infected person, therefore is not necessary.[7]

RISK FACTORS

The most significant risk factor for progression from latent TB infection to active TB is HIV. Other people who are at a higher risk of developing activeTB are those who have or have had

- a gastrectomy,
- cancer,
- Hodgkin's lymphoma,
- diabetes mellitus,
- silicosis.

SYMPTOMS OF TB

People with TB often present with vague symptoms such as fatigue, anorexia, and weight loss. A cough, fever, and night sweats are also symptoms. In later stages, chest pain and hemoptysis are present. When a person starts coughing up blood, he or she often is driven to seek medical attention, but by then, caseation, consolidation, fibrosis, and cavitation usually are present. Health care providers note

- dullness on percussion over the affected area;
- crepitant crackles, bronchial breath sounds, wheezes on auscultation; and

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- whispered pectoriloquy (ie, the sound of the patient whispering "99" is louder with auscultation over lung fields where consolidation is present)[8].

DIAGNOSTIC TESTING

Symptoms of pulmonary tuberculosis may include persistent cough, anorexia, weight loss, chest pain, hemoptysis, and night sweats. The most common test for tuberculosis is the tuberculin skin or Mantoux test. This involves the intradermal injection of 0.1 mL of purified protein derivative containing 5 tuberculin units. The skin reaction is read in 48-72 h, and a positive reaction is generally defined as an induration of greater than 10mm[4,9] .Chest radiographs are critical for the diagnosis of tuberculosis. In general, an apical or subapical infiltrate is highly suggestive of disease. Bilateral upper lobe infiltration with the presence of cavitation is also common. Patients with HIV may demonstrate a less classical picture on radiographs, which may be confounded by the presence of Pneumocystitis carini pneumonia.

Sputum smears and cultures are also used in the diagnosis of TB.Smears are examined for the presence of AFB. In general three to five sputum specimens are collected on different days and analyzed for AFB. Although the absence of AFB does not rule out tuberculosis, a positive sputum culture containing M. tuberculosis provides a definitive diagnosis.

Medications to Treat Tuberculosis –Drug interactions
Isoniazid

Isoniazid isTaken with food or 1 to 2 hours after eating[7,10].It Can cause peripheral neuritis, hepatic injury, nephrotoxicity, and hypersensitivity reaction.Patients who are on this drug should avoid alcohol.It may increase toxicity of carbamazepine, phenytoin. It Decreases blood levels of oral contraceptives, warfarin, sulfonyl ureas, and methadone.Usually given in combination with rifampicin

Rifampin

Patients should avoid alcohol. May decrease effects of digoxin, methadone, fluconazole, oral anti diabetic drugs, oral anticoagulants, phenytoin, and verapamil[10]. Turns urine orange.

Pyrazinamide

Metabolized in the liver and excreted in urine.Used in conjunction with at least one another antitubercular medication. May decrease effects of allopurinal, colchicine, and probenecid. May cause hypersensitivity reaction[10].

Ethambutol

Suppresses replication of mycobacteria.It Can cause nephrotoxicity.It is administered with food[10].

Streptomycin

It is aminoglycoside that can cause nephrotoxicity ,peripheral neuritis, and oto toxicity. First medication developed for the treatment of TB in the 1940s[10].

SECOND LINE MEDICATIONS –
Capreomycin, kanamycin, Ethionamide, Paraaminosalicylic acid, Cycloserin, Ciprofloxacin, Amikacin, Oflaxacin, Moxifloxacin.

ANAESTHETIC IMPLICATIONS

Patients with TB who need surgical or endoscopic procedures may have several underlying risk factors along with TB; therefore, nurses must have a basic knowledge of the immune

system and TB. To protect their patients, and themselves, perioperative nurses must confidently apply the nursing process through out the patient's perioperative experience. Preventing the spread of TB to health care workers requires use of an N95 respirator(Filters at least 95% of air borne particles) as described by the National Institute for Occupational Safety and Health[11]. This is a type of mask that prevents 95% of particles that are 0.3 microns or larger from passing through the mask. Regular surgical masks will not block aerosolized particles as small as the TB bacillus. The N95 respirator has a rubberized strap that fits around the head and a rubberized border around the mask filter that creates a snug fit[12].Personnel must be "fit tested" by occupational health department personnel to ensure that the respirator fits tightly and correctly[11,12].As a first step in preventing occupational acquisition of tuberculosis, anesthesia personnel should participate in annual tuberculin screening programs. In this way, tuberculin conversions can be detected and chemoprophylaxis instituted as needed. Anesthesiologists and other HCWs who present with a positive tuberculin test should have a baseline chest radiograph. Subsequent radiographs are not required unless symptoms suggest activation of the disease.Patients with active or suspected tuberculosis should be retained in isolation rooms with negative pressure ventilation. High risk procedures, such as bronchoscopy or endotracheal intubation and suctioning, should be performed in negative pressure isolation booths or rooms whenever possible. Patients should be transported to the OR wearing a well-fitting surgical mask to prevent casual exposure of other patients and personnel to airborne bacilli. To prevent contamination of the anesthesia machine and circuit, a HEPA(High efficiency particulate absorption) filter should be placed between the Y-connector and the mask, laryngeal mask airway, or endotracheal tube.

