



Evaluation of Incidence of Mycobacterium Infection and its Effect in the Haematological Values and Lung Volumes of Subjects in Uburu Ohaozara Local Government Area of Ebonyi State

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ABSTRACT

Mycobacterium are widely distributed throughout the world, and only a few species are pathogenic to man and other mammals, birds, reptiles, and fish (Cruikshank, 1976). Evaluation of *mycobacterium* infection and its effect on some haematological values and lung volumes in the subjects was studied using those infected with the pathogenic species (*Mycobacterium tuberculosis*).

Six (6) months intensive research was carried out by screening 150 subjects at Uburu in Ohaozara local government area of Ebonyi state, to study the effect in the haematological values and Lung volumes and its incidence in that region. 32 infected subjects (F: 20 and M: 12) out of the 150 screened between the age range of 17-60 yrs used for the study which was carried out from July – November 2019.

The result of evaluation of incidence shows that the rate of infection of subjects is average (medium). The occurrence in male subjects (40%) than in their female counterparts (60%). Also the infection was noticed to be occurring most in the age range of 18-50yrs. The haematological values especially the erythrocyte sedimentation rate was very high (120 ± 0.8 mm/hr westergreen) in both male and female, the haemoglobin (g/dl), PCV (l/l), and the white blood cell differentials were significantly reduced. The high rate of infection of subjects could be due to poor living and feeding condition in the area.

INTRODUCTION

Tuberculosis (TB) is an infectious disease that is caused by a bacterium called *Mycobacterium tuberculosis*. Tuberculosis primarily affects the lungs but it can also affect organs in the central nervous system and circulatory system among others. The disease was called "consumption" in the past because of the way it would consume the infected people from within (Christopher 2002).

PATHOGENESIS OF TUBERCULOSIS:

When a person becomes infected with tuberculosis, the bacterium in the lungs multiply causing pneumonia. The person experiences pain and has a persistent cough which often brings up blood. In addition, lymph nodes near the lungs and the heart becomes enlarged.

As the bacterium tries to spread to the other parts of the body, it is interrupted by the body's immune system. The immune system forms scar tissue or fibrosis around the bacterium which helps fight the infection and prevents it from spreading within the body and to other people. If the bacteria manages to break through the scar tissue, the disease returns to active state; pneumonia develops and there is damage to the kidneys, bones and meninges that line the spinal cord and brain. Tuberculosis infection can be latent (they are inactive but present in the body, the patient has no symptoms, and is not contagious) or active; hence the bacteria are active, contagious and make the patient ill.

ORIGIN OF MYCOBACTERIUM TUBERCULOSIS:

Tuberculosis has existed in human since antiquity; it is believed to have originated with the first domestication of cattle (Madigan et al, 2006). Evidence of tuberculosis occurred in human skeletal remains and mummies as early as 4000BC (Balcells et al, 2006).

PATTERNS OF INFECTION:

- 1) **Primary Tuberculosis:** Seen as an initial infection usually in children. The initial focus of infection is a small sub-pleural granuloma accompanied by granulomatous hilar lymph node infection; together, these make up the Ghon Complex. In nearly all cases, these granulomas resolve and there is no other spread of the infection.
- 2) **Secondary Tuberculosis:** Seen mostly in adults as a reactivation of previous infection (or re-infection), particularly when health status

declines. The granulomatous inflammation is much more florid and widespread.

Typically, the upper lung lobes are most affected, and cultivation can occur when resistance to infection is particularly poor, a "miliary" pattern of spread can occur in which there are a myriad of small millet seed (1-3mm) sized granulomas, either in lungs or in other organs. Dissemination of tuberculosis outside of lungs can lead to the appearance of a number of uncommon findings with characteristic patterns.

SITES OF TUBERCULOSIS INFECTION:

- i) **Skeletal Tuberculosis:** This involves mainly the thoracic and lumbar vertebrae followed by knee and hip. There is extensive necrosis and bony destruction.
- ii) **Genital Tract Tuberculosis:** Tuberculosis salpingitis and endometritis result from dissemination of tuberculosis to the fallopian tube that leads to granulomatous salpingitis, which can drain into the endometrial cavity and cause a granulomatous endometritis with irregular menstrual bleeding and infertility. In the male, tuberculosis involves prostate and epididymis most often with non-tender induration and infertility.

