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TUBERCULOSIS OF THE SPINE: PRESENTATION,  
MANAGEMENT AND SHORT-TERM OUTCOME OF  
TREATMENT AT THE UNIVERSITY TEACHING  
HOSPITAL, LUSAKA, ZAMBIA.

BY

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“He has half the deed done, who has made a beginning.”

**-Horace**

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Lastly I thank all the people, the list is endless, who directly or indirectly played a role in making this study better than it would otherwise have been.

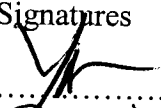

I thank you all from the bottom of my heart.

## Approval

This dissertation by Dr. James Munthali is approved as fulfilling part of the requirements for the award of the degree of Master of Medicine in Orthopaedic Surgery by the University of Zambia, subject to the examiner's report.

Signatures

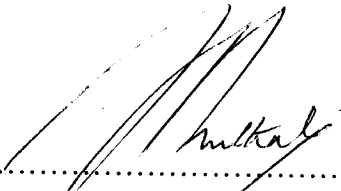


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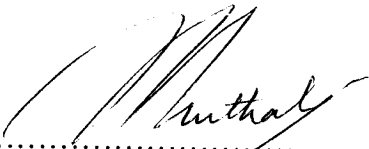
## Declaration

I hereby declare that this dissertation herein presented for the degree of Master of Medicine Orthopaedic Surgery has not been previously submitted wholly or in part for any other degree at this or any other University nor is it being currently submitted for any other degree.

Signed .....  ..... (Candidate)  
Approved by .....  ..... (Supervisor)  
Approved by .....  ..... (Co-supervisor)

## Statement

I hereby testify that this study is entirely the result of my own independent investigations. The various sources to which I have referred are clearly cited in the text and the references.

Signed: .....  ..... (Candidate)  
Date: ..... 06 - 06 - 04 .....

## **Dedication**

I dedicate this work to my wonderful daughters Tiwonge and Nsamwa who throughout the study complained very little about the divided attention they got. Their contribution to my morale was immeasurable.

## List of Abbreviations

AAFB	-	Acid-Alcohol-Fast Bacilli
AIDS	-	Acquired Immunodeficiency Syndrome
AM	-	Atypical Mycobacteria
BCG	-	Bacillus Calmette Guerin
CDC	-	Centres for Disease Control
CT	-	Computerised Tomography
CXR	-	Chest X-ray
ESR	-	Erythrocyte Sedimentation Rate
FBC	-	Full Blood Count
Ga	-	Gallium
Hb	-	Haemoglobin
HIV	-	Human Immunodeficiency Virus
MDP	-	Methylene Diphosphonate
MOTT	-	Mycobacteria Other than Tuberculosis
MRC	-	Medical Research Council
MRI	-	Magnetic Resonance Imaging
NSAIDs	-	Non-steroidal anti-inflammatory drugs
NTM	-	Non-tuberculous Mycobacteria
TB	-	Tuberculosis
Tc	-	Technetium
UTH	-	University Teaching Hospital
WBC	-	White Blood Cell
WHO	-	World Health Organisation

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## Abstract

In this study, 32 patients with tuberculosis of the spine who presented to the University Teaching Hospital (UTH) in Lusaka, Zambia and who satisfied specific inclusion criteria for the study were followed up for a period of six months. The group comprised 18 male (56%) and 14 female (44%) patients with an average age of 30.2 years (range was from 2 to 83 years). The main symptoms at presentation were back pain (81 %), deformity of the spine (69%) and weakness of the legs (66%). One patient (3%) had a cervical lesion, 22 patients (67%) had thoracic lesions and 10 patients (30%) had lumbar lesions. Categorization by site of involvement showed affection of the thoracic and lumbar spine to be 54% and 46% respectively in the HIV-positive patients and 5% (1 out of 20) for the cervical spine, 75% (15 out of 20) for the thoracic spine and 20% (4 out of 20) for the lumbar spine in the HIV-negative patients. 17 patients (53%) presented with marked neurological deficit (Frankel grades A B & C) while 15 patients (47%) presented with almost normal neurological status (D & E). After a minimum of 2 months on conservative management most patients showed improvement resulting in 10 patients (31%) with marked neurological deficit and 22 (69%) with almost normal neurology. However 3 patients (9%) deteriorated from Frankel grade B to A while four (13%) remained static with one patient at grade A and three patients at grade B. Five patients (16%) had to undergo surgical treatment for TB spine. Histology confirmed TB in 4 patients while one was non-specific. There were two mortalities one each from the conservatively managed and the surgically managed groups. Surgery improved the mean kyphosis angle from 40° (range 27°-52°) to 22.5° (range 15°-30°). There was no

difference in response to treatment between the HIV-negative and the HIV-positive patients.

## **Objectives**

### **General Objective**

To determine the presentation, management and short-term outcome of treatment of Tuberculosis (TB) of the spine at the University Teaching Hospital (UTH) in Lusaka, Zambia.

### **Specific Objectives**

1. To determine the age and sex distribution of TB of the spine.
2. To determine the clinical presentation of TB of the spine with regard to symptoms, signs and haematological features.
3. To evaluate the frequency of involvement of the various parts of the vertebral column and the prognosis.
4. To determine any relationship between the site of TB of the spine and HIV status.
5. To evaluate the clinical response of HIV-positive and HIV-negative patients to treatment.
6. To determine the relative accuracy of the diagnosis of TB of the spine at UTH
7. To make recommendations to UTH and Government.

## Rationale

It is estimated that five percent of TB affects the skeletal system and 50 percent of this is spinal (Norden *et al*, 1994). Tuberculosis of the spine is a potentially debilitating condition not only because of its chronic nature but also because of the ever-present danger of spinal cord compression with resultant neurological deficits (Watters, 1997).

TB of the spine has been rife in underprivileged communities. This has recently been compounded by immigration and HIV/AIDS (the cursed duet) which have not only led to its increase in the developing world but also resurfacing in the developed world (Bayley *et al*. 1992, Jellis 1994, Moon 1997 & Jellis 2002a).

Work done at the UTH on TB of the spine has mainly dwelt on the clinical presentation and outcome of treatment especially in the light of HIV infection. As a result of the poor response to major surgery seen in HIV-positive patients (especially those undergoing internal fixation for various reasons) there has been a reluctance to intervene surgically in TB spine patients with neurological deficits who are HIV positive. No work has been done in Zambia to determine how the stage of HIV disease influences response to conservative and operative treatments in patients with TB spine.

Secondly, there is no well documented protocol for the anti-TB treatment regime to be used in patients with TB spine resulting in varied regimes dependent on the choice of the attending doctor. This has made it difficult to evaluate the efficacy of treatment in TB spine patients.

# LITERATURE REVIEW

## Introduction

It is generally known that tuberculosis (TB) is an ancient disease. TB has generally paralleled the socio-economic rise and fall of humankind. By the beginning of the twentieth century, tuberculosis was a major cause of adult death in Western society (Farer *et al*, 1979 & Leff *et al*, 1979). According to Reichman and Hershfield (1993) in the era before antituberculosis drugs were available, patients for whom treatment in a sanatorium setting was considered to be successful still had a 60 per cent mortality rate within six years after discharge from the sanatorium.

Spinal tuberculosis also referred to as tuberculous spondylitis has existed for over 5000 years (Kerry, 1978), and mummified remains from northern Egypt dating from 3400 B.C. provide strong evidence of its presence (Kerry, 1978). According to Kerry (1978) and Webb (1936) the first known description of tuberculous spondylitis was written in Sanskrit sometime between 1500 and 700 B.C.

