



**A COMPARISON OF PRESUMPTIVE DIAGNOSIS OF  
TUBERCULOSIS AND PLEURAL HISTOLOGY WITH  
MICROBIOLOGY IN EMPYEMA THORACIS IN THE  
UNIVERSITY TEACHING HOSPITAL, LUSAKA**

By

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A dissertation submitted to the University of Zambia in partial fulfillment of the requirements for the award of the degree of Master of Medicine in General Surgery

**The University of Zambia**

2015

## DECLARATION

I hereby declare that this dissertation presents my own work. In my knowledge, it has not previously been submitted for a degree, diploma or any other qualification at this or any other university.

Signed.....

Candidate; Dr James Matabile

Signed.....

Supervisor; Professor Girish Desai

Signed.....

Co supervisor; Dr Robert Zulu

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**CERTIFICATE OF APPROVAL**

This dissertation entitled **A COMPARISON OF PRESUMPTIVE DIAGNOSIS OF TUBERCULOSIS, AND PLEURAL HISTOLOGY WITH MICROBIOLOGY IN EMPYEMA THORACIS IN THE UNIVERSITY TEACHING HOSPITAL, LUSAKA** by Dr James Matabile has been approved as fulfilling part of the requirements for the award of the degree of Masters of Medicine in General Surgery

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Date.....

Internal Examiner: Signature.....

Date.....

## **ABSTRACT**

### Background

Empyema Thoracis is known to result from the infection of pleural effusions arising from many different causes. The histology of the pleura, and the microbiology of the pus contained is what this study was attempting to uncover.

### Objectives

1. To determine the pleural histology of patients with Empyema Thoracis at UTH
2. To identify bacterial infections causing Empyema Thoracis by examining the pus from the pleural space.
3. To introduce the Abram's needle in obtaining pleural biopsy at The University Teaching Hospital in Lusaka.

### Methods

The study was descriptive, in which consecutive consenting adult patients with Empyema Thoracis were recruited. The presumptive diagnosis of pleural Tuberculosis was compared with the pleural histology and microbiology. The study was carried out in the casualty Department of the University Teaching Hospital, in Lusaka. The sample size calculated was 37, and the study was done over 9 months. Pleural biopsy was done for histology and ZN, as well as collection of the pleural pus for microbiological analysis. The outcome measures were the pleural histopathology and culture results of the pus.

### Results

37 patients were recruited in the study, with 24 male and 13 females. The age range was from 22 to 54 and of different levels of education. Of the participants, 23 were HIV positive and 14 negative. Of the HIV positive participants, nearly half (47.8%) were on HAART.

Pleural Biopsy was done in all the participants, and no complications identified. No specific disease was identified on histology of the pleura, save for the different forms of inflammation, and no granulomata were identified.

Bacteria were identified in only 54% of the pus submitted. Of them, 50% grew Streptococcus species. All the others grew different types of gram negative bacteria namely *enterobacter agglomerans*, *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Proteus vulgaris*.

### Conclusion

Abram's needle was used for pleural biopsy successfully without complications. However, its use in Empyema thoracis did not give clear, specific histologic diagnosis of the aetiology. Many different gram positive and negative bacteria were identified from the pleural pus. Therefore microbiology of the pus was more useful than the biopsy of parietal pleura.

## **DEDICATION**

To my wife Fortune and children Calvin and Tinashe. Without their support and patience, this work would not have been remotely possible.

## ACKNOWLEDGMENTS

It is with utmost gratitude that I acknowledge the invaluable contribution and support of my supervisors Prof Girish Desai and Dr Robert Zulu. Their guidance, advice, corrections and revisions helped shape this project into what it is. I also appreciate the contributions from the Department of Surgery (UTH), the Graduate Proposal presentation Forum and the University of Zambia Biomedical Research Ethics Committee. Many thanks to Dr Soka Nyirenda (Internal Medicine), Dr CLT Ngwisha for the dedicated and timeless assistance. Finally, I would like to say thanks to many colleagues, nurses, and Laboratory staff who assisted in recruiting participants, collecting and processing the specimens. It was all not in vain.



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## LIST OF ABBREVIATIONS

AIDS	.	.	.	.	Acquired Immunodeficiency Syndrome
ET	.	.	.	.	Empyema Thoracis
HIV	.	.	.	.	Human Immunodeficiency Virus
NSAID	.	.	.	.	Non-Steroidal Anti Inflammatory drug
TB	.	.	.	.	Tuberculosis
UTH	.	.	.	.	University Teaching Hospital
ZDHS	.	.	.	.	Zambia Demographic Health Survey
ZN Stain	.	.	.	.	Ziehl-Neelsen stain for Tuberculosis identification

## CHAPTER ONE

### 1.1 INTRODUCTION

About one third of the world's population is infected with tuberculosis (TB), but the number of those who actually manifest active disease is much lower (Koegelenberg et al., 2010). Among the presentations, include pulmonary and extrapulmonary tuberculosis. Extrapulmonary TB is TB in lymph nodes, bones and joints, peritoneum, genitourinary tract, pleura, pericardium, meninges and disseminated (miliary) TB. Pleural tuberculosis quite commonly presents with an accumulation of pleural fluid, and when the pleural fluid is infected, an Empyema thoracis (ET) results (Varaine *et al.*, 2010).

Other known causes or associations of Empyema Thoracis are pulmonary TB, pneumonia, lung abscess, bronchiectasis, pulmonary malignancies, and amoebic abscesses extending upwards from the liver, oesophageal rupture and trauma to the lung, complicated by infection (Odell, 1994).

Empyema Thoracis is a relatively common condition seen among both the immunocompetent as well as the immunocompromised patients with various underlying conditions (Amadi, 1993). The problem has become common in the past two decades (Bayley 1990). It accounts for a significant proportion of admissions in the medical wards of the University Teaching Hospital (UTH) in Lusaka. Even with appropriate therapeutic attempts, the mortality of patients with Thoracic empyema is 15-20%, and higher in the immunocompromised (Desai et al., 2001).

In the year 2011, there were 52 intercostal drains inserted in casualty theatre of the UTH for ET. Over the following twelve months (2012), a total number of 64 patients underwent the procedure for Empyema Thoracis (UTH Phase 5 theatre Records).

With the advent and spread of HIV, the cases of ET have increased steadily, as pointed out by Professor Bayley (Bayley A.C, 1990). The HIV pandemic is currently prevalent at around 13.5% in Zambia (WHO, 2010). Tuberculosis is regarded as the major cause of ET in Zambia, and all cases of non - traumatic ET are treated as tuberculosis, (Desai & Mugala, 1992). With the long list of possible causes and associations of ET, some of the cases may not be due to tuberculosis. This study

aims to address this question and determine what proportions of ET have pleural TB at UTH by ascertaining the exact cause of the condition, whether TB or not.

The identification of the aetiology of ET requires a histological examination of the parietal pleural specimen collected, and this is the gold standard. Several methods of collecting pleural tissue exist, that can be used to confirm whether it is tuberculosis or not. The methods include thoracoscopy, open biopsy and closed biopsy (Koegelenberg et al., 2010). However, the first two methods are expensive and of a highly invasive nature respectively. The most suitable method in a setting like Zambia is the closed needle biopsy. It is less invasive, less costly, and has relatively few complications.