Other types of tuberculosis depending on sites are Urinary Tract Tuberculosis, CNS Tuberculosis, Gastrointestinal Tuberculosis, Adrenal Tuberculosis, Scrofula (Tuberculous lymphadenitis of the cervical nodes), and Cardiac Tuberculosis which occurs in the pericardium.

COMMON SYMPTOMS OF TUBERCULOSIS:

Coughing that lasts longer than two weeks with green, yellow, or bloody sputum, weight loss, fatigue, fever, night sweats, chills, chest pain, shortness of breath, loss of appetite.

The objective of this study is to evaluate the incidence of *mycobacterium tuberculosis* in Uburu Ohaozara L.G.A, its effects in some haematological parameters and lung volumes in the sufferers.

Lung volumes and capacities are measurement conducted to ascertain the volume of air that moves into and out of the lungs under different conditions (Oyebola, 2002).

MATERIALS AND METHODS

Subjects: The subjects in this study were patients that come to chest clinic at Presbyterian Joint hospital Uburu in Ohaozara local government area of Ebonyi

state. They consist of three groups namely: Group A (The control subjects 15 subjects) Group B (Female test subjects:20) and Group C (Male test subjects: 12).

Experimental design:

To select these subjects for study, most people who attend chest clinic at Presbyterian Joint hospital within the period of this study were screened for *mycobacterium* infection by means of test such as Ziel-Nelson stain, mantoux test and ESR. 32 subjects were positive to Ziel-Nelson test out of 150 persons screened indicating that they have been infected with *mycobacterium tuberculosis* before or within the period of the six months study. The effect of this disease in haematological values and lung volumes were studied in the thirty two (32) sick subjects while 15 subjects (apparently healthy) that tested negative in the Z-N stain and having normal ESR, haematological values and lung volumes were used as control in the research.

Tests

Haematological tests carried out are

- Erythrocyte Sedimentation Rate (ESR) as described by Baker et al, 1998.

- Haemoglobin concentration test, packed cell volume, white blood cell count and white blood cell differential count as described by Baker et al, 1998.
- Bacteriological tests done in this research is Ziel-Nelson tests or Acid Fast Bacilli Test as described by Baker et al, 1998.
- Physiological test include measurement of lung volumes as described by Guyton et al 2006.

Collection of sample

2.0ml of blood samples for Full blood count, ESR, and white cell differential count were collected in EDTA bottles, mixed and kept in a refrigerator at 4^oc, before test is carried out. Sputum samples for Ziel-Nelson (Z-N) stain were collected in clean Plain bottles labelled and kept secluded in a corner of the diagnostic research lab.

Statistical Analysis:

The values obtained in the research study were presented as mean and standard deviation (Mean \pm S.D). The student's -t- test was done to determine the level of significance.

RESULTS:

Table 1 indicates the effect of *mycobacterium tuberculosis* in haematological values of male and female subjects at Uburu in Ohaozara L.G.A of Ebonyi State.

Groups	Hb g/dl \pm S.D	Pcv % \pm S.D	WBC/mm ³ \pm S.D	ESR mm/hr Westergreen \pm S.D
Control Group A (n=15)	13.6 \pm 0.8	40 \pm 0.6	6,420 \pm 120	2 \pm 0.5
Subjects: Male, Group B n=12	11.4 \pm 0.3	34 \pm 0.5	3,100 \pm 30	90 \pm 0.6
Group C Females n=20	9.2 \pm 0.5	27 \pm 1.0	2,900 \pm 15	120 \pm 0.8
P. value	P < 0.05	P < 0.05	P < 0.05	P < 0.05

Table 2: shows the effect of *mycobacterium* infection on white blood cell differential count of Male and Female subjects at Uburu in Ohaozara LGA Ebonyi state.