In the late eighteenth century, Sir Percival Pott noted the association between tuberculous involvement of the thoracic spine and paraplegia. This resulted in the condition being referred to as 'Pott's Paraplegia'.

## Causative organisms

Three main related organisms—*Mycobacterium tuberculosis*, *Mycobacterium bovis* and *Mycobacterium africanum* —are the causes of tuberculosis. *Mycobacterium*

*tuberculosis* is by far the most common. Disease due to *Mycobacterium bovis* is often seen in poor communities in the developing world where there is consumption of unpasteurized milk. In developed countries infection by *Mycobacterium bovis* is limited by the widespread pasteurization of milk. *Mycobacterium africanum* is rarely found outside of Northwestern Africa (Reichman & Hershfield, 1993).

*Mycobacterium tuberculosis* is a thin rod with round ends, 2.0 to 2.5 µm long. It is non-motile, without a capsule, and is difficult to stain with use of the usual methods. If it is stained with the classic carbol fuchsin or Ziehl-Neelsen method, it resists decolourisation with strong mineral acids and alcohol; hence, *Mycobacterium tuberculosis* is considered an acid-alcohol-fast (AAFB) or acid-fast (AFB) bacillus. Its histological appearance is small curved or straight rods of red or pink. *Mycobacterium tuberculosis* does not grow on ordinary culture medium; it grows only on enriched medium called Lowenstein-Jensen medium containing an egg and potato base or serum (albumin) base. It has a slow rate of growth, and grossly visible colonies first appear at two to four weeks. *Mycobacterium tuberculosis* is a strict aerobe, and its rate of growth is highly dependent on oxygen tension. When tension is high, as in a tuberculosis cavity of the lung, *Mycobacterium tuberculosis* multiplies freely. When tension is much lower, as in the caseous foci of the lung, it multiplies slowly or not at all.

Lately a group of mycobacteria that cause TB like- pulmonary disease, lymphadenitis, superficial and soft tissue infections and disseminated disease in humans, especially those that are immunocompromised and in a variety of animals, birds, reptiles and fish

has been described and is referred to as atypical mycobacteria (AM), non-tuberculous mycobacteria (NTM), or mycobacteria other than tuberculosis (MOTT).

According to Gunja (1997) skeletal infection by atypical Mycobacterium species is uncommon. Usually there are underlying risk factors such as HIV infection, immunosuppressive therapy (e.g. transplant patients), lymphoma-leukaemia or a history of penetrating trauma. Atypical Mycobacteria include *M. avium-intracellulare* and *M. kansasii* (immunosuppressed persons), *M. marinum* (aquatic exposure) and *M. terrae* (exposure during farm work). They commonly infect the tendon sheaths and osteoarticular structures of the hand and wrist. Clinically, they are indistinguishable from TB, but they tend to run a milder course. X-ray features are similar to those in TB. Treatment is a combination of chemotherapy and surgical debridement.

## **Epidemiology**

The World Health Organization (WHO) has estimated that one-third of the global population is infected with *Mycobacterium tuberculosis*, and tuberculosis remains the most frequent infectious cause of death and disability in adults on a worldwide basis, accounting for close to three million deaths each year (CDC, 1989a & Kochi, 1991).

According to Grzybowski (1991), when the prevalence of tuberculosis in a community is high, most of the population in that community has been infected by the age of twenty years. On the contrary when the prevalence of tuberculosis in a community is low, almost all clinically infected patients are more than fifty years old and probably were infected years earlier and are showing signs of reactivation of the disease

(Grzybowski, 1965). This view of TB has changed with the advent of the HIV/AIDS pandemic.

Whereas TB of the spine was originally known to be a disease of childhood it is now known that it affects adults as much as it does children.

## **Pathogenesis**

Haematogenous seeding of tuberculous bacilli is the most common form of skeletal infection. Occasionally direct extension from adjacent foci (lung, kidney, lymph nodes) is seen (Gunja, 1997). Spinal tuberculosis is always secondary to a primary lesion and occurs due to haematogenous spread. The primary focus may be active or quiescent and may be in the lungs, mediastinal lymph nodes, kidneys and other viscera (Thamburaj, 2002) and presents a series of interrelated problems. The disease begins in the anterior aspect of a superior or inferior vertebral end plate and tends to spread beneath the anterior longitudinal ligament to involve adjacent vertebral bodies on either side of a disc. Narrowing of the disc space occurs when destruction of cancellous bone on both sides of a disc allows the disc to herniate into the affected vertebral body or bodies. This gives rise to the radiological features of TB of the spine.

Osseous infarction and osteonecrosis may lead to a decrease in vertebral height and may be accompanied by paravertebral and possibly epidural formation of an abscess (Weaver & Lifeso, 1984). Because the anterior portion of a vertebral body is involved and the posterior portion (pedicle, spine) is less commonly involved, a sharp kyphosis

(clinical gibbus) may occur, and even with resolution of the acute infectious process the kyphosis may continue to cause anterior compression of the cord and late neurological sequelae (Weaver & Lifeso, 1984). Multiple sites in the spine may be involved simultaneously. In a series by Weaver and Lifeso (1984), 5 per cent of patients who were seen with neurological impairment had no obvious discernible vertebral lesion; epidural abscess, severe arachnoiditis, and intradural tuberculomas accounted for these neurological lesions. Spinal tuberculosis has often been called 'the great imitator' because its radiographic appearance may mimic other pathological conditions affecting the spine such as tumour deposits, trauma, staphylococcal and salmonella osteomyelitis, brucellosis and discitis. Consequently, other diagnoses must be kept in mind, even in areas endemic for tuberculosis. Cold abscesses are formed adjacent to the vertebral column, and calcification of the cavity is pathognomonic for TB. According to Gunja (1997) pyogenic and tuberculous spondylitis cannot be clinically distinguished. Diagnosis must be made microbiologically.

Thamburaj (2002) recognizes four types of TB spine:

1. **Para discal:** lesion begins in the metaphysis, erodes the cartilage and destroys the disc, resulting in narrowing of the disc space.
2. **Central:** lesion begins in the midsection of the body which gets softened and yields under gravity and muscle action, leading to compression, collapse and bony deformation.
3. **Anterior:** lesions lead to cortical bone destruction beneath the anterior longitudinal ligament. Spread of the infection is in the subperiosteal and subligamentous planes resulting in the loss of periosteal blood supply to the body

with resultant collapse. Other factors such as periarteritis and endarteritis contribute to the collapse.

4. **Appendicular:** the infection settles in the pedicles, the laminae, the articular processes or the spinous processes and causes initial ballooning of the structure followed by destruction.

In a study by Bloch et al. (1989), the incidence of involvement of vertebrae in TB spine was thoracic spine in 50 per cent, the cervical spine in 25 per cent, and the lumbar spine in 25 per cent.

## **Diagnosis**

### **History & Examination**

Slowly progressive constitutional symptoms are predominant in the early stages of the disease. These include weakness, malaise, night sweats, fever and weight loss. Even though Wood (1998) considers back pain a late symptom associated with bone collapse, most authors (Jellis 2002a, Thamburaj 2002, Meddeb et al. 2002, Rasit, Razak & Ting, 2001, Gunja 1997) consider it a predominant feature, present in approximately 70% of patients and it is associated with a stiff spine and paravertebral muscle spasm. Typically the pain is worse at night.