Closed methods for harvesting parietal pleura include using the Abram's needle, Cope needle, Fransen needle, Vim Silverman Needle, Harefield needle and Trucut needles (Sison & Weiss, 1962). The Abram's needle has been in use since the 1950s, and is the leader in terms of providing the diagnostic yield that is required, as well as safety and ease of use (Scerbo et al. 1971). It is also accepted internationally.

The procedure of pleural biopsy involves inserting the Abram's needle into the pleural space, and using it to obtain multiple pieces of parietal pleura, under sterile conditions. The instrument also allows the collection of pus from the pleural space. All this is done under local anaesthesia and allows the patient to go out of theatre to the ward without any restrictions (see Appendix D).

The orientation and instruction on the use of the Abram's needle was given to the researcher by one of the supervisors, Dr Robert Zulu. Dr Zulu is a Consultant General Surgeon in the Department of Surgery in the University Teaching Hospital.

The site for this study was the UTH. The University Teaching Hospital (UTH) is the largest and final referral hospital in Zambia. UTH has a bed capacity of 1800 beds and often a bed occupancy rate beyond 100% (Chintu et al., 1995).

The study participants were drawn from the Department of Internal Medicine, but the study took place in the Surgery Department. The flow of ET patients in the UTH is such that they are taken to the Surgery Department merely for insertion of the chest drain. Afterwards, they go back to Medicine for continued care. The collection

of the pleural biopsy specimens and insertion of the chest tubes was in the Casualty theatre, which falls under the department of Surgery.

## **1.2 LITERATURE REVIEW**

Many different diseases of the pleura (such as Empyema Thoracis) may present similarly. Nevertheless, their treatment differs depending on the actual identified aetiology. Therefore, biopsies have to be collected, and histological interpretation of pleural biopsies is extremely important for correct diagnosis (Cagle & Allen., 2011).

One of the commonest presentations of pleural disease is pleural effusion, and when it becomes infected, an ET often results (Ostrow., 2006). ET is therefore considered the final outcome of many different diseases that present initially as pleural effusions. It is therefore very important to tease out the actual cause of the effusion, from the many possibilities. Pleural biopsy comes in at this point, as the solution. With the increased prevalence of HIV/AIDS, wider use of immune - suppressants and organ transplantation, increasing age of the population, pleural infection will become and remain a common and significant illness (Brims et al., 2010).

Empyema Thoracis is defined as a collection of pus in the pleural space (Odell et al., 1994). Whether the term 'empyema' should be defined as a fluid, which is pus on inspection, or as fluid containing excess polymorphonuclear cells, is debatable (Odell et al., 1994). By far the most common and important cause is an extension of infection from the infected lung whether due to tuberculosis, pneumonia, lung abscess, malignancies or rarely bronchiectasis. Empyema may also arise when an amoebic abscess spreads upwards from the liver, secondary to severe trauma to the chest complicated by infection or when the oesophagus ruptures. Our working description of the condition is a situation in which a purulent or turbid fluid is present in the pleural space, and usually does not require microscopic confirmation of leucocyte levels in the fluid. It is obvious to the naked eye, (Odell et al., 1994).

Odell et al divided Empyema Thoracis into three stages i.e. Exudative phase, Fibrinopurulent phase, and Organizational / chronic stage (Odell et al, 1994). Complications of untreated ET include broncho-pleural fistula, Empyema necessitans, chronic discharging sinus, chronic respiratory insufficiency and septicaemia (Amadi, 1993).

There are two types of empyema thoracis associated with tuberculosis. One is when a tuberculous pleurisy exudate is infected. Another one is because of primary infection, which directly causes a purulent collection in the pleural space. In either of the two cases, the pleural biopsy should be able to show if the parietal pleura has the classical TB finding on histology (Ostrow, 2006). In Africa, about 30% of TB cases are complicated with pleural effusions (Ostrow, 2006), but what is not known is the proportion of patients with ET that actually have TB. The association between AIDS and TB is well known and widely documented. It is uncertain whether pleural space Infection is more common in HIV patients, but it is known to be more serious (Ostrow, 2010).

Closed pleural biopsies are applicable in areas where the prevalence of TB is high, and there are limited medical resources, where thoracoscopy is not readily or widely available (Psathakis & Skouras, 2011). The setting in Zambia fits into this situation quite well. The TB prevalence in Zambia as of 2010 is 345 per 100 000(WHO, 2010).It is therefore expected that closed pleural biopsies will be a useful tool in the management of empyema thoracis patients (Psathakis & Skouras, 2011). Pleural biopsy is therefore the standard of care in the ideal situation in the management of empyema thoracis in order to identify the aetiology. In a study by Ihsanullah et al carried out in Abbottabad, Pakistan in 2009, the diagnostic yield of closed percutaneous pleural biopsy was 95%. The authors state that pleural biopsy is still a reliable and valuable investigation in diagnosing pleural disease, provided that adequate pleural specimen is taken (Ihsanullah et al., 2009).

In comparison to thoracoscopy, closed biopsy is less invasive, better tolerated and less painful. The rate of complications is negligible when compared with the ones for thoracoscopy (Koegelenberg et al., 2011). Furthermore, the case for closed pleural biopsy is stronger in tuberculous pleurisy because the sensitivity approximates that of thoracoscopy specifically when applied to TB. This is because the tuberculous granulomata are uniformly distributed over the entire pleura. This results in the fact that the likelihood of accurately diagnosing TB is higher.

Closed pleural biopsy can also be useful in diagnosing sarcoidosis, anthracosis, rheumatoid, fungal pleurisy and neoplastic lesions.



Complications of closed pleural biopsy include pneumothorax (15%), site pain (1-15%), vasovagal reaction with potential syncope (1-5%), haemothorax (<2%), site haemorrhage with haematoma formation (Koegelenberg et al., 2011).

The closed pleural biopsy needle that is in widest use currently is the Abram's needle. It is a needle that is very safe for collection of parietal pleural for histological analysis (Khadadah et al., 2009). The Abram's needle is made up of three parts, which allow for the collection of pleural specimens in a very safe and minimally invasive manner. The needle was invented in 1958 by Abram and has been in worldwide use since then. The yield of this biopsy method is very high when the size of each specimen is optimum (3mm) and at least 4 specimens (4-6) are collected (Khadadah et al., 2009). The Abram's pleural biopsy needle is a reusable stainless steel instrument that can be easily re-sterilized unlimited times, between use in different patients. The Abram's needle should be the needle of choice for closed pleural biopsy in the setting of probable tuberculous effusions.

In a study in Brazil, the Abram's needle was found to be superior to the Cope needle in the quality and size of material obtained, detection of the mesothelial cells, and the quantity of fibrin preserved. This is because of the type of needle that it is; guillotine type, which cuts through the tissues without distorting the tissue architecture. The efficiency of the Abram's needle is marginally superior to the Cope needle, but this is not statistically significant (Morone et al., 1987). The Abram's needle is thus the instrument of choice in carrying out closed pleural biopsies in Zambia.

