THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

APPLIED SCIENCE DEPARTMENT

COURSE: HIGHER NATIONAL DIPLOMA IN MEDICAL LABORATORY SCIENCES (MEDICAL MICROBIOLOGY)

PROJECT TITLE: PREVALENCE OF MYCOBACTERIUM TUBERCULOSIS AT MEWA HOSPITAL

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ABSTRACT

Pulmonary tuberculosis is the most manipulation of tuberculosis in Kenya. The efficient and reliable method for the diagnosis of pulmonary tuberculosis is sputum for smears. Culture is of great importance in order to ascertain the findings of chest X - Ray films.

A total of 150 sputum specimens were collected from patients suspected to be suffering from pulmonary tuberculosis.

A total of three specimens were collected for each patient in order to eliminate any mis-diagnosis due to some errors or inaccurate microscope findings.

Culture prove to be the most efficient and high sensitive method able to detect the slighter infections.

X – Rays also prove to be efficient and sensitive just like culture method although at times mis-interpretations of the pictures led to false positive or false negative.

Introduction

Pulmonary tuberculosis is the commonest manifestation infection with mycobacterium tuberculosis. The organism gains entrance directly through the upper part of the respiratory tract in inhaled dust or droplets from a TB infected person (Monica cheesebrough volume II).

The organism cause inflammatory reactions leading to a lignified destruction of lung tissue into a cheese like mass. The yellow pieces of cessions material contain tubercle bacilli are often coughed up by patients in sputum. (Medical Nursing by Christine .M. Chapman).

Tubercle bacilli in the sputum and tissue smears often assumes an irregularly beaded staining appearance, normally the regions that are not stained are considered to contain inclusion bodies such as glucogen. (Applied Medical Microbiology by J.G. Collee).

In the animal tissues, tubercle bacilli are thin straight rods measuring about 0.4 x 3 mm. On artificial media, coccoid and filamentous forms are seen.

Mycobacterium cannot be classified as either gram positive or gram negative. (Review of Medical Microbiology 13th Edition by E. Janetz).

Mycobacterium tuberculosis do not stain with gram staining technique, due to the fact that they have high lipid content. This also makes the organs to be resistant to drying alcohol, acid, alkaline and certain bactericides.
Therefore mycobacterium can be stained with carbol fuchsin which consists of a strong basic dye called basic fuchsin combined with phenol. The bacilli that retain or hold fast to the carbil fuchsin are referred to as acid fast bacilli. (AFB). The organism once stained, it resists decolouration even with alcohol containing 3% mineral acid.
(Monica Cheesbrough vol. III).

The growth of this organism is usually very slow, that is 2 – 3 weeks, it’s a strict aerobe. The organism is killed on exposure to UV radiation. Temperature requirements is 35 - 37°C.

In diagnosis of pulmonary tuberculosis, X – Rays of the chest and sputum smears are considered. X – Ray examination of chest levels the local focus of the infection. The X – Ray shows a combination of both white and black patches that black uninfected areas and white infected tissues which prevent the penetration of the radiations.

Tuberculin skin test can also used to defect the presence of previous immune sensitization to mycobacterium.

Its normally common test to young children who cannot produce sputum.
OBJECTIVES OF THE PROJECT.

(i). To study the prevalence of mycobacterium tuberculosis in patients suspected to be having pulmonary tuberculosis.

(ii). To study the effects of the disease in relation to age and sex.

(iii). To study and suggest improved methods of control, how they can be cheaply implemented and/or practiced.
Methods materials and procedures used

The method used for the diagnosis of mycobacterium tuberculosis is the Zn staining technique and tuberculin skin test especially for young children who cannot produce sputum.

Materials which were used for diagnosis were: -

1. Sputum specimens.
2. New slides.
3. Microscope.
4. Carbol fuchsin stain (filtered).
5. 3% acid alcohol
7. Applicator sticks.
8. Staining rack.

Procedure.

1. using a piece of stick, transfer a purulent part of the sputum, especially that containing any pieces of yellow caseous material, to a slide and make a smear about 3% mm across. Use a circular movement to spread the specimen.

   If the sputum contains large blood clots, transfer a portion of the specimen to another container and add a few drops of 10% w/v sapolin solution to lyze the clots and free the organisms.

2. Allow the smear to air-dry in a safe place, or heat fix.
3. Cover the smear with the filtered carbon fuchsin stain on a staining rack.
4. Heat the stain until vapours just begins to rise (i.e about 60°C). Do not ever heat.
5. Allow the heated stain to remain on the slide for 7 minutes.
6. Wash off the stain with clean water. If the tap water or clean boiled rain water.
7. Cover the smear with 3% w/v acid alcohol for 5 minutes or until the smear or sufficiently decolourized i.e pale pink.
8. Wash well with clean water.