At presentation there is 20% incidence of a paravertebral abscess and about 90% incidence of a gibbus (Thamburaj, 2002).

Cervical involvement may cause hoarseness because of recurrent laryngeal nerve paralysis, dysphagia and respiratory stridor also referred to as Milar Asthma (Wood,

1988). The most serious is the neurological involvement with overall incidence of about 30% and the deficit depends on the site, the direction of spread and pathological changes produced. The risk is highest in the region of cervico-thoracic region because of a narrow vertebral canal. The most common cause of neurological deficit is compression, which may be due to an abscess, granulation tissue, sequestered bone and disc or pathological subluxation in active disease.

In healed diseases the deficit may be due to transverse ridge of bone anterior to the cord, due to angulations of the spine or healing, stretching or attrition of the cord due to spinal deformity and or fibrosis of the dura mater (Jellis 2002).

In a given case more than one factor may contribute to the pathogenesis. Non compressive causes such as endarteritis, periarteritis or thrombosis of the arterial supply of the cord (Thamburaj, 2002) should be considered as possible causes of the neurological deficit.

## **Investigations**

### **Haematology**

General tests of inflammation, such as the erythrocyte sedimentation rate (ESR), are often raised but this is neither specific nor completely reliable (Watts & Lifeso, 1996).

A full blood count (FBC) will often show reduced haemoglobin (Hb) associated with chronic illness while the white blood cell count (WBC) would show a lymphocytosis.

However according to Jellis (2002) if in addition the patient has a concurrent HIV infection, the anaemia may be more marked and the ESR very high but because of lymphocyte destruction, the lymphocyte count may be normal or even low.

### **Immunology**

There have been some major advances in serological testing in osteoarticular tuberculosis. The enzyme-linked immunosorbent assay test (ELISA), has a reported sensitivity of 60 to 80 per cent but it may be negative in patients who have advanced disease (Coldtz et al. 1994, Pandey and Talib,1993) furthermore the high cost is a major deterrent to its widespread use in developing countries.

New work in chromatography, nucleic acid probes, and polymerase chain reaction in addition to nucleic acid probes by systems using antibodies against *Mycobacterium tuberculosis* are gradually being introduced, but at this stage they have not been tested extensively and are not widely available (Pandey & Talib 1993, Reimer 1994, Ryan & Murray 1994, Salfinger & Morris, 1994).

According to Watts and Lifeso (1996), in regions where brucellosis is endemic, a *Brucella* complement-fixation test should be performed as brucellosis can mimic tuberculosis clinically.

## **Radiology**

### **Plain X-Rays**

Features include rarefaction of the vertebral end plates, increasing loss of disc height, variable degrees of osseous destruction, new-bone formation and soft-tissue (paraspinal) abscess which on the anteroposterior (AP) radiographs may appear as a fusiform shadow around a thoracic lesion while in the lumbar spine loss of the psoas shadow is indicative of a cold abscess (Watts & Lifeso 1996, Jellis 2002).

Obvious bone destruction of adjacent sides of two or more vertebral bodies and loss of the intervening disc spaces as the kyphosis develops are usually late signs (Jellis 2002).

Often, multiple bones are involved in the spine, and late fusion or collapse of bone is not uncommon. Radiographic findings in patients who have disease related to the human immunodeficiency virus may be caused by other diseases and should not be automatically ascribed to tuberculosis (Watts & Lifeso, 1996).

### **Computerised Tomography (CT) Scan**

CT scan is useful in delineating the extent of bone destruction (Jellis, 2002a). According to Hoffman, Crosier and Cremin (1993), since CT gives a very good definition of posterior element involvement it is indicated if posterior instability with pedicle involvement is suspected on AP radiographs and if surgery is contemplated. It is now becoming increasingly evident from the use of CT scans that posterior element involvement in TB of the spine is more common than previously appreciated.

## **Magnetic Resonance Imaging (MRI)**

MRI shows qualitative changes in soft tissue and may therefore show changes in the spinal cord and the extent of cold abscesses or ligamentous destruction. It is useful in differentiating between compression due to pus and granulation tissue (which may respond to conservative treatment) and that due to fibrosis which requires surgical decompression (Jellis 2002, Hoffman *et al.* 1993).

MRI therefore may be of greatest value in the evaluation of intramedullary lesions and isolated extradural disease. Intramedullary lesions include tuberculomas; spinal cord cavitation; spinal cord edema; and possibly unsuspected, non-contiguous lesions throughout the spine (Gupta *et al.* 1994).

According to Bell *et al.* (1992), it is helpful for localization in planning of surgical approaches.

## **Bone Scan**

According to Watts and Lifeso (1996) there are no specific scintigraphic features of tuberculosis that are pathognomic. In a study by Weaver and Lifeso (1984) of fifty-six patients who had a tuberculous lesion, technetium-99m (Tc-99m) bone scans showed diffuse changes in uptake similar to those seen with metastatic disease in thirty-five patients (63 per cent), and the scans proved to be negative, or so-called cold, in the presence of active disease in twenty-one (38 per cent). They concluded that the negative scans may represent avascular segments of bone due to the formation of an abscess.

A study aimed to identify features specific to tuberculous (TB) involvement of the spine in bone scan images and to evaluate these features as a diagnostic tool was conducted by Shanthly, Oommen and Suderaraj (1999). Bone scan images of 50 patients with clinical diagnosis of spinal TB were studied prospectively based on specific features that were observed in a retrospective study of patients surgically treated for TB of the spine. They found that the sensitivity of bone scan was 88.5% and its specificity for the diagnosis of TB of the spine was 75%.

Kim et al. (2003) compared the efficacy of Tc-99m MDP and Gallium-67 (Ga-67) citrate scanning in detecting TB spine. They concluded both are equally efficacious in the detection of TB spine and recommended that they can be used to screen the entire body to detect multiple site involvement of the spine. Indium-111-scanning has also been tried. It is non-specific but may show decreased activity in bone marrow involvement (Nocera *et al*, 1983). The cost of these investigations are however prohibitive to allow their general use in developing countries.

### **Biopsy, Culture & Sensitivity**

A definite diagnosis of tuberculosis can be made only if AAFB are demonstrated on appropriately stained sections of the lesion or if *Mycobacterium tuberculosis* can be cultured from the lesion (Jellis 2002). However there are comparatively few tubercle bacilli in bone and joint TB. Shanthly, Oommen and Suderaraj (1999) reviewed the results of 20 patients with a diagnosis of TB spine that had biopsy of the lesions. They found that 16 (80%) had positive biopsy findings while all 10 patients who did not have a previous diagnosis of TB spine had negative biopsy findings.

To obtain biopsy from a spinal lesion without surgery needs guidance from fluoroscopy or CT scanning. Watts & Lifeso (1996) recommend core needle biopsy in the diagnosis of spinal TB. This, unfortunately, may not always be possible due to lack of facilities in most institutions, the high cost of such investigations when available and the limitation posed by the shortage of personnel with the expertise.

According to Jellis (2002), most cases of spinal TB are diagnosed on history, examination and radiology supported by blood investigations including ESR. Medical Research Council (MRC) trials in the 1970s showed that this had a better than 95% accuracy (Medical Research Council Working Party on Tuberculosis of the Spine, 1974). In regions of the world where TB is common, it has been recommended in cases of suspected bone TB that treatment proceed without culture diagnosis because of the lack of appropriate facilities . A study will however have to be carried out to determine whether this still holds true for patients with HIV infection who are susceptible to a variety of other opportunistic infections (Watts & Lifeso, 1996).