### **1.3 STATEMENT OF THE PROBLEM**

In the UTH, all cases of non-traumatic Empyema Thoracis are treated empirically as extrapulmonary tuberculosis without histological evidence. Currently, no efforts are made to obtain histological evidence of the same. With the many diseases that can possibly end up in Empyema Thoracis, it is of extreme importance that the aetiology is sought.

Patients with ET due to diseases other than TB are unnecessarily exposed to the long duration and toxic effects of the anti tuberculous drugs. The high cost of the anti tuberculous drugs does not help the situation either.

### **1.4 STUDY JUSTIFICATION**

Percutaneous pleural biopsy with the Abram's needle is a very safe and sensitive procedure in tuberculosis- associated empyema thoracis (Ihsanullah et al., 2009). This is expected to help get the correct diagnosis and therefore focus anti tuberculous treatment on the patients who need it. That avoids the exposure of patients with non-TB empyema to the toxicity of the drugs. Pleural biopsy in empyema thoracis is the minimal standard of ideal care, as it affords the physicians an opportunity to make a positive histological diagnosis before treatment commences.

What has been shown in other research is that not all patients with ET had tuberculous pleurisy. It is therefore of utmost importance that the actual numbers of patients with ET that have tuberculous pleurisy is brought out.

### **1.5 HYPOTHESIS**

Not all patients with Empyema Thoracis have pleural Tuberculosis

## **CHAPTER TWO**

### **2.0 OBJECTIVES**

#### **2.1 GENERAL OBJECTIVE**

To compare presumptive diagnosis of tuberculosis with diagnosis using pleural Histopathology and Microbiology in patients with Empyema Thoracis at The University Teaching Hospital in Lusaka.

#### **2.2 SPECIFIC OBJECTIVES:**

1. To determine the pleural histology of patients with Empyema Thoracis at UTH
2. To identify bacterial infections causing Empyema Thoracis by examining the pus from the pleural space.
3. To introduce the Abram's needle in obtaining pleural biopsy at The University Teaching Hospital in Lusaka.

## **CHAPTER THREE**

### **3.1 RESEARCH METHODS AND PATIENTS**

#### **Study Design**

It was a Descriptive Cross-Sectional study. The histology and microbiology results were compared with the clinical diagnosis of Tuberculous Pleurisy in Empyema Thoracis.

#### **Setting**

The study was carried out at the University Teaching Hospital, Department of Surgery, in Lusaka, Zambia. The histology results were obtained from the University Teaching Hospital, Pathology Laboratory.

#### **Duration of the Study**

Study Period was nine months, from January 2014 to September 2014.

#### **Target Population**

These were from the adult population 18 years and above of both sexes admitted to medical wards at The University Teaching Hospital. All the patients that were referred to the surgical admission wards from the medical wards with a diagnosis of empyema thoracis for insertion of Thoracostomy tube. The patients who fit the inclusion criteria and gave consent for their inclusion in the study were recruited.

#### **Sampling**

Convenience sampling was used, with consecutive patients being recruited in order to eliminate bias. The aim was to capture all the adult patients who came with the diagnosis of ET.

#### **Sample size calculation**

From the 2012 chest clinic annual report, there were 1405 Extrapulmonary TB cases

The number of Empyema thoracis cases over the same period was 64

The calculation was done according to the formula as follows:

$$n = \frac{t^2 \times P(1-P)}{m^2}$$

Where

**n** = required sample size

**t** = confidence level at 95% (standard value of 1.96)

**p** = estimated prevalence of Empyema thoracis in the project area (1405/64=0.05)

**m** = margin of error at 5% (standard value of 0.05)

#### **Calculation:**

$$n = \frac{1.962 \times 0.05(1-.05)}{0.052}$$

$$n = \frac{3.8416 \times 0.0475}{0.0025}$$

$$n = \frac{0.182476}{0.0025}$$

$$n = 72.9904 \sim 73$$

In view of the initially proposed duration of the research, which was 6 months, the sample to be collected was half of 73, which gives 37.

#### **Inclusion Criteria**

- a) Patients with empyema thoracis above the age of 18 years, of either sex
- b) On aspiration, patients who had purulent or turbid fluid aspirated from the pleural space.
- c) Patients with a clinical diagnosis of Tuberculous Empyema Thoracis who consented to take part in the study

#### **Exclusion criteria**

- a) Thoracic empyema of traumatic origin
- b) Patients below the age of 18 years
- c) Refusal to give consent to participate in the study

### **Data collection**

The initial clinical data was collected in the casualty department or Phase 5 theatre before performing the pleural biopsy. The data collected was demographic data, HIV status, Respiratory symptoms and their duration, Signs, X-ray findings, appearance of the chest aspirate. This was entered in the data capture sheet.

The procedure of pleural biopsy was done with Abram's needle. It was used to collect 4 to six pieces of parietal pleura, under sterile conditions. The pus was also collected from the pleural space, and submitted for microscopy and culture (see Appendix D).

Pleural biopsies were performed, and the numbers entered in the data collection sheet. Specimens were submitted for histological analysis.

When the histology result was available by the histology laboratory, the main histological features were recorded, as well as the final diagnosis or conclusion. The histological diagnosis was taken as not being TB when the conclusion stated as such. If it was stated as TB, then it would have been stated. On the microbiology, the microscopy and Culture findings of the pus swab were entered in the data capture sheet.

Data was collected at both the time of patient enrolment and when the histology/microbiology result was ready. The result was disclosed to the patients and their attending physicians. The biopsy was to be repeated if the specimen was deemed non-representative after the first collection, or if no pleura was identified histologically.

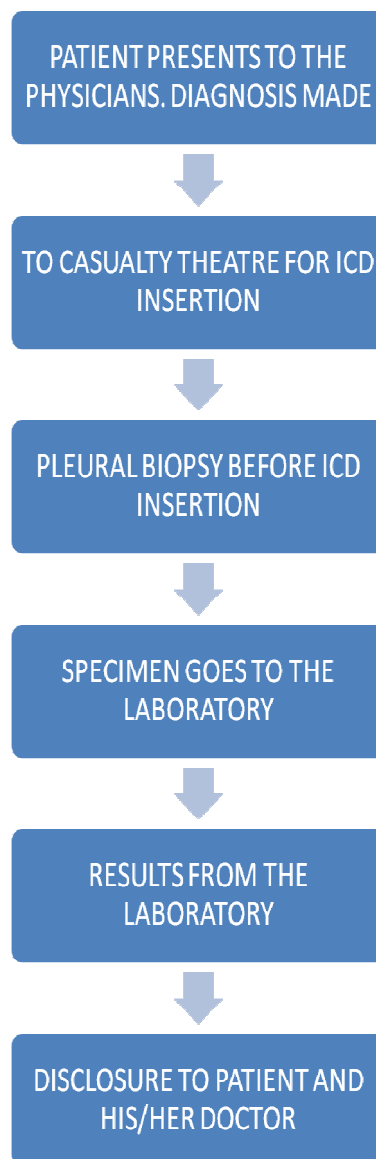
The practice in the Laboratory is to go ahead and perform the Ziehl Neelsen test whether or not the histology was suggestive of TB.

### **Variables**

These were the variables that were got from the patients. They included HIV status, Respiratory symptoms and their duration, Signs, X-ray findings, appearance of the chest aspirate.