9. Wipe the back of the slide clean and place in a draining rack for the smear to air-dry (do not blot dry).

10. Examine the smear microscopically with 100 x objective.

**RESULTS**

Results were reported as:

- > 10 AFB/field +++
- 1 - 10 AFB/field ++
- 10 - 100 AFB/100 field +
- 1 - 9 afb/100 fields Report the exact number.
**Tuberculin skin test**

This done by injecting into the skin a small amount of mycobacterium antigen in the form of tuberculoid or purified derivative (OPD).

After three days the infected area is inspected for signs of a cellular reaction shown by swelling and reddening.

The area of inoculation is measured in millimeter, a reaction of 10 mm or more or regarded as positive and indicative of sensitization to tubercular bacilli or other related antigenically released mycobacteria.

**Interpretation of Tuberculin test.**

A positive tuberculin test indicates that an individual has been infected with tubercle bacilli in the past, but it does not indicate present active disease.

Although tuberculin – positive healthy individuals may have some resistance to widespread disease, in fact most active tuberculosis occurs in persons who have had positive tuberculin tests few months or years.

The tuberculin – positive person is at risk of developing disease from activation of the primary infection, whereas the tuberculin – negative person is not at risk.
### DATA TABLE I

<table>
<thead>
<tr>
<th>AGE</th>
<th>MALE</th>
<th>FEMALE</th>
<th>TOTAL NO. TESTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 - 10</td>
<td>2</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>11 - 15</td>
<td>2</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>16 - 20</td>
<td>5</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>21 - 30</td>
<td>10</td>
<td>12</td>
<td>25</td>
</tr>
<tr>
<td>31 - 40</td>
<td>10</td>
<td>5</td>
<td>40</td>
</tr>
<tr>
<td>41 - 50</td>
<td>8</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td>51 - 60</td>
<td>3</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>60 +</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>40</td>
<td>38</td>
<td>150</td>
</tr>
</tbody>
</table>

1. Total prevalence (male and female)
   \[
   \text{Prevalence} = \frac{\text{Number of positive} \times 100}{\text{Total number examined}}
   \]
   \[
   = \frac{78 \times 100}{150} = 52\%
   \]

2. Prevalence of male.
   \[
   = \frac{40 \times 100}{150} = 26.67\%
   \]

   \[
   = \frac{38 \times 100}{150} = 25.33\%
   \]
TOTAL PREVALENCE

PREVALENCE OF MALE AND FEMALE.

Key

![Key](Positive)

![Key](Negative)

Key

![Key](Positive (male))

![Key](Positive (female))

![Key](Negative (male and female))
# Prevalence of Age Groups

<table>
<thead>
<tr>
<th>Age</th>
<th>No. Tested</th>
<th>Positive</th>
<th>Negative</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 - 10</td>
<td>10</td>
<td>3</td>
<td>7</td>
<td>2%</td>
</tr>
<tr>
<td>11 - 15</td>
<td>20</td>
<td>6</td>
<td>14</td>
<td>4%</td>
</tr>
<tr>
<td>16 - 20</td>
<td>15</td>
<td>8</td>
<td>7</td>
<td>5.33%</td>
</tr>
<tr>
<td>21 - 30</td>
<td>25</td>
<td>22</td>
<td>3</td>
<td>14.69%</td>
</tr>
<tr>
<td>31 - 40</td>
<td>40</td>
<td>15</td>
<td>25</td>
<td>10%</td>
</tr>
<tr>
<td>41 - 50</td>
<td>30</td>
<td>20</td>
<td>10</td>
<td>13.33%</td>
</tr>
<tr>
<td>51 - 60</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>2%</td>
</tr>
<tr>
<td>60 +</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>0.67%</td>
</tr>
</tbody>
</table>

**Key**

Number of positive people x 100
Total number tested
FIGURE 1

NUMBER OF POSITIVE PATIENTS

Key

Males.

Females.

AGE GROUPS
PREVALENCE OF DIFFERENT AGE GROUPS

FIGURE 11

Prevalence

Age groups
DATA ANALYSIS

According to the data collected, patients were grouped according to their ages and also sex. The data indicates highest prevalence in the age group of 21 – 30. Since tuberculosis in this is mostly an opportunistic disease in patients with HIV, this could have contributed, since this age group is mostly the sexual active group, hence most of them could be laboring HIV which could be the exposing factor to pulmonary tuberculosis.

The data also indicates slightly higher prevalence in males as compared to female. This is contributed by males being exposed to risk factors like over crowding places while many females are in their houses.