### **Skin Tests**

In areas where childhood BCG immunization is practiced antigen skin tests like the Mantoux are not reliable indications of active tuberculosis. In addition in HIV infection, the reaction depends on the stage of immune depression reached. Such patients are prone to anergy and negative skin-testing, especially in the later stages of AIDS. Consequently such tests have been abandoned as diagnostic tools in most countries (Jellis, 2002 Okwera et al. 1990, Rieder et al. 1989).

## **Treatment**

### **Medical Treatment**

The mainstay of treatment of TB spine is primarily medical. According to the Ninth Report of the Medical Research Council Report (1985) and the MRC Reports from Hong Kong and Bulawayo (1974a, 1974b & 1982) operative intervention is an adjunct to appropriate antituberculosis chemotherapy. This should be supplemented by rest for a period ranging from 4-6 weeks, good food, and correction of anaemia (Jellis, 2002, Thamburaj, 2002).

The Medical Research Council of the United Kingdom, in multiple studies throughout the world (1974, 1976, 1978, 1985), has shown that drug therapy alone can be effective treatment for tuberculosis of the spine, with an acceptable resolution of neurological sequelae and prevention of substantial progression of the kyphosis in most patients.

Successful medical treatment requires the prolonged administration of a minimum of three drugs to which the organisms are susceptible, and at least one of these drugs must be bactericidal. Because of the spontaneous emergence of drug resistance in a small number of tubercle bacilli, monotherapy with even the most potent bactericidal drug (isoniazid) may result in the selection of a resistant bacterial population and lead to failure of the treatment and to acquired drug resistance. Therefore, a combination of drugs is necessary to treat tuberculosis effectively.

Most treatment regimes include four drugs namely rifampicin, isoniazid, pyrazinamide and ethambutol (Jellis 2002a, Thamburaj 2002, Crosier, 1994, Centers for Disease Control, 1994, De Cock *et al.*, 1995 Haas & Des Prez, 1995).

Isoniazid is the most potent bactericidal drug available and is particularly effective against actively growing organisms. It is easily administered and inexpensive. Isoniazide is administered at a dose of 5mg/kg (4-6mg/kg) of body weight. Hepatic toxicity is a major side effect. Patients who have a history of excessive alcohol consumption or hepatitis infection have an increased probability of isoniazid hepatotoxicity (WHO, 1997).

Peripheral neuropathy caused by the interference of isoniazid with the metabolism of pyridoxine may be a substantial problem. Pyridoxine should be given in conjunction with isoniazid at a dose of 10mg/day (WHO, 1997).

Rifampicin and pyrazinamide are the most effective sterilizing drugs, and they are specifically effective against bacilli that are dormant and undergo periodic bursts of activity. Rifampicin is bactericidal at the usual adult dosage of 10mg/kg (8-12mg/kg) body weight a day with a maximum of 600mg daily. The most common adverse reaction is gastrointestinal upset, but mild jaundice may also occur. Pyrazinamide is bactericidal as well. The dosage is generally 20-30mg/kg of body weight a day (WHO, 1997).

Ethambutol is bacteriostatic. Retrobulbar neuritis is the most frequent and serious adverse effect, with symptoms including blurred vision, central scotomata, and red-

green color blindness. This complication is dosage-related and it is recommended that red-green color discrimination and visual acuity tests should be administered before and during treatment. It is therefore recommended that patients who are too young should not receive ethambutol. The dosage is 15-20mg/kg of body weight a day to a maximum of 1.2g/day (WHO, 1997).

Prolonged drug therapy is necessary to eliminate or sterilize so-called persistent bacilli, which are small populations of metabolically inactive organisms. The optimum duration of treatment has been an issue of considerable debate, and much of the information available concerns the treatment of pulmonary disease. The short-course regimens (six or nine months) may not be applicable to TB spine unless when combined with surgical treatment (Watts and Lifeso, 1996). Most authors recommend that treatment be continued for a minimum of twelve months (Vidyasagar & Murthy, 1994, Crosier, 1994, Thamburaj 2002, Rasit *et al.*, 2001). Children should be managed essentially the same as adults, with the use of appropriately adjusted doses of the drugs (Centers for Disease Control, 1989b)

Other drugs that are especially useful in the face of multiple-drug-resistant organisms include streptomycin, ethionamide and cycloserine.

### **Surgical Treatment**

The absolute indications for operative intervention are a marked neurological deficit, especially if it is related to severe kyphosis or sequestered bone or disc in the neural canal; large abscesses in a patient in whom respiratory obstruction has developed; a

neurological deficit that has worsened despite adequate chemotherapy; and continuing progression of kyphosis or instability despite adequate chemotherapy. Relative indications for operative intervention are related to the inability to obtain adequate material for culture by other means, neurological deficits in patients for whom prolonged bed rest may lead to other problems, persistence of pain or spasticity caused by a demonstrable mechanical block, or pain related to spinal instability where spontaneous fusion has not occurred (Ho and Leong 1994, MRC 1974a, MRC 1978, Upadhyay *et al.* 1993, Upadhyay *et al.* 1994a & Upadhyay *et al.* 1994b).

Since spinal TB primarily involves the anterior vertebral structures, anterior operative approaches are usually recommended. From an anterior approach, abscesses can be evacuated, all avascular material can be excised, and anterior decompression of the spinal cord can be performed safely. This procedure of anterior debridement with decompression of the spinal cord and grafting was pioneered by Hodgson and Stock (1956) and has become widely known as the 'Hong Kong procedure'. Hodgson *et al.* (1960) reported 412 patients treated by radical removal of the diseased area and anterior spinal fusion. They had a mortality of 2.9% but no deaths occurred in patients who had disease of limited extent or of short duration and who had no pulmonary involvement. Using this approach, tissue is easily obtained for histological study and culture, and the kyphosis can be corrected or at least stabilized with use of autogenous bone graft.

The Hong Kong procedure involves approaching the vertebrae from the left side with the patient positioned in the right lateral recumbent position. The rib that in the midaxillary line lies opposite the maximum convexity of the kyphosis is selected. This

is usually two ribs superior to the center of the vertebral focus. An incision is made along this rib, the rib is resected and a standard thoracotomy is done. The lung is mobilized and pushed anteriorly. A longitudinal incision is then made in the pleura close to the aorta in the groove between the aorta and the abscess. The aorta is then displaced anteriorly and medially, revealing the intercostals vessels which are secured and divided for the entire length of the abscess cavity. Some elements of the splanchnic nerves in the way may also be divided. The aorta is displaced anteriorly away from the spine and the abscess is palpated across the anterior aspects of the vertebrae. A T-shaped incision is made through the abscess wall: the first incision is transverse and opposite the center of the disease process, and the second is longitudinal and medial to the distally placed ligatures on the intercostals vessels. The two triangular flaps are raised revealing the diseased area, including the inside of the abscess cavity. The debris, pus and sequestered bone or disc is removed by suction or with a pituitary rongeur. All diseased bone is removed for the whole length of the diseased segment. All tuberculous granulation and fibrous tissue is removed exposing the dura. The disc at each end of the cavity is removed to expose normal bleeding bone. After cutting a mortise in the vertebrae at each end a strut graft (the resected rib, tricortical graft from the iliac crest or bone bank grafts) is inserted keeping the vertebrae sprung apart (Wood, 1998).