The dependant variables were the histological findings, and the bacterial microscopy and culture results obtained from the pleural pus. They were nominal or categorical data.

**Figure 1: Patient and Specimen Flow for the Study**



### **3.2 HISTORY, EXAMINATION AND PUS COLLECTION**

HIV status (from the patient's file as it is now mandatory for every patient to be tested for HIV), and whether on Antiretroviral Treatment. If not yet tested, this was done by the Abott determine, and the confirmatory test Unigold was used after counseling.

Symptoms (such as fever, cough, fatigue, shortness of breath, chest pain) and their duration

Pleural Fluid Aspiration with a 21 G needle into a 10ml syringe. This was examined visually to check whether the fluid is purulent, or turbid (Desai & Mugala 1992).

Pus on a swab stick was sent for microscopy, culture and ZN staining.

### **3.3 PLEURAL BIOPSY**

Collection of specimens of pleura from the affected side by Abram's needle (see Appendix D)

The pleural biopsy procedure was performed under local anaesthesia with 1% Lignocaine infiltration in the appropriate intercostal space and site.

All the pleural biopsies were carried out by the researcher, on all the patients. There was no training of other research assistants. The reasons for that were for uniformity, and that there was no funding for more research assistants, as the research was fully funded by the individual researcher.

Patients were given oral non-steroidal anti-inflammatory drug (NSAID) after the procedure of chest tube insertion as analgesic.

The procedure did not inconvenience the participant in that the biopsy specimen collection was done in the same place where the drainage tube was to be inserted. Therefore, the invasiveness was the same as that for tube thoracostomy alone. The patients went to the theatre only once. The biopsy only took a few minutes of the time before insertion of the chest drain.

Multiple specimens were taken from the same opening in which the Intercostal drainage tube was to be inserted. Biopsies were not obtained from multiple other



areas in the chest wall because that would have meant increasing the invasiveness of the whole procedure, and that would have definitely required consent for many more operative procedures in other areas of the chest wall.

### **3.4 ETHICAL CONSIDERATIONS**

Ethical approval was obtained from the University of Zambia Biomedical Research Ethics Committee. Permission has been obtained from UTH Management and the Department of Surgery. All information pertaining to patient identity (name, age, file number) was kept strictly confidential.

The Abram's pleural biopsy needle is a safe instrument with very low rates of complications. It has been used before in Zambia (Anecdotal evidence). The known adverse events of the pleural biopsy that might occur are site pain, pneumothorax, haemothorax and site haemorrhage with haematoma formation. The intercostal drain (whose insertion followed the biopsy) should have been able to treat the pneumothorax, haemothorax that might occur. The haemorrhage at the site was to be treated using local pressure with a gauze swab. The cost of managing the adverse events was to be borne by the researcher. Every effort was made to minimize the adverse effects of the procedure of pleural biopsy.

Consent for pleural biopsy was obtained at the time consent for Intercostal drain was obtained. Consent for enrolment in the study was obtained later.

The procedure was done under local anaesthesia with 1% Lignocaine infiltration in the appropriate intercostal space. Oral analgesia was administered after the procedure.

The study was done at no cost to the participants.

## CHAPTER FOUR

### RESULTS

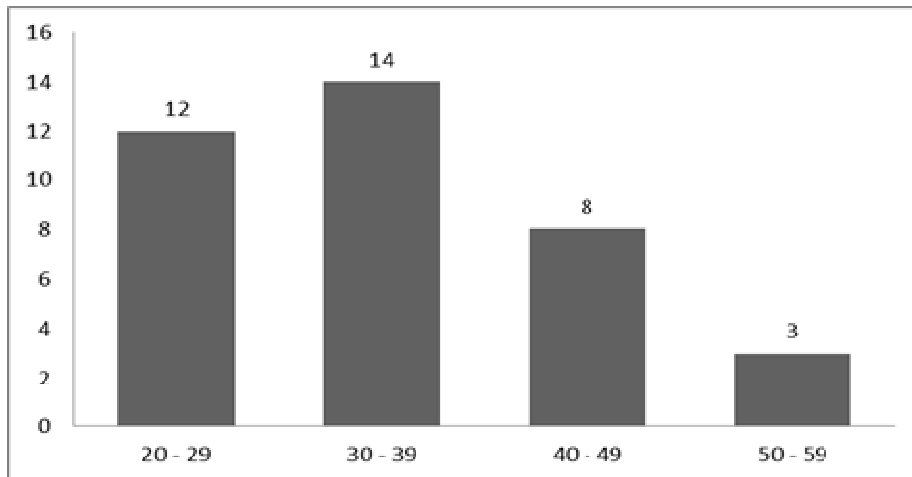
#### 4.1: CHARACTERISTICS OF THE PARTICIPANTS

The study enrolled 37 participants who all had a diagnosis of ET. And below are the characteristics of the patients:

**Table 1:** Characteristics of the participants

Variable	Values	Frequency (n=37)	Percentage
Sex	Male	24	64.9
	Female	13	35.1
Marital status	Single	6	16.2
	Married	22	59.5
	Divorced	2	5.4
	Widowed	7	18.9
Residence	Rural	12	32.4
	Urban	25	67.6
Highest educational level attained	Primary	12	32.4
	Secondary	21	56.8
	Tertiary	4	10.8
HIV status	Positive	23	62.2
	Negative	14	37.8
HAART status (n=23)	Yes	11	47.8
	No	12	52.2

**Figure 2:** The Age distribution of the participants with ET



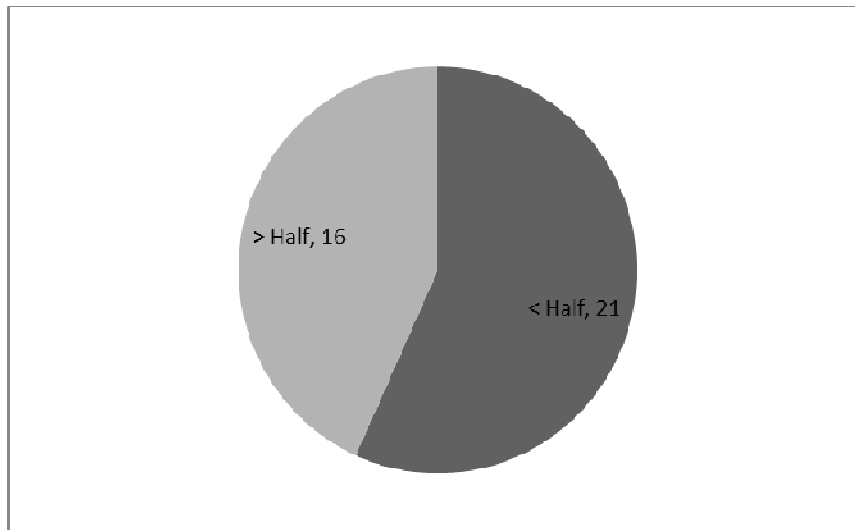
Twenty six (70.3%) of the participants were aged less than 40, whereas only 27.7% were aged 40 and above

**Table 2:** Side of Chest with Empyema Thoracis

Side	Number	Percentage
Left Side	12	32.4
Right Side	25	67.6
<b>Total</b>	<b>37</b>	<b>100</b>

