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Prevalence of Tuberculosis Infection and its Effect in the Lung Volumes and Capacities of the Subjects in Ihiala Local Government Area of Anambra State, Nigeria.

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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). Prevalence of tuberculosis infection and its effect in the lung volumes and capacities in the subjects was studied using those infected with the pathogenic species (Mycobacterium tuberculosis).

Eight (8) months intensive research was carried out by screening 458 subjects at Ihiala L.G.A to study tuberculosis infection, effect in the lung volumes and capacities and its prevalence in that region, 25 infected subjects (m: 15 and f: 10) out of the 458 screened subjects between the age range of 15-80 years were used for the study which was carried out from January-August 2015. The result of the study showed that the rate of infection in the subjects at Ihiala L.G.A was low. The occurrence in the male subjects (51.2%) was more than in their female counterparts (48.8%). Also the infection was noticed to be occurring most in the age range of 20-70 years in both males and females. The lung volumes and capacities measured with spirometer were observed to be decreased in the 25 tuberculosis infected subjects. The tuberculosis infection could be attributed to exposing oneself with infected persons unknowingly as a result of active life struggle over the years.

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 "consummation" 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 system, and is not contagious) or active; hencethe 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 granulomatioushillar 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 reinfection), 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 characteristics 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 prostrate and epididymis most often with non-tender in-duration 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 objectives of this study are to check its prevalence in Ihiala L.G.A, its effects in the lung capacities and 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 consist of three groups namely: Group 1- (The control subjects-10 subjects); and the Group 2- (Male test subjects- 15); Group 3 (Female test subjects-10). All the groups are within the age range of 15-80years.

Experimental design:

Persons who visited health centres and hospitals within Ihiala L.G.A of Anambra statewith complain of prolong cough and chest pain were screened for tuberculosis infection using Z-N stain, mantoux test

and ESR. Out of 458 subjects screened for tuberculosis, a total of 25 subjects (15 males and 10 females) were infected with tuberculosis infection within the 8 months of study. The effect of tuberculosis infection in the lung volumes and capacities were also studied in the twenty-five (25) sick subjects while 10 subjects (apparently healthy) who tested negative in the Z-N stain, having normal ESR, lung volumes and capacities were used as control in the research.

Screening Test for Tuberculosis:

a) Ziel-Nelson Test or Acid fast Bacilli Test as described by Baker et al, 1998.
b) Erythrocyte sedimentation Rate (ESR) as described by Baker et al, 1998.
c) Measurement of lung volumes and capacities as described by Guyton et al, 2006.

Mantoux test or Tuberculin test as described by Cruikshank, 1976.

Collection of samples:

Sputum samples for Ziel-Nelson (Z-N) stain were collected in clean plain bottles, while 2.0ml of blood sample for ESR test was collected in EDTA bottle, mixed and kept in a refrigerator (4℃) till the test is carried out.

Statistical Analysis:

The results obtained in the research were presented as mean and standard deviation (mean $\pm$ s.d), also in percentages. Student –t- test was done to determine the level of significance.

RESULTS

Table1: shows prevalence of tuberculosis infection among male and female subjects in Ihiala. Results indicated that more males are infected than females.

Subjects	NP	PP (%)
Males	231	50.2%
Females	227	49.5%
Total	458	100%

KEY:
S= Sex.
NP= Number of persons screened for tuberculosis infection.
PP= Percentage of persons recorded positive for the tuberculosis infection.

Table 2: Indicates Age specific prevalence of tuberculosis in both males and females in Ihiala L.G.A.

Age (yrs)	NPS	NP	PP (%)
15-20	40	0	0
20-30	54	14	16.3
31-40	50	29	33.7
41-50	46	17	19.8
51-60	46	12	14.0
61-70	60	7	8.2
71-80	42	2	2.3

KEY:
A= Age in years.
NPS= Number of persons screened for tuberculosis.
NP= Number of persons positive for tuberculosis.
PP= Percentage of persons positive for tuberculosis.

Table 3: Indicates the effects of tuberculosis in the lung volumes and capacities of the infected subjects in Ihiala L.G.A. Anambra state. There is a significant decrease in the lung volumes and capacities of the patients.

Groups Group 1	Lung Volumes				Lung Capacities			
	IRV L ± S.D	ERV L ± S.D	TV ML ± S.D	RV L ± S.D	I.C L ± S.D	FRC L ± S.D	VC L ± S.D	TLC L ± S.D
Control males N=10	3.05 ± 0.068	1.06 ± 0.48	510 ± 15	1.4 ± 0.06	3.5 ± 0.2	2.2 ± 0.3	4.8 ± 0.04	6.0 ± 0.58
Control females N=10	3.0 ± 0.05	1.0 ± 0.07	500 ± 0.25	1.2 ± 0.82	3.2 ± 0.06	2.0 ± 0.86	4.5 ± 0.02	5.5 ± 0.52
TB Infected Subjects Group 2 Males n=15	2.5 ± 0.325	0.75 ± 0.025	450 ± 75	0.8 ± 0.06	2.8 ± 0.47	1.6 ± 0.68	4.0 ± 0.66	5.2 ± 0.78
Group3 Females n=10	2.3 ± 0.47	0.6 ± 0.054	430 ± 62	0.6 ± 0.04	2.5 ± 0.74	1.4 ± 0.48	3.8 ± 0.72	5.0 ± 0.85
P value	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05

DISCUSSION

Tuberculosis, a disease caused by spreading the causative bacteria from person to person through air borne particles has been studied. Its prevalence and its effects in the lung volume and capacities of the sufferers in Ihiala L.G.A of Anambra state was used as a research tool to study its cause and effect in the people living in the area. 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 systems 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 from this study showed evidence of a low infection rate of tuberculosis infection among the people of Ihiala L.G.A of Anambra state. It can also be noticed that the rate of infection of M. tuberculosis differ among age and sex (Table 1&2). The result showed that males recorded higher infection rate (51.2%) than females (48.8%). This could be attributed to the fact that males expose themselves more to the infection as they engage in outdoor activities such as commercial driving, eating in canteens, and other public eating houses, travelling etc., more than female counterparts.

According to sex distribution, this study agrees to that of Kolappa 2002 which reported that in Tamil Nadu, India, men have prevalence rate of 2-4 times higher than women. Lung volumes and capacities were affected in the subjects infected with T.B in this study. 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 quiet breathing)in such conditions, the rate of respiration is increased so that the minute ventilation (i.e. the tidal volume × 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.

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