Louw (1990) in a series at Kalafong Hospital in Pretoria South Africa developed a procedure (Kalafong Procedure) based on the "Hong Kong procedure" but modified to involve an anterior debridement, decompression and vascularised rib grafting, followed either during the same procedure or 14 days later by multilevel posterior osteotomies,

instrumentation and fusion Surgery was performed under cover of four-drug antituberculosis chemotherapy. The advantage of the Kalafong procedure is in its reduction of a long-standing rigid kyphosis in the thoracic spine even in adults.

There have been several studies to investigate the use of cortical allografts, vascularised rib pedicle grafts and anterior instrumentation in spinal tuberculosis instead of the traditional autologous rib and iliac crest grafts in the treatment of spinal tuberculosis (Govender & Kumar, 2003, Benli *et al.* 2003, Govender, 2002, Govender *et al.*, 2001a, Govender & Parbhoo, 1999). It is accepted that fresh-frozen allografts and anterior instrumentation are a suitable alternative to autologous rib and iliac crest grafts in the treatment of spinal tuberculosis they remained stable even though fusion occurred late. It is also concluded that vascularised rib pedicle grafts were superior to autologous rib grafts in supporting and promoting early fusion of the anterior column in children with kyphosis.

According to Travlos & Du Toit (1990) indications for posterior operative approaches to the spine, although rare, include situations in which the posterior spinal elements are more involved than the anterior ones or those in which both the anterior and the posterior elements are involved and posterior stabilization is needed before anterior decompression and arthrodesis is performed.

At specific anatomical sites, such as the occipito-cervical junction, Lifeso (1987) recommends a transoral biopsy to decompress and obtain tissue for culture, followed by a posterior stabilization procedure. A posterior operative approach is also indicated in patients with a stable spine who have slight deformity or involvement of the bone but

who also have intramedullary or possibly extramedullary tuberculomas and an epidural abscess.

The costotransversectomy approach seems to have somewhat limited applications but is useful for the drainage of a large abscess in the thoracic spine in a patient who is not medically fit to have a formal thoracotomy. It is also useful in patients with substantial thoracic kyphosis, in whom an anterior transthoracic approach is technically difficult. Often, a costotransversectomy allows sufficient exposure for removal of an anterior bone bar and for limited bone-grafting.

According to Oga *et al.* (1993) posterior stabilization with various metallic implants does not appear to increase the risk of prolonged infection, and it may allow patients to be mobilized earlier with less need for postoperative immobilization.

### **Spinal TB & HIV Infection**

With the increase in the number of patients with concurrent HIV infection and extrapulmonary tuberculosis concern has been raised about the response of such patients to both non-operative and operative forms of treatment to TB of the Spine. According to the CDC classification (1993), extrapulmonary tuberculosis is an AIDS-defining disease. In HIV-positive patients with tuberculosis 60% develop skeletal lesions compared with 3-5% in HIV-negative patients (Moon, 1997). A number of studies have been done to determine if there is any difference between these two groups.

Leibert *et al.* (1996) followed up 26 patients with spinal TB in New York, USA. Seven of the patients (27%) were HIV seropositive. When compared with HIV-negative patients those with HIV and spinal tuberculosis had similar clinical presentations; most had a diagnosis made with percutaneous needle aspiration biopsy of clinically involved areas. Open procedures added little diagnostic information. Most were treated without surgery and response to antituberculosis therapy was uniformly good. They concluded that clinical presentations of spinal tuberculosis are similar in HIV-positive and –negative patients, and good outcomes can be expected with regard to mycobacterial disease. Unfortunately they did not document the clinical stage of the HIV infection and did not determine whether this had a bearing on the presentation and outcome. In addition there was no mention of whether or not any of the patients was on anti-retroviral therapy.

Govender *et al.* (2001b) in Natal, South Africa carried out a prospective study on the outcome of elective anterior spinal decompression for tuberculosis in HIV-infected patients. A total of 39 patients had anterior spinal decompression for neurological deficit. Fresh frozen allografts were used in 38 patients. Antituberculosis drugs were prescribed for 18 months but antiretroviral therapy was not used. Six patients died within two years of surgery. Neurological recovery and allograft incorporation were observed at follow-up. The immediate postoperative complications were similar to a group of HIV-negative patients with spinal tuberculosis operated on in a previous study (Govender & Parbhoo, 1999). Although the CD4/CD8 ratios were reversed, the relative lymphocytosis in most of the patients suggested early-stage disease. The six patients who died had a significantly decreased CD8 counts indicating a more advanced stage.

The investigators concluded that adequate preoperative nutritional support and compliance with antituberculosis treatment are essential in ensuring satisfactory outcome.

## **PATIENTS AND METHODS**

This is a prospective cross-sectional study that ran for 1 year in which 32 patients with TB spine were followed up for a period of 6 months. The sampling method used was Incidence Density Sampling of patients presenting with TB spine at UTH either directly through the outpatient Orthopaedic Clinic or seen on consultation by the General Surgeons and other departments within the hospital. The patients or their parents or guardians (in the case of children) entered in the study were required to sign a consent form (Appendix I). None of the HIV-positive patients was on anti-retroviral therapy (ARVs).

### **Inclusion criteria**

The presence of the following:

1. Suggestive history
2. Suggestive plain X-ray of the spine showing
  - (i) or destruction of contiguous surfaces of the affected vertebral bodies with reduction or disappearance of the disc space with/without
  - (ii) paravertebral abscess
3. Raised Erythrocyte Sedimentation Rate (ESR)
4. Presence of a gibbus/ kyphosis and criteria 1&2
5. Presence of neurological deficit and criteria 1&2

### **Exclusion criteria**

1. Doubtful plain x-ray features.
2. Any overt malignancy occurring concurrently with the TB of the spine.
3. Neurological deficits that may be explained by other aetiology other than TB of the spine.

### **Mandatory Investigations**

All patients admitted to the study had the diagnosis confirmed by:

1. History
2. Physical Examination
3. X-rays –CXR  
-Relevant part of the vertebral column (AP & lateral films)
4. FBC & ESR (Westergren)

### **Additional investigations**

1. HIV serology was done on all the patients entered into the study. The Abbott and Gene II antibody tests were used.
2. Sputum for AAFB (X3) for patients with suspected concurrent pulmonary disease.
3. Bacteriology of abscess material for those who underwent surgical decompression.

The neurological status on admission and at review was documented according to Frankel *et al* (1969) as outlined in the table below:

**Table 1: Frankel Classification of Spinal Injury**

<b>Group</b>	<b>Diagnosis</b>
<b>A</b>	Complete neurological deficit with no sensory or motor sparing distal to the lesion.
<b>B</b>	Sparing of some sensation but no motor function distal to the spinal lesion.
<b>C</b>	Sparing of sensation but no useful motor function distal to the spinal lesion.
<b>D</b>	Sparing of sensation and useful motor function distal to the spinal lesion.
<b>E</b>	Normal neurology.