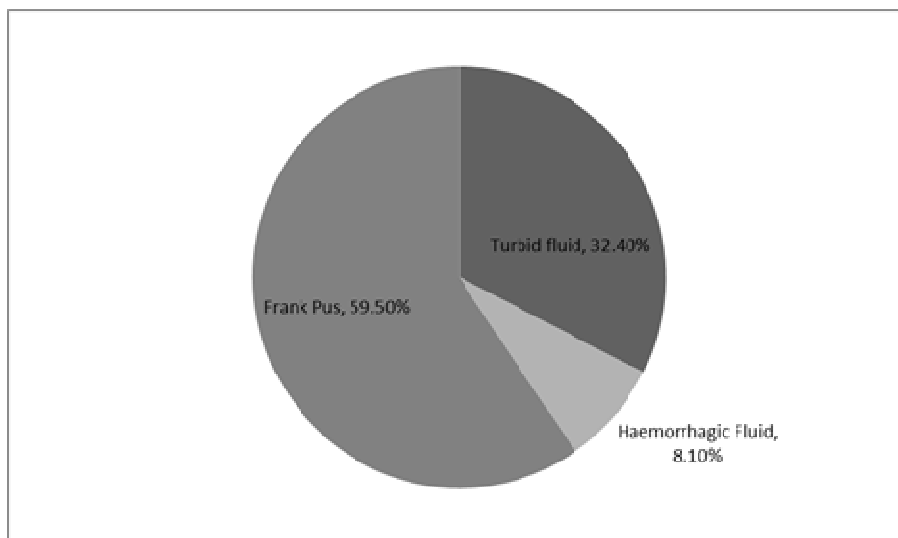
Most of the participants had the ET on the Right side

**Figure 3:** Amount of pus in the Hemithorax by Chest Radiograph



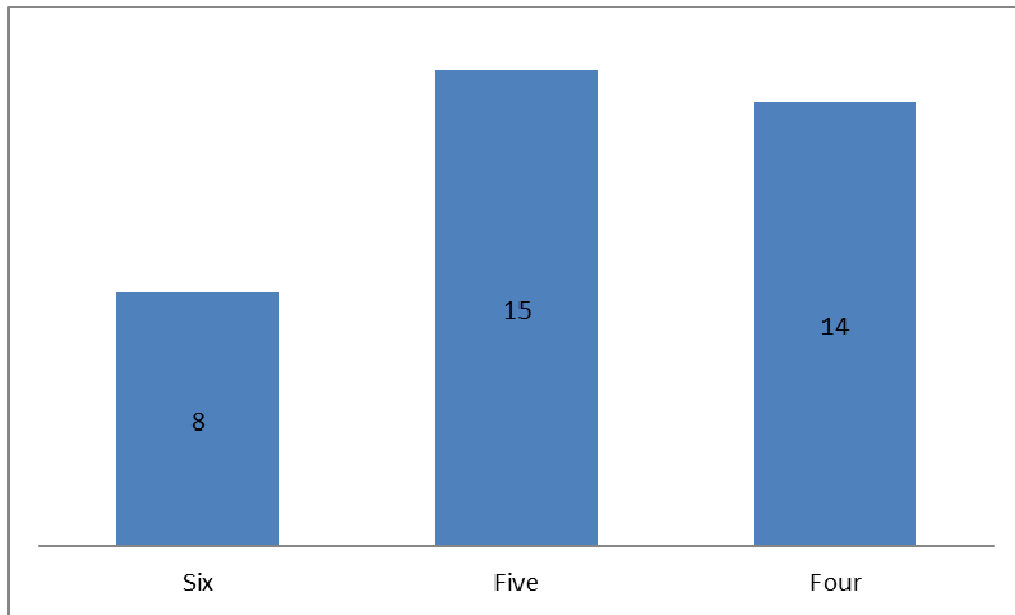
21 of the study participants had less than half of the chest full of pus, whereas only sixteen had more than half

**Figure 4:** Type of Fluid aspirated from the Chest

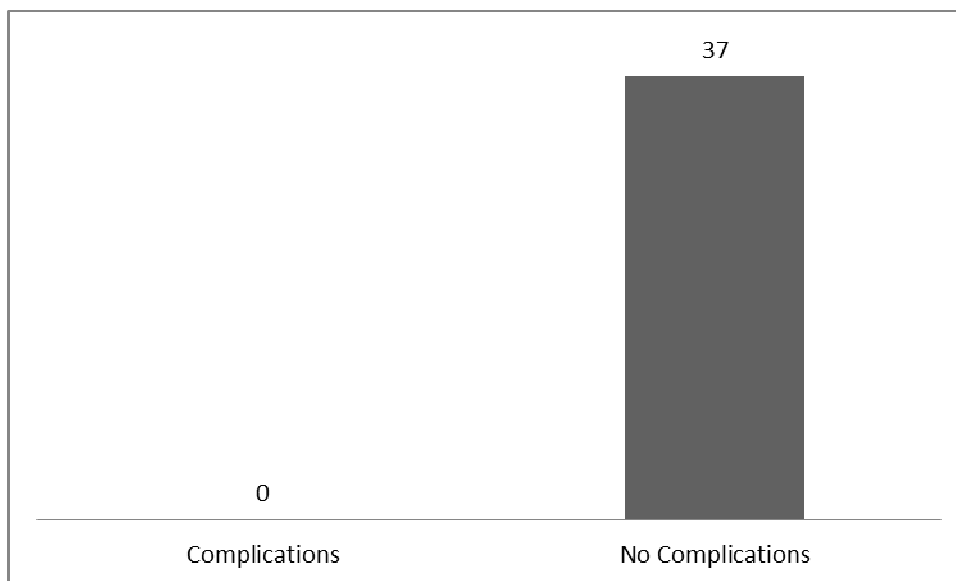


More than half (59.5%) of the participants had frank pus in the chest. The rest had turbid fluid (32.4%) and Haemorrhagic fluid (8.1%)

**Figure 5:** Total Number of Biopsy specimens collected per patient



**Figure 6:** Complications of Pleural Biopsy



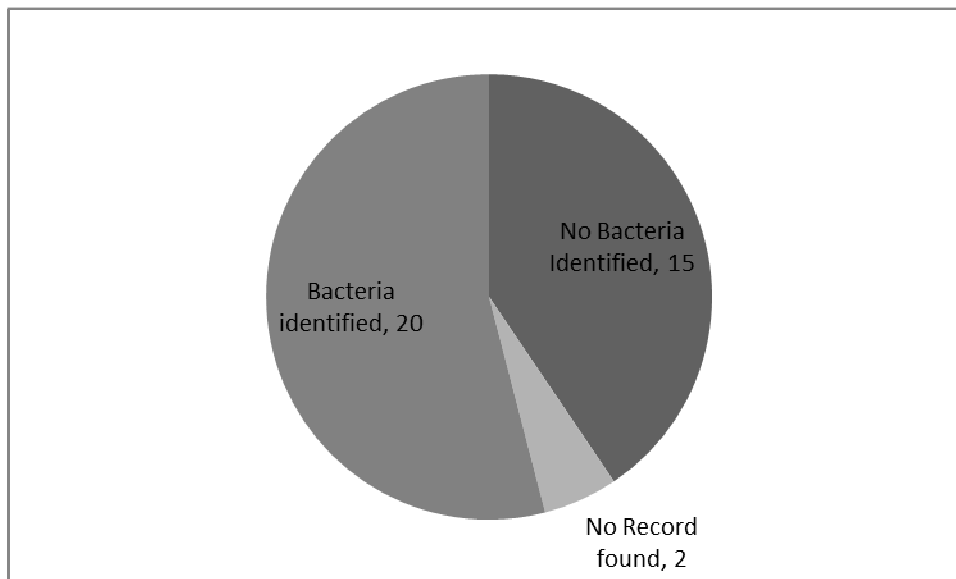
No complications were encountered in all the pleural biopsies that were performed.