PRE OPERATIVE CARE

Patient with TB presents a challenge for nurses. Care begins with a thorough and accurate assessment. The pre operative nurse should review the patient's medical history and physical examination results and note the signs and symptoms of TB and their onset. The nurse should review the patient's chest x ray, laboratory test results and particularly focus on liver function tests because antitubercle medications may be toxic to the liver. Pulmonary function tests and arterial blood gas results along with ventilation and perfusion scans often are performed, and the nurse should ensure that the test results are on the preoperative chart. Conducting a thorough medication history that includes medications to which the patient is resistant also is essential..Tuberculosis can be transmitted by contaminated particles (eg, dust, lint, glove powder) floating through the air; therefore, it is imperative that the nurse station should institute or continue respiratory and airborne precautions. The pre operative nurse must ensure that the infected patient is isolated in a negative-air-pressure room. Antituberculosis agents may be ordered on the day of surgery to keep blood levels constant and if ordered, may be administered with a small amount of water. The nurse must ensure that the patient wears a mask when leaving the room. If possible, the patient should wear the mask until he or she undergoes induction of anesthesia. Procedures should be performed at the bedside in a negative-air-pressure room, if possible, to avoid exposing other patients and personnel.

INTRAOPERATIVE CARE

Perioperative personnel may not know what type of TB a patient has ie, MDR-TB(Multiple drug resistant TB) or XDR-TB(Extensively drug resistant TB) especially when the scheduled procedure is diagnostic in nature Large numbers of organisms may be released into the air during aerosol generating procedures, such as bronchoscopy, endotracheal intubation, endotracheal suctioning, induced sputum collection, administration of medication by nebulizer, and open-abscess irrigation.It is imperative that perioperative personnel and other patients are protected from the tubercle bacillus, which can remain air borne for hours[13].

SCHEDULING PROCEDURES.

It is advisable that any aerosol generating procedure be scheduled as the last procedure of the day[14]. The procedure should be performed where there is exhaust ventilation. If possible, it is best to perform the procedure in the patient's

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room on the medical/surgical unit if the room has negative air pressure. Personnel should be kept to a minimum necessary for the procedure. No visitors or observers should be permitted in the procedure room even if it is the patient's room on the medical unit.It is imperative that the anesthesia care provider use disposable anesthetic equipment if at all possible; care must be taken to prevent contamination of the nondisposable anesthesia equipment and machines. If there is a possibility of anesthesia machine contamination, formaldehyde gas can be used for sterilization[14].

PROBLEMS SPECIFIC TO PATIENTS WITH TB

All patients experience risks when undergoing surgery. Patients with TB who must undergo surgery,however, are at particular risk for hyperthermia, hypothermia, deficit oxygenation, and decreased inspiratory and expiratory effort. Fever increases the metabolic rate and cardiac output, which taxes a patient who already is burdened with the complications of TB. If the patient begins to shiver as a result of hyperthermia or hypothermia, the patient's metabolic rate may increase by 200%. Anaesthesia also can cause a rise in body temperature[15]. Nurses should implement interventions to promote normothermia. Decreased oxygenation or carbon dioxide elimination at the alveolar-capillary membrane may occur because of tubercles and obstructions related to necrotic lung tissue.Patients with TB may have an inability to clear secretions or obstructions from the respiratory tract to maintain a clear air way and may have pneumonia as a result of retained secretions[15]. Patients with TB also may have an ineffective cough as a result of malnutrition and weakness. These problems may be manifested as abnormal blood gases,abnormal breathing (eg, adventitious breathsounds or abnormal rate, depth, or rhythm); abnormal skin color; confusion; cyanosis;dyspnea; excessive sputum production; hypoxia; orthopnea; or restlessness[15].Patients with TB also may have decreased inspiratory and expiratory effort that does not provide adequate ventilation.