### **TREATMENT REGIME**

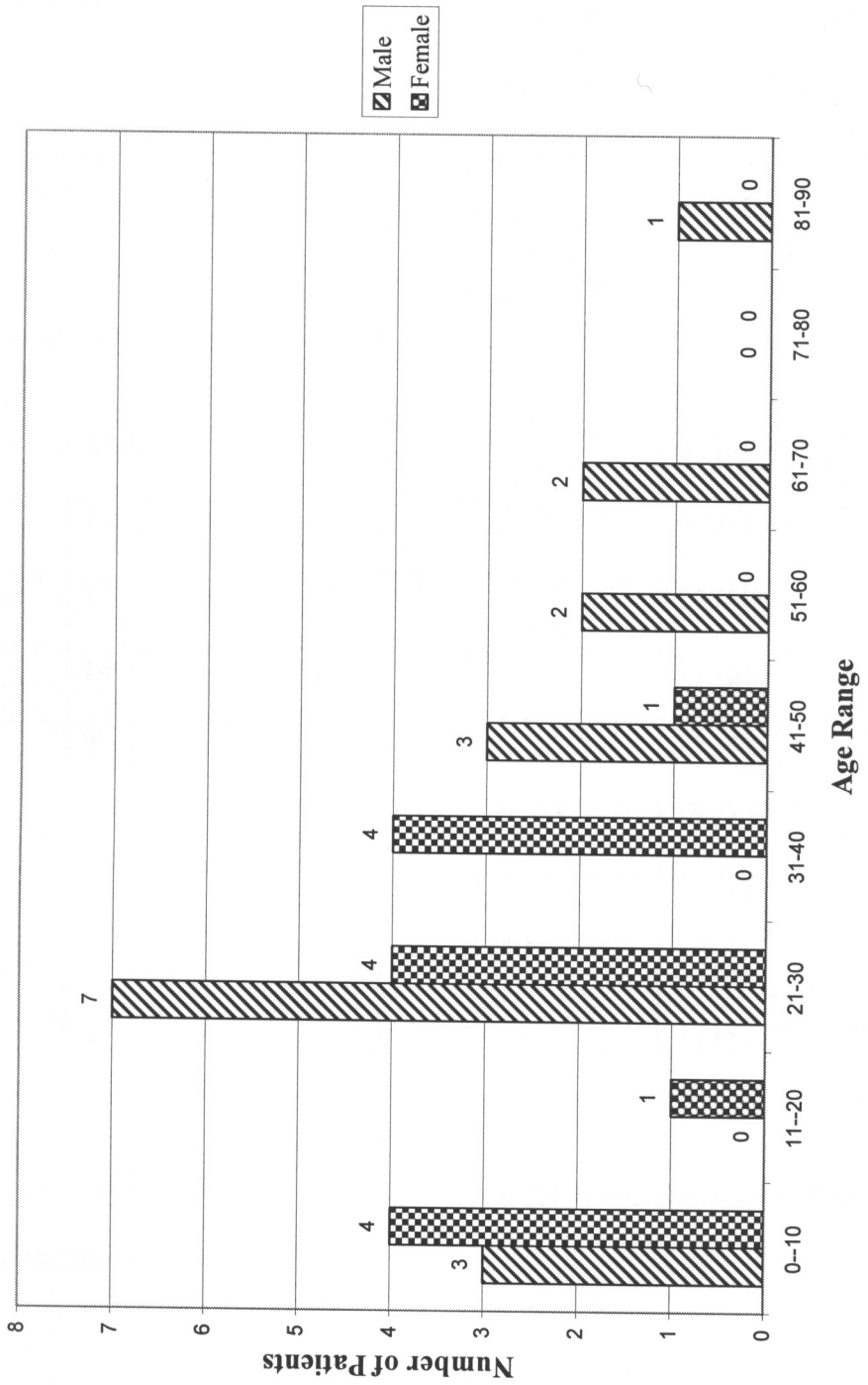
This was standard and involved;

- Initial hospitalization for 8 weeks on strict bed rest
- Protection of spinal cord by restricting activity and nursing in the prone position
- Commencement of multidrug anti-TB treatment (ATT) comprising Rifampicin (10mg/kg), Isoniazid (5mg/kg) and Pyrazinamide (25mg/kg) for all with the addition of Ethambutol (15mg/Kg) for non-pregnant/non-breastfeeding adult females and all adult males in the continuation phase. Pryridoxine was administered to all patients on Isoniazid at a dose of 10mg/day.
- Passive physiotherapy.
- Surgery (Hong Kong procedure) for those with neurological deficits of less than 2 months duration.

- Monitoring – clinical condition
  - ESR
  - X-ray
- Discharge
- Follow-up in the outpatient clinic at 1 month, 3 months and 6 months

# RESULTS

Fig. 1 Age and Sex Distribution of Patients seen with TB spine (n=32)



Age range: 2-83  
 years  
 Average age: 30.2  
 years  
 M: F = 18:14

As shown in **Figure 1**. Thirty-two patients were recruited in the study with ages ranging from 2 to 83 years. The majority of the patients were in the 21-30 year age group. There were 8 paediatric patients. The overall sex distribution was 18 male and 14 female patients