The data also indicates lower prevalences of the age group of 5 – 10 and 60+. This in due to the fact that these age group have the least exposing factors since most of people at that age groups are not sexually active, therefore the question of AIDS as an exposing factors is doubtful. Also at this age groups the attendance of social gathering and overcrowded places is minimal hence reducing the risk of contracting the disease.

The age group of 31 – 40 and 41 – 50 has also slightly higher prevalences because may of them could be having contributing factors like AIDS.
DISCUSSION

The most frequent source of pulmonary tuberculosis infection is the human who excretes, particularly from the respiratory tract, large numbers of tubercular bacilli.

Close contact e.g. in a family and massive exposure e.g. a medical personnel make transmission by droplet nuclei most likely. The milk of tuberculous cows or a source of infection where bovine tuberculosis is not well controlled and where milk is not pasteurized.

Susceptibility to tuberculosis is a function of 2 risks: the risk of acquiring the infection and the risk of developing clinical disease after infection has occurred.

For the tuberculin – negative person, the risk of acquiring tubercle bacilli depends on exposure to sources of infections bacilli – principally sputum positive patients.

The risk is proportionate to the rate of active infection in the population i.e. when many people are suffering from the disease in a society or community, this increase the risk of getting the disease.

The other risking factor is crowding when people are overcrowded in an area, the risk is also high.

Socioeconomic disadvantage increase the risk of acquiring disease and inadequacy of medical care. These factors, rather than genetic ones, probably account for the significantly higher rate of tuberculosis infection in American Indians and blacks than in white.

The second risk – the development of clinical disease after infection has a genetic component (proved in animals) and is influenced by age i.e high risks in males than in female.

Another second risk i.e the development of clinical disease after infection in under nutrition. Poorly feeding individuals have a risk of developing a clinical pulmonary tuberculosis after infection as opposed to well feeding individuals. Immunological status contributes a lot to immune individuals like the infants, pregnant mother and Immuno compromised patients have high risk of developing clinical disease after being exposed to tubercle bacilli.

Coexisting diseases like aids, diabetes contributes a lot to the development of clinical diseases. Individuals with other existing diseases are at risk of developing clinical tuberculosis than individuals who are not sick of any disease.

Infections occurs at an earlier age in urban than in rural populations.

Following infection, there is usually a localized multiplication of the organism in the lung and nearby lymph glands. In children there is often a marked enlargement of the lymph glands. The first multiplication of the organism referred to as primary tuberculosis infection.

Occasionally the primary infection is in the tonsil or intestinal tract. In most people the primary infection is self healing.

Pulmonary tuberculosis can occur when the primary infection does not heal completely and there is either continued multiplication or reactivation of the organism in the lung several months
or years later. Reactivation may occur due to poor health, malnutrition or defective immune response.

A continued active infection in the lymph glands can lead to the bacilli spreading by way of the lymphatic system and blood circulation to the lungs, pleural cavity, kidneys, bones and joint.

Occasionally, especially in children, an enlarged lymph gland may rupture into one of the bronchi and cause acute tuberculosis of the affected lung.

The main symptoms of pulmonary tuberculosis in adults are a chronic cough with the production of Mucoid or mucopurulent sputum which may contain blood. In the later stages of the disease, there is usually loss of weight fever and sweating especially during sleep. Tiredness, chest pain and anaemia.

Complication of pulmonary tuberculosis include dry pleurisy or plural effusion, lung collapse, acute military tuberculosis and occasionally tuberculosis meningitis.

In children pulmonary tuberculosis is more difficult to diagnose because there is rarely a cough with sputum production. A diagnosis is usually made from a positive tuberculin reaction.

Occasionally, acid fast bacilli can be found in gastric washings.

In developing countries, tuberculosis is one of the most frequent opportunistic infections in those with Aids and HIV infections.
PREVENTION AND CONTROL

1. Public health measures designed for early detection of cases and sources of infection (tuberculin test, X-Ray) and for their prompt treatment until non-infectious.

2. Eradication of tuberculosis in cattle (test and slaughter) and pasteurization of milk.

3. Drug treatment of a symptomatic tuberculin converters in the age group most prone to develop complications e.g. young children and immunosuppressed persons who were tuberculin – positive in the past.

4. Immunization against tuberculosis.

5. Safety precautions for laboratory personnel’s when handling sputum specimens.

6. Maintaining good health by eating good diet.

7. Avoiding exposing factor like Aids and over crowded places.
PREFERENCE

1. Medical manual for tropical countries volume II (Monica Cheesbrough).
3. Applied Medical Microbiology (by J. G. Collee).
5. Medical manual for tropical countries volume III (by Monica Cheesbrough).
ACKNOWLEDGEMENTS

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Although I cannot name and list all of the above sparcially thank my supervisor and lecturer Mr. Mohamed O. Mboga who without his intellectual critisms and support, this project could not be a success.

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