**Table 3:** Histological diagnosis of pleura biopsied

Diagnosis	Frequency
Chronic Inflammation	18
Acute Inflammation	6
Non- specific inflammation	9
Acute/Chronic Inflammation	2
Subacute Inflammation	2
Total	37

None of the Histological specimens showed TB, and all of them just showed different types of inflammation

**Figure 7:** Organism Identification in Microbiology



Bacteria were only grown and identified in 54% of the pus specimens collected. In the rest, there was a dry swab or lost specimen (40.6%), or even just an absence of the record (5.4%).

**Table 4:** Characteristics of Bacteria identified

Bacteria Characteristics		Numbers	% in group	% of Total
Gram Negative	Rods	6	75	30
	Cocci	2	25	10
Subtotal 8			100	
Gram positive	Diplococci	8	67	40
	Rods	2	17	10
	Cocobacilli	2	17	10
		12	100	
Totals		20	100	100

**Table 5:** Species of bacteria cultured from the pus in the ET

Species	Frequency (N=20)	Percentage
<i>Streptococcus Species</i>	10	50
<i>Enterobacter Agglomerans</i>	1	5
<i>Escherichia Coli</i>	3	15
<i>Klebsiella Pneumoniae</i>	3	15
<i>Pseudomonas Aeruginosa</i>	1	5
<i>Proteus Vulgaris</i>	2	10
<b>Total</b>	<b>20</b>	<b>100.0</b>

## **CHAPTER FIVE**

### **DISCUSSION**

This is a study that was done in the UTH to look at patients who presented with ET, to try and see whether the aetiology of the empyema could be identified, by looking at the histology of the pleura, as well as carrying out a microscopic evaluation of the pus or fluid obtained. The small sample size may not be representative of the population. However, it brings out very important information to the fore.

### **5.1 PARTICIPANT DEMOGRAPHIC CHARACTERISTICS**

#### **5.1.1 SEX DISTRIBUTION**

In the study, twenty-four (64.9%) were males while 13 (35.1%) were females and the ratio was 1.8:1. This is similar to the sex distribution of the participants in a similar study that was done in Pakistan, where 68% of the patients with ET were males (Khan et al., 2004). What could not be identified from this study is why there are more of males presenting with empyema. Is it to do with biological factors, or is it about the differences in the health-seeking behaviours of the different sexes?

#### **5.1.2 AGE DISTRIBUTION**

The ages of the patients ranged from 22 to 54 years. The average age was 35.19 years. The range with the highest number of participants was 30 to 39 years (37.8%), whereas the lowest number was in the bracket from 50 to 59 years (8.10%). The age from 30 to 39 is the range in which the patients are in their most productive, and the age in which the effects of the illness is likely to be felt the most in the community. In the range of the fifties, the patients are beginning to slow down economically, and thus the impact is felt less. Therefore ET has a high socio-economic impact on society.

#### **5.1.3 MARITAL STATUS**

Six (16.2%) were single, 22 (59.5%) were married, 2 (5.4%) were divorced, and 7 (18.9%) were widowed. The married participants were in the majority. This status is what is expected of people in the age group most affected by ET.



#### **5.1.4 AREAS OF RESIDENCE**

Twelve (32.4%) were from rural areas while 25 (67.6%) were from urban areas. The urban households tend to live more in the crowded conditions which encourage the spread of infectious causes of ET. The rural populations tend to live in less crowded households, which may appear to be protective.

#### **5.1.5 HIGHEST EDUCATION LEVEL ATTAINED**

Twelve (32.4%) had attained primary education, 21 (56.8%) had attained secondary education, and 4 (10.8%) had attained tertiary education. The highest numbers of the study participants were in the bracket that had attained secondary education, followed by the ones with primary education. The results suggest that higher education level does not make people less likely to get ET. The converse is not correct either. There is no obvious correlation between level of education reached and the likelihood of contracting the disease entity.

#### **5.2 HIV AND HAART STATUS**

The results have further revealed that 23 (62.2%) patients were HIV positive while 14 (37.8%) were HIV negative. Of the 23 that were HIV positive, only 11 (47.8%) patients were on HAART. The HAART duration ranged from 3 to 48 months; with an average duration of 14.27 months. The mode for HAART was 9 months. The higher number of patients who were HIV positive might seem to suggest that the presence of HIV in the body predisposes the patients to ET. Looking at the HAART status of the patients, it appears as though HAART does not affect the likelihood of having ET. For this issue to be settled conclusively, an immunological study which also takes into consideration the duration of HAART will be very helpful. This coupled with a larger sample size and number of centres will be very helpful in this regard.

#### **5.3 CHARACTERISTICS OF CHEST FLUID**

##### **5.3.1 SIDE OF CHEST WITH ET**

In 67.6% of the study participants, the ET was on the Right side, whereas the rest had it on the left. The significance of this is that in more of them, the pleural biopsy

could be done with relative ease, as the heart is on the left side in most people. When the ET is on the left side, we have to be more careful as we need to avoid injuring the heart and pericardial sac.

Injury to the pericardium and its contents comes about when the operator does not pay attention to the anatomy when performing the pleural biopsy. This has to be inculcated in the doctors when training for pleural biopsy is done.

### **5.3.2 AMOUNT OF CHEST FLUID BASED ON RADIOGRAPH**

Most of the study participants (56.8%) had less than half of the affected Hemithorax filled with the pus. This was done by approximating the amount by counting the ribs under the fluid on the radiograph. In the cases where the pus less, it required that the biopsy and ICD insertion to be done lower (Patel N et al, 2009). This calls for more care in the procedure, as the chances of injury to the diaphragm increase, the lower the site of the procedures. It is a bit easier when the fluid is more, and the site of the biopsy/ ICD is higher. If the procedures are properly done, it does not matter where the biopsy is done. What is required is for the operator to be appropriately trained, careful and alert throughout the procedure.

### **5.3.3 TYPE OF FLUID ASPIRATED**

In more than 90% of the participants, the fluid aspirated from the pleural space was either frank pus or turbid fluid. These conform to the accepted definition of Empyema (Odell JA, 1994). This confirms the diagnosis of the physicians who referred the patients for ICD insertion. What remains to be confirmed is whether the underlying pathology is tuberculous pleurisy, as is presupposed by the physicians when the diagnosis of ET is made.

## **5.4 PLEURAL BIOPSY**

The procedure followed in doing the pleural biopsy was as advised in the literature (Scerbo et al 1971, Patel et al 2009). Parietal pleura harvested with Abram's needle was placed in containers of formalin, and submitted for histological examination.