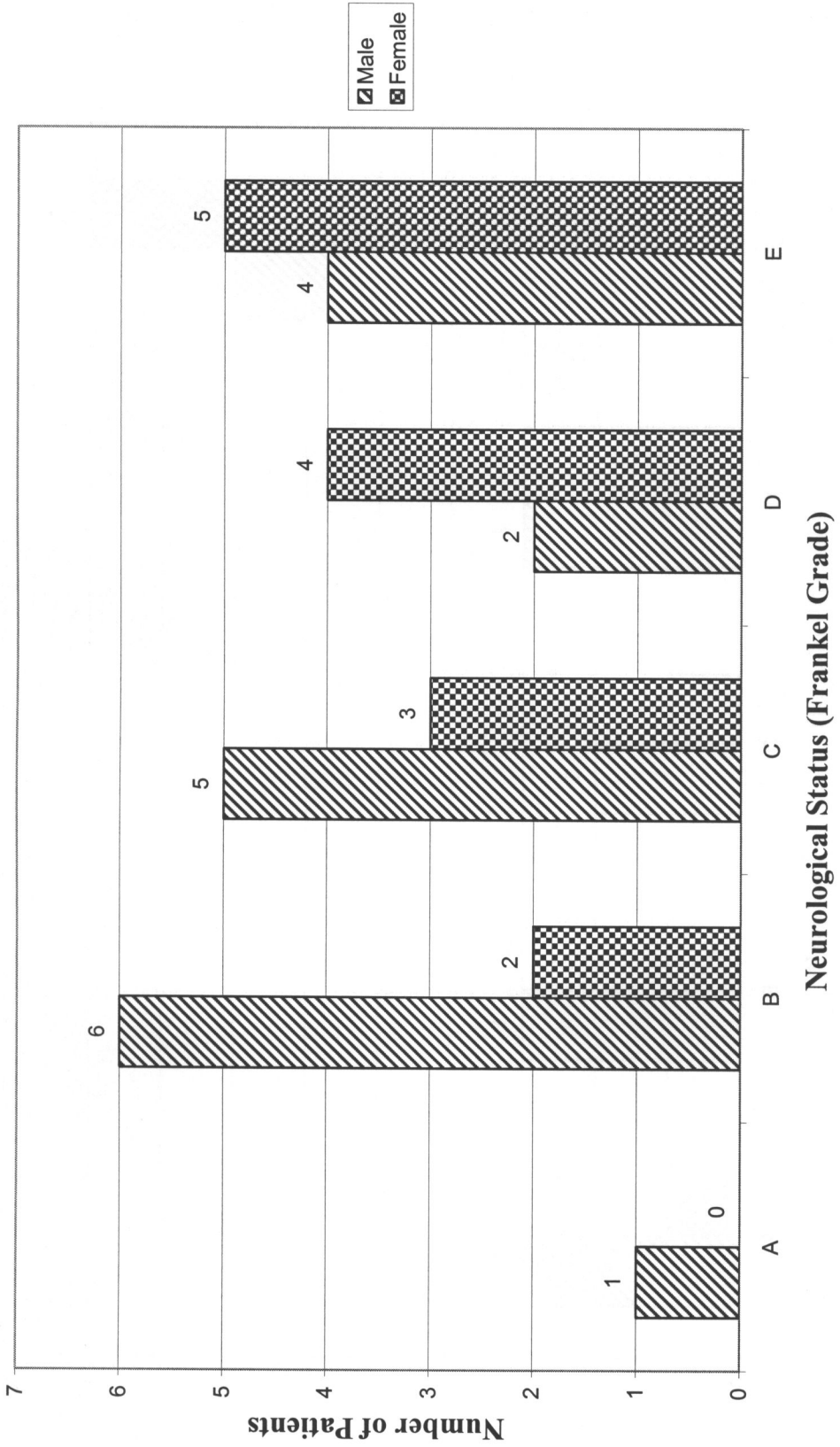
**Table 2: Symptoms at Presentation**

	<b>Male</b>	<b>Female</b>	<b>Total (%)</b>
<b>Backache</b>	16	10	26 (81)
<b>Deformity of spine</b>	12	11	22 (69)
<b>Weakness of legs</b>	14	7	21 (65)
<b>Weight loss</b>	9	8	17 (53)
<b>Fever</b>	6	7	13 (41)
<b>Night Sweats</b>	7	5	12 (38)
<b>Past History of PTB</b>	3	2	5 (15)
<b>TB contact</b>	4	3	7 (22)

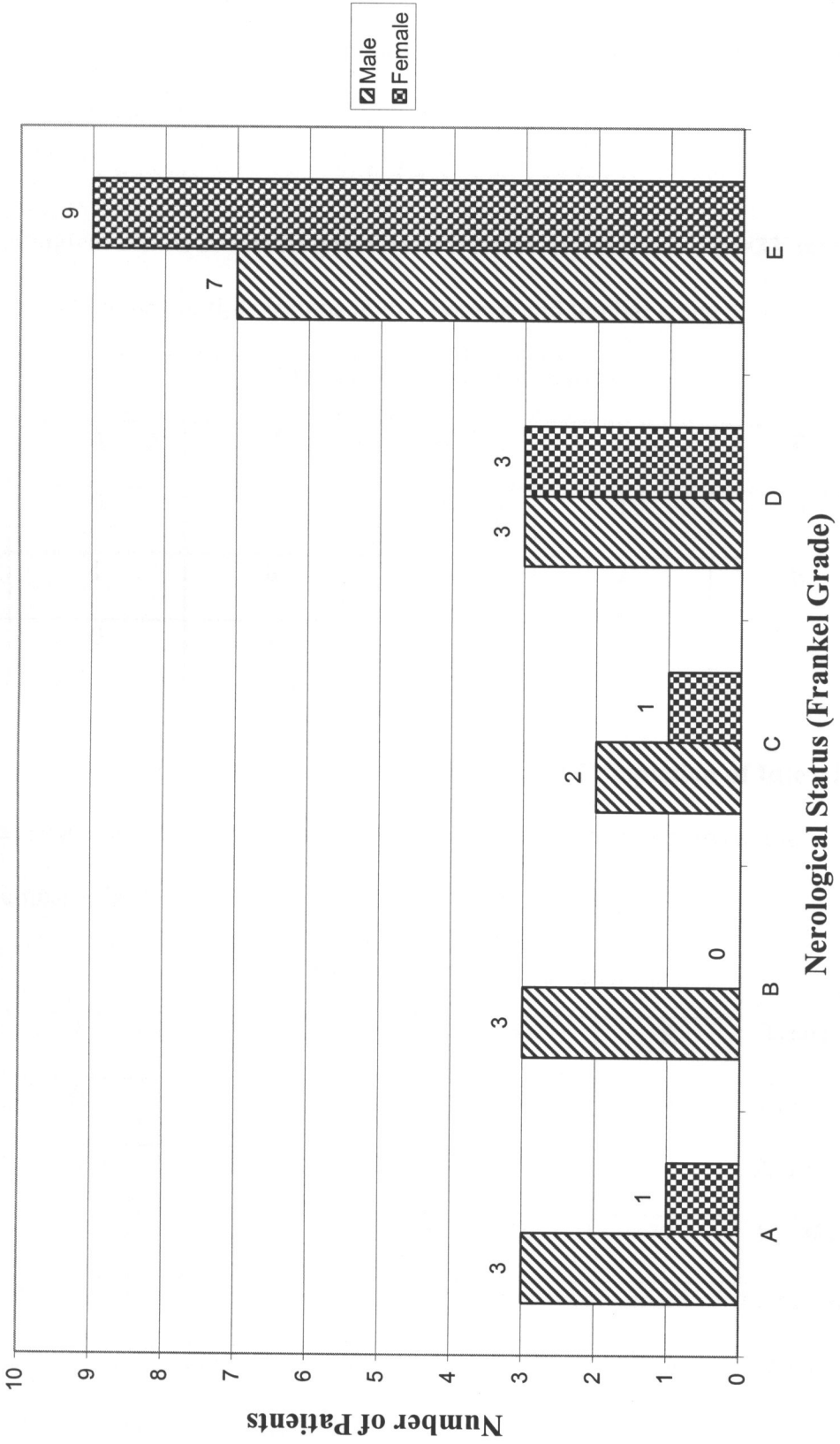
**Table 2** shows that the majority of patients presented with backache (81%), deformity of the spine (69%) and weakness of legs (65%).

At presentation according to **Figure 2**, seventeen of the patients (53%) presented with significantly impaired neurological status (Frankel Grades A-C) while 15 patients (46%) had neurological status of Frankel grades D & E.

**Fig. 2 Neurological status of Patients at Admission according to the Frankel Classification**



**Fig. 3. Neurological Status of Patients According to Frankel Classification at Completion of Intensive Phase of Chemotherapy (n=32)**



As shown in **Figure 3** at the completion of the intensive phase of anti-tuberculosis therapy there were 22 patients (68%) with mildly impaired to normal neurological status, Frankel grades D & E respectively.

**Table 3: Neurological Status According to Site of Disease at Admission (n=33, one patient had non contiguous multiple lesions in the thoracic and lumbar spines)**

Site of Disease	Frankel Grade at Admission				
	A	B	C	D	E
Cervical spine	0	0	0	1	0
Thoracic spine	1	8	5	2	6
Lumbar spine	0	1	3	3	3

**Table 4: Neurological Status According to Site of Disease at Completion of Intensive Phase of Treatment. (n=33, one patient had non contiguous multiple lesions in the thoracic and lumbar spines)**

Site of Disease	Frankel Grade					Total (%)
	A	B	C	D	E	
Cervical spine	0	0	0	1	0	1 (3)
Thoracic spine	4	3	2	4	9	22 (67)
Lumbar spine	0	0	1	2	7	10 (30)

According to **Tables 3 & 4** twenty-two patients (67%) had involvement of the thoracic spine while there was one patient (3%) with involvement of the cervical spine and 10 patients (30%) with involvement of the lumbar spine.