POST OPERATIVE CARE

Postoperative care should, if possible, take place in a room with negative pressure that provides some isolation from outside hallways.However, because most post anesthesia care units are not so designed, immediate post operative care should be maintained in the OR until the patient can be safely transferred to a suitable isolation room. Patients who require intensive care should be placed in a private room with ventilation that meets AFB isolation precautions.

Extensively Drug-Resistant TB(XDR TB)

They have resistance to the two most important second-line medication combinations (ie, fluoroquinolone and amikacin, kanamycin and capreomycin)[16], and XDR-TB has a strong association with HIV.The World Health Organization issued a warning that XDR-TB(Extensive drug resistance) is now present in many places in the world[17]. These strains are virtually untreatable because they are unaffected by the two most important first-line medications used to treat TB[18.] (ie, isoniazid, rifampin)

CONCLUSION

A collaborative approach is paramount when dealing with a patient with TB. Not only does a patient with TB have a potentially fatal disease, but care must be taken so others are not infected with what could be an incurable type of TB. Care management is crucial in this often complex patient population who may suffer from other underlying pathologies such as ineffective gas exchange and airway clearance.The patient with TB presents many challenges to the perioperative team in preventing infection and transmissionof organisms. The nurse with a basic knowledge about TB can provide a safe perioperative experience.

REFERENCE

1) Sepkowitz KA. Tuberculosis and the health care worker: a historical perspective. Ann Intern Med 1994;120:71-9. | | 2)central tuberculosis division-tuberculosis india 2006.Annual report of the Revised national Tuberculosis control programme.New Delhi:Directorate of General Health Services, Ministry of Health and Family weifare,Government of India,2006.www.tbcindia.org (accessed on june 2,2006) | 3)Gijs E, Mario R,Dermot M-Scale up:meeting targets in global tuberculosis control. Lancet 2004;363:814-9. | 4) Des Prez RM, Goodwin RA Jr. Mycobacterium tuberculosis. In:Mandell GL, Douglas RG Jr, Bennett JE, eds. Principles and practice of infectious disease. 2nd ed. New York: John Wiley, | 1979:1383-406 | | 5) Riley RL, Mills CC, O'Grady F, et al. Infectiousness of air from a tuberculosis ward. Am Rev Respir Dis 1962;85:511-25. | | 6) Fraser A, Paul M, Attamna A, Leibovici L. Drugs for preventing tuberculosis in people at risk of multiple-drug-resistant pulmonary tuberculosis. Cochrane Database Syst Rev. 2006(2):CD005435 | | 7) Mycobacterium tuberculosis. Microbiologybytes. http://www.microbiologybytes.com/video/Mtuberculosis.html. Accessed October 2, 2008 | | 8) Springhouse. Respiratory Care Made Incredibly Easy! Philadelphia, PA: Lippincott Williams &Wilkins; 2005:344 | | 9) Am Thoracic Society. Control of tuberculosis in the United States. Am Rev Respir Dis 1992;146:1623-33. | | 10) Lalloo UG, Naidoo R, Ambaram A. Recent advances in the medical and surgical treatment ofmulti-drug resistant tuberculosis. Curr Opin Pulm Med. 2006;12(3):179-185 | | 11) Respiratory Protection—910.134. Occupational Safety and Health Administration. http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=12716. Accessed October 2, 2008. | | 12) TB patient Andrew Speaker's mask won't stop spread of TB. Inside Surgery. | http://insidesurgery.com/index.php?itemid=404. Accessed October 2, 2008) | | 13) Sheldon LK. Oxygenation. 2nd ed. Sudbury, MA: Jones and Bartlett Publishers; 2008:401 | | 14) Woodhead K, Wicker P. A Textbook of Perioperative Care. Edinburgh, Scotland: Elsevier/Churchill Living stone; 2005:401. | | 15) Ackley BJ, Ladwig GB. Nursing Diagnosis Handbook: An Evidence-Based Guide to Planning Care. 8th ed.Edinburgh, Scotland: Elsevier Mosby; 2008:937 | | 16) Stout J. Drug-resistant tuberculosis (MDR TB and XDR TB). Presented at: Bad Bugs: Infectious Disease Update; September 2007; Chapel Hill, NC | | 17) Emergence of XDR-TB. World Health Organization. http://www.who.int/mediacentre/news | /notes/2006/np23/en/index.html. Accessed October 3, 2008. | | 18) Adam K. An old foe gains strength: health authorities warn that the spread of drug-resistant | TB could threaten AIDS sufferers. Newsweek. September 13, 2006. http://www.newsweek.com/id/45752. Accessed October 2, 2008. |