Groups	Neutrophil e % \pm S.D	Lymphocyte % \pm S.D	Monocyte % \pm S.D	Eosinophile % \pm S.D	Basophile % \pm S.D
Control Group A (n=15)	65 \pm 0.2	31 \pm 0.2	3 \pm 0.1	0 \pm 0	1 \pm 0.1
Subjects: Male, Group B n=12	78 \pm 0.5	20 \pm 0.4	1 \pm 0.4	1 \pm 0.1	0 \pm 0.1
Group C Females n=20	82 \pm 0.2	17 \pm 0.1	1 \pm 0.1	0 \pm 0.1	0 \pm 0.1
P. value	P < 0.05	P < 0.05	P < 0.05	P < 0.05	P < 0.05

Table 3: shows the effects of *mycobacterium* infection in the lung volumes of Male and Female subjects at Uburu in Ohaozara LGA Ebonyi state.

Groups	IRV L ± S.D	ERV L ± S.D	T.V mL ± S.D	RV L ± S.D
Control Group A (n=15)	3.02 ± 0.05	2.02 ± 0.03	450 ± 12	1.2 ± 0.2
Subjects: Male, Group B n=12	2.05 ± 0.05	1.08 ± 0.07	310 ± 0.25	1.0 ± 0.6
Group C Females n=20	1.1 ± 0.04	0.6 ± 0.02	250 ± 0.12	0.7 ± 0.04
P. value	P < 0.05	P < 0.05	P < 0.05	P < 0.05

IRV= Inspiration reserved volume, ERV= Expiration reserved volume

T.V= Tidal volume, R.V= Residual volume

DISCUSSION

The incidence of *mycobacterium tuberculosis* and its effect on some haematological values and lung volumes of subjects in Uburu Ohaozara local government area of Ebonyi state of Nigeria has been evaluated.

Tuberculosis, a disease caused by spreading the causative bacteria from person to person through air borne particles has been studied. One of the three things may happen when *mycobacterium tuberculosis* enters the human body. The bacterium is destroyed because the body has a strong immune system, the bacterium enters the body and remains as latent tuberculosis infection, the patient has no symptoms and cannot transmit it to other people; the patient becomes ill with tuberculosis.

However only people who have active tuberculosis infections can spread the tuberculosis bacteria. Coughing, sneezing even talking can release the bacteria into the surrounding air, and people breathing this air can then become infected. This is more likely to happen if one is living in close quarters with someone who has tuberculosis or if a room isn't well ventilated. (National Institute, 2013).

The result obtained from this research study clearly indicated its devastating effects on some haematological values (see Table 1). The reported decrease in haemoglobin concentration and packed cell volume by earlier workers (Constable, 1963) indicates that *mycobacterium* infection could predispose to anaemia. Anaemia is a state of lower than normal concentration of haemoglobin which can also result from low Packed cell volume below 30% have been reported as indicative of anaemia (Chen et al, 1998).

Erythrocyte Sedimentation Rate (ESR) though not a specific diagnostic test was also observed to be high in all the test subjects (Table 1).

Lung volumes were affected in the subjects infected with T.B in this research (Table 2). In disease conditions such as T.B, fibrosis, neuromuscular diseases such as myasthenia gravis etc., The lungs become less expansible thus resulting in a reduction in all the volumes and capacities.

To compensate for the decreased tidal volume (volume of air inhaled or exhaled during quite breathing) in such conditions, the rate of respiration is increased so that the minute ventilation (i.e. the tidal volume x respiratory rate) could be maintained at a level closer to a normal individual. Lung can involve only certain foci as seen in tuberculosis. In such conditions, the reduction in the volume (Table 3) in the involved segments is usually compensated by hyper-expansion of the healthy lung segments. However as the disease progresses, the increased respiratory drive fails to compensate for the loss of volume and results in hypoxia and hypercapnoea. With further deterioration, the patients with such diseases tend to undergo ventilator failure which is also known as Type II Respiratory Failure. (Lung volume and capacities in Health and Diseases, 2013). Though factors such as sex variation, age and size determines the lung volumes and capacities, the values obtained in this research study indicated a decrease in the values (P<0.05) of the infected subjects compared to their corresponding controls in both male and female counterparts.

Mycobacterium infection could be attributed to that people expose themselves more to the infection as people engage in outdoor activities such as cooking, serving in canteens, driving and eating in other public places.

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