#### **5.4.1 TOTAL NUMBER OF PLEURAL BIOPSIES COLLECTED PER PATIENT**

The total numbers of specimens collected from the patients was five (15), four (14) and six (8). This is in line with the recommended numbers of 4 to six if we are to have a good chance of making the correct histological diagnosis from the pleural tissue. Having followed these conditions, the result obtained can be taken to be correct and representative. The collection of more specimens from the participants was not going to increase the yield or likelihood of getting a better histological diagnosis (Khadadah et al., 2009).

#### **5.4.2 COMPLICATIONS OF PLEURAL BIOPSY ENCOUNTERED**

In all the pleural biopsies performed in this study, no major complications were encountered, which is in keeping with what was found in other studies. This is as a result of strict adherence to the recommended procedure, and adequate preparation before the procedure was done. This confirms that percutaneous pleural biopsy with Abram's Needle is a relatively easy, safe and useful procedure in the search for the aetiology of pleural disease with Para pneumonic effusions.

There is also a possibility that the complications were not manifested because of the presence of the intercostal drain in the chest after the biopsy. It still comes in as a good precaution after pleural biopsy.

#### **5.4.3 HISTOLOGICAL DIAGNOSIS OF THE PLEURA COLLECTED**

The histological diagnosis of all the pleural biopsies done showed the conclusions to be chronic inflammation (48.6%), acute inflammation (16.2%), Non-specific inflammation (24.3%), Acute /Chronic inflammation (5.4%) and subacute inflammation (5.4%). They went further to subject the specimens to ZN test which is specific for TB, but it was also negative. What this has demonstrated is that none of the pleural tissues obtained was positive for TB. The meaning of this is either there was no Tuberculosis in the specimen, or the pus in the pleural space makes it impossible to identify TB in the pleura. This appears to agree with what was concluded in a study in Karachi, Pakistan, where pleural biopsy with Abram's needle was less helpful in determining the aetiology of ET, than pus culture (Shaista et al.,

2012) The most logical way of settling this is to carry out thoracoscopically guided biopsy, or even do a similar research, but based on pleural effusions and not pleural empyema. Of course increasing the numbers of participants in the study will invariably increase on the reliability and validity of the research.

## **5.5 MICROBIOLOGY OF THE CHEST FLUID**

### **5.5.1 BACTERIA IDENTIFIED**

Of all the 37 pus specimens sent to the laboratory, the records were not found in two of the cases. In fifteen (40.6%), no bacteria was identified on microscopic examination. It was in the rest (54%) that bacteria were seen, identified and typed. This means that in about half of the specimens, the bacteria were clearly identified. The rest (40.6%) showed pus which could not exhibit any bacterial cells. In a study in Pakistan, the patients with pus that showed no growth were the same ones that had a pleural histology that suggested a tuberculous aetiology (Ihsanullah., 2009). In this study, no such association was identified because all the pleural specimens did not show tuberculous aetiology.

The bacteria identified were of many different forms i.e. gram positive and gram negative ones. There were also rods, cocci, diplococcic, and cocobacilli. This goes to show the wide variety of bacteria that were identified in the pus that was submitted. With the wide array of bacteria that were identified, it suggests that any bacteria can actually be found in the pus in ET. This raises the need for bacteriological testing so as to identify the actual bacteria that is present in a particular patient.

The presence of streptococcus species in 50% of the pus could suggest that the pus was as a complication of streptococcal pneumonia. The presence of other types of bacteria like *Escherichia coli*, *Klebsiella pneumoniae* and *proteus vulgaris* might have arisen from pneumonias, or haematogenous spread of bacteria from areas such as the genitourinary tract or the gastrointestinal tract. This is even more likely in the patients who have immunosuppression most likely due to the HIV virus. This fits in with the picture that we have in this country.

One other important bacterial species that was identified was the *Pseudomonas aeruginosa*. This is a very notorious nosocomial infection, which the patients might

have acquired during their hospital stay. If that were the case, shortening of the hospital stay will go a long way to reducing its transmission.

## **CHAPTER SIX**

### **6.1 CONCLUSION**

A few conclusions have been made from this study. They are listed as follows:

- 1) Pleural histology is a very helpful method in attempting to uncover the aetiology of pleural disease. However, its use in Empyema Thoracis does not give satisfactory histological evidence probably because of the intense inflammatory process which appears to affect the histology. However; it can be used in pleural effusions, with the reasonable expectation of getting representative results.
- 2) Many different bacteria can be satisfactorily isolated and cultured from pus in the pleural space. The bacteria in the pleura spread either directly from the lung, or haematogenously from the gastrointestinal or genitourinary tracts.
- 3) The use of the Abram's needle for pleural biopsies was introduced satisfactorily, albeit at a small scale, with the subsequent collection of adequate tissue specimens without encountering any complications.

The research findings proved the hypothesis of the study. Not all of the patients with thoracic empyema had a pleural histology that was consistent with tuberculous pleurisy.

### **6.2 STUDY LIMITATIONS**

Some limitations have been identified as the study was taking place as follows:

- 1) The participants' numbers were not large enough to enable us make some of the conclusions confidently.
- 2) The restriction of participants, only to those who had ET had the effect of excluding many patients with pleural effusions, and in their cases we would have more easily identified the aetiology.
- 3) The collection of pleural biopsies from only one site in the pleura. There is a possibility that the pathology may have been evident or available at sites away from the area of the pleural biopsy.

- 4) Delays in producing the histology results disadvantages the patients in that it was not possible to have an input in the management. By the time the results were ready; the patients had either been discharged, or even died.

### **6.3 RECOMMENDATIONS**

- 1) In all patients with ET, pus specimens should be collected and sent to the laboratory for Microscopy, culture and sensitivity, so as to identify the bacteria and strategize on the appropriate antibiotics to be used.
- 2) Physicians attending to patients with empyema thoracis should consider the differential diagnosis for the condition, rather than merely treat them presumptively as Tuberculosis
- 3) The laboratory at UTH should be encouraged and improved to try and produce histological and other results in a timely manner.
- 4) Pleural histology should be made available in patients with Empyema Thoracis and other pleural diseases. It could go a long way in uncovering the aetiology of the condition.

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[Www.who.int/gho/countries/zmb.pdf](http://www.who.int/gho/countries/zmb.pdf)

## **APPENDICES**

### **APPENDIX A: PARTICIPANT INFORMATION SHEET**

#### **Introduction**

My name is Dr. James Matabile, a Registrar in General Surgery, and Department of Surgery at the University Teaching Hospital. I am conducting a study on Empyema Thoracis at UTH. The purpose of the study is to find out the Histology of the parietal pleura in the patients with this condition at UTH.

#### **Procedure**

I am requesting you to participate in the study by

- I. Giving blood on voluntary basis for an HIV test if your HIV status is not known. You will be counseled by a trained counselor prior to and after HIV testing. Only 5mls (equivalent of 1 teaspoon) of blood will be drawn for all the tests from your vein in your arm. Blood will be drawn by a qualified medical practitioner. If it is known, just the record will be taken note of.
- II. The fluid in your chest will be aspirated in a 10ml syringe in order to see if it is clear fluid, turbid fluid, or frank pus.
- III. Four (4) pieces of tissue (about 0.3mm) will be collected from the side of your chest with the fluid before the chest tube is inserted to drain the pus out. These specimens will be submitted to the histology laboratory in order to determine the aetiology of the chest fluid.

#### **Foreseeable Risk**

During the collection of blood, you may experience some discomfort or bruising at the site of collection. To minimize this, trained personnel will collect blood using the smallest needle that is sterile, not used before and free of germs and aseptic technique will be employed. The same precautions will be followed at the time of aspirating pus from your chest through the Abrams needle.

At the time of collecting tissue from your chest wall, you will be injected with local anaesthetic so that you do not feel any pain during the procedure and at the time you will be having a chest tube inserted. The risk of pain will still be there, but minimal. There is a possibility of you having a collection of air or blood in your chest, or bleeding from the wound after the procedure. This might make you have difficulty in breathing. This will be treated with the chest tube that will be inserted after the tissue collection. The researcher will take the responsibility of managing the difficulties that might arise.

### **Benefits**

You will benefit directly in that we will be sure of the cause of the pus collection in your chest. We will inform both you and your attending physician of the results of this procedure. This will mean that the treatment you will get will be specific for your condition. Secondly, you will make major contribution to the information known about the causes of Empyema Thoracis in UTH. The study will neither delay your treatment nor prolong your stay in the hospital.

### **Confidentiality**

The researcher will keep the records and results of your blood as well as the result of the biopsy locked in a cabinet and the researcher will keep the keys. The results will not be disclosed to other people, neither will other people be told of your participation in the study.

### **Voluntariness**

If you feel that you have been injured or inconvenienced as a direct consequence of participation in the study, you are at liberty to withdraw from the study at any time without any penalty or loss of benefits.

### **Contact Details**

In the case where you have any questions or seek clarification, please contact me Dr. James Matabile on 0977850288, Department of Surgery, University Teaching Hospital, P/B RW1X, Lusaka.

You may also contact the Chairman of the University of Zambia Biomedical and Research Ethics Committee. Ridgeway Campus. P.O Box 50110, Lusaka, Zambia, telephone 0211-256067 if you would like to know your rights as a research participant.

**APPENDIX B: *CONSENT FORM***

Your signing this form means that you understand the information presented and that you want to participate in the study. You understand that participation is voluntary and you may withdraw from the study at any time. If you agree to participate in the study, kindly sign the consent form that follows.

I .....of  
address.....

On this day of .....month of ..... of the year..... Do understand the nature of this study and the risks of participating in this study have been explained to me. I have read the foregoing information, or it has been read to me. I have had an opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to be a participant in this research and agree to the terms of the study as laid out by the researcher.

Signature or Thumbprint of participant .....

Name of the participant .....

Date..... (Day / month / year)

**Statement by a Witness**

I have witnessed the accurate reading of the consent form to the participant, and the individual has had an opportunity to ask questions. I confirm that the participant has given consent freely

Name of witness: .....

Signature of witness: .....

Date: ..... (Day / month / year)

**Statement by the Researcher**

I have accurately read out the information to the participant and to the best of my ability made sure that the participant understands that the following will be done:

1. Aspiration of pus from the pleural space using a needle and syringe.
2. Collection of pleural biopsy specimens from the pleural space affected by Empyema Thoracis.
3. Standard treatment of patient with Empyema Thoracis as prescribed by the Hospital protocol.
4. Counseling and testing for HIV.
5. Standard management of the complications that might occur as a result of the procedure

I confirm that the participant was given an opportunity to ask questions and all the questions have been answered correctly and to the best of my ability. I confirm that the participant was not coerced into giving consent and consent has been given freely and voluntarily.

Name \_\_\_\_\_ of \_\_\_\_\_ researcher:  
.....

Signature of Researcher:.....

Date:..... (Date / Month /Year)

APPENDIX C: *DATA CAPTURE SHEET*

**TITLE:** A COMPARISON OF CLINICAL DIAGNOSIS AND PLEURAL HISTOLOGY IN EMPYEMA THORACIS IN THE UNIVERSITY TEACHING HOSPITAL, LUSAKA

**STUDY SITE:** UNIVERSITY TEACHING HOSPITAL

**RESEARCHER:** DR MATABILE JAMES

**1) DEMOGRAPHIC DATA**

i. Participant Number.....

ii. Age.....

iii. Sex : Male  Female

**iv. Marital Status**

a. Single

b. Married

c. Divorced

d. Widowed

**v. Residence**

a. Urban

b. Rural

**vi. Education**

a. None

b. Primary

c. Secondary

d. Tertiary



## 2) CLINICAL

### i. HIV status

1. Positive
2. Negative
3. If positive, is patient on HAART
  - a) Yes
  - b) No
4. Duration of HAART .....

- ii. Duration of Chest Symptoms .....
- iii. Respiratory Symptoms .....
- iv. Signs.....

### v. Radiology

1. Amount Of Fluid
  - a) < Half the chest
  - b) >Half the chest

### vi. Side of Empyema

1. Left
2. Right
3. Both

### vii. Fluid Aspirated

1. Clear Serous fluid
2. Turbid fluid
3. Frank pus
4. Haemorrhagic fluid

### viii. Pleural Specimens Biopsied

1. Four
2. Five

3. Six

- ix. Complication(s) of the pleural biopsy.....  
.....  
.....  
.....
- x. Treatment of the complications.....  
.....  
.....  
.....

**3) HISTOLOGY**

- i. Histological features :.....  
.....  
.....  
.....  
.....
- ii. Final  
Diagnosis.....  
.....

**4) CULTURE RESULTS**

- I. Gram Stain  
results.....
- II. Bacteria Grown .....
- III. Sensitivity pattern  
.....

5) AAFB results where applicable

## **APPENDIX D: METHOD PLEURAL BIOPSY WITH THE ABRAM'S NEEDLE**

- I. The appropriate side of the chest will be cleaned with Chlorhexidine, Iodine and Methylated Spirit in the usual fashion for any sterile operative procedure.
- II. The chest wall is infiltrated with 1% Lignocaine in the intercostal space where the fluid is present, as judged by clinical examination and radiology, preferably at a dependant point in the pleural space.
- III. A skin incision (0.5 -1cm) is made in the appropriate space.
- IV. The Abrams needle is advanced into the pleural space with the cutting edge closed.
- V. Once in the pleural space, the cutting needle is to be opened and a bit of fluid
- VI. Aspiration carried out to confirm its presence.
- VII. The needle is then withdrawn, maintaining the pressure in the direction of the cutting edge until the chest wall is engaged.
- VIII. The biopsy needle is then held firmly against the chest wall, and then the Hexagonal strip twisted clockwise.
- IX. The biopsy needle is withdrawn.
- X. This will be repeated several times at different angles until 4 to 6 specimens are collected.
- XI. The specimens will be placed in 4% Formalin, and sent for histological examination, with the signed laboratory request form.
- XII. The intercostal under water seal drain is inserted in the same wound in a standard manner, and fixed to the chest wall by the Baragwanath stitch.
- XIII. The patient will be observed for one (1) hour to check for complications that might occur as a result of the procedure(Scerbo et al., 1971).