**Table 5: Results of the Main Haematological Tests done on the patients at admission**

Sex	Age (years)	Hb (g/dL)	WBC ( $\times 10^9/L$ )	Lymphocyte count % & Absolute count [ $\times 10^9/L$ ]	ESR (mm/hr)	HIV Status
M	2	8.7	10.2	49 (4.9)	27	+ve
M	4	10.9	11.4	53 (6.0)	63	-ve
M	7	9.1	4.2	68 (2.8)	79	-ve
M	22	12.4	5.4	54 (2.9)	30	+ve
M	23	13.1	4.2	42 (1.8)	35	-ve
M	25	11.3	5	51 (2.6)	120	+ve
M	26	16.9	4.6	43 (2.0)	54	-ve
M	26	15.6	5.4	33 (1.8)	28	-ve
M	27	15.2	5.3	46 (2.4)	50	-ve
M	28	11.2	6.1	36 (2.2)	33	+ve
M	42	10.0	5.2	53 (2.8)	121	+ve
M	44	12.1	4.8	26 (1.2)	27	-ve
M	46	10.0	6	39 (2.3)	65	+ve
M	52	14.2	7	40 (2.8)	40	-ve
M	56	10.4	7.7	34 (2.6)	52	-ve
M	66	12.5	10	60 (6.0)	70	-ve
M	67	11.9	5.6	45 (2.5)	93	-ve
M	83	12.7	9.2	52 (4.8)	103	-ve
F	3	9	8.3	55 (4.5)	80	+ve
F	5	10.3	7.1	35 (2.5)	60	-ve
F	6	9.4	8.0	52 (4.1)	104	-ve
F	8	9.7	4.2	46 (1.9)	52	-ve
F	11	11.3	4.6	37 (1.7)	65	-ve
F	22	12.6	4	46 (1.8)	98	+ve
F	23	8.6	5.2	58 (3.0)	115	+ve
F	27	11.5	5.8	42 (2.4)	37	-ve
F	30	13.7	7.8	45 (3.5)	34	+ve
F	32	12	5.2	38 (2.0)	96	-ve
F	35	10.3	8.6	56 (4.8)	62	+ve
F	35	11.2	6.3	28 (1.8)	74	-ve
F	36	12.4	3.5	48 (1.7)	47	+ve
F	48	7	5.7	37 (2.1)	100	-ve

Table 5 shows that all the eight paediatric patients (3 male and 5 female) had a haemoglobin count below the normal of 12g/dL. The group average was 9.8g/dL.

Eleven of the 15 adult male patients (73%) had a haemoglobin count lower than the normal of 14g/dL while the group average was 12.6g/dL.

Among the adult female patients four (44%) had a haemoglobin count less than the normal of 12g/dL. The average Hb for the adult female patients was 11g/dL.

The total WBC count was within normal for all the patients (normal range being 5-15 x 10<sup>9</sup>/L and 4-11 x 10<sup>9</sup>/L for paediatric and adult patients respectively). The average WBC count for the paediatric patients was 7.25 x 10<sup>9</sup>/L while for the adult patients it was 6 x 10<sup>9</sup>/L.

A total of 16 patients (6 paediatric and 10 adults) had a differential lymphocyte count higher than normal range of 20-45%. The average differential count for the paediatric patients was 49% while that of the adult patients was 43%. However a total of 30 patients (94%) had a differential count higher than the generally accepted average of 30%.

All the 32 patients had their ESR raised beyond the normal of 15mm/hr (by Westergren). Twenty-three patients (72%) had more than a three-fold rise of the ESR.

**Table 6: HIV Serological Status of the Patients (n=32)**

<b>Serological Status</b>	<b>Male</b>	<b>Female</b>	<b>Total (%)</b>
<b>HIV-negative</b>	12	8	<b>20 (62)</b>
<b>HIV-positive</b>	6	6	<b>12 (38)</b>

As shown in **Tables 5 & 6**, there were a total of twelve patients (38%) who were HIV-positive. Among the paediatric patients there were two patients (25%) who were HIV-positive while 10 (42%) were HIV-positive among the adult patients.

**Table 7: Sites involved for the HIV-positive patients (n=12, one patient had involvement at two non-contiguous sites in the mid-thoracic and lumbar regions)**

	<b>Male</b>	<b>Female</b>	<b>Total (%)</b>
<b>Thoracic spine</b>	4	3	<b>7 (54)</b>
<b>Lumbar spine</b>	3	3	<b>6 (46)</b>

Among the HIV-positive patients seven (54%) had involvement of the thoracic spine while six (46%) had involvement of the lumbar spine.

**Table 8: Neurological Status of the Patients at Admission according to Serological Status**

(n =32)

	Neurological Status					
	A	B	C	D	E	Total
<b>HIV -ve</b>	1	6	4	5	4	<b>20</b>
<b>HIV +ve</b>	0	2	4	1	5	<b>12</b>

**Table 8** shows that among the HIV-negative patients there were 11 (55%) who had significantly impaired neurological status (Frankel Grades A-C) and 9 (45%) who had mildly impaired to normal neurological status (Grades D & E) whereas in the HIV-positive patients there were six patients (50%) with significantly impaired neurological status (Frankel Grades A-C) and six patients (50%) with mildly impaired to normal neurological status (Grades D & E).

**Table 9: Neurological Status of the Patients after Completion of Intensive Phase of Chemotherapy according to Serological Status (n =32)**

	Neurological Status					
	A	B	C	D	E	Total
<b>HIV -ve</b>	4	3	1	2	10	<b>20</b>
<b>HIV +ve</b>	0	0	2	3	7	<b>12</b>

At the completion of the intensive phase of ATT as shown in **Table 9**, there were eight patients (40%) with Frankel grades A to C and 12 patients (60%) in the mildly impaired to normal neurological status category (Frankel grades D & E) among the HIV-negative patients.

Among the HIV-positive patients there were two patients (17%) with Frankel grades A to C and 10 patients (83%) with mildly impaired to normal neurological status category (Frankel grades D & E) at the completion of the intensive phase of ATT.

**Table 10: Overall Management of the Patients (n=32)**

	Male	Female	Total (%)
<b>Chemotherapy</b>	14	13	<b>27 (84)</b>
<b>Chemotherapy + Anterior Decompression + Grafting</b>	4	1	<b>5 (16)</b>

According to **Table 10** the majority of patients (84%) were managed conservatively with ATT while 5 patients (16%) underwent anterior decompression and bone grafting.

**Table 11: Reasons for Surgical Intervention (n=5)**

	Male	Female	Total
<b>Deteriorating Neurological Status</b>	2	1	<b>3</b>
<b>Lack of improvement on Chemotherapy</b>	2	-	<b>2</b>

**Table 11** shows that deteriorating neurological status (three patients) and lack of improvement on ATT (two patients) were the reasons for surgical intervention.

**Table 12: Details for the Patients who underwent Surgical Management (n = 5)**

Sex	Age (years)	Site Involved	Frankel Grade at Operation	Pre-op Kyphosis	Post-op Kyphosis	Histology Results	Outcome
M	52	T9-T10	A	35°	21°	Confirmed TB	Improved to D
M	26	T6-T7	B	46°	24°	Confirmed TB	Improved to D
M	27	T8-T9	B	27°	15°	Chronic Inflammatory Process	Improved to C
F	11	T5-T6	A	52°	30°	Confirmed TB	Improved to D
M	23	T8-T9	A	42°	Not done	Confirmed TB	Died (1 day post-op)

According to **Table 12** all the patients who had anterior decompression and bone grafting had involvement of the thoracic spine. The pre-operative kyphosis for four of the patients (excluding the mortality) range from 27° to 52° with a mean of 40° and post-operatively this improved to a range of 15° to 30° with a mean of 22.5°.

Four of the five patients had TB confirmed on histology of the biopsy material taken during the operation.

## DISCUSSION

### Age and Sex Distribution

A total of 32 patients were recruited in the study (**Fig. 1**). Of these 18 (56%) were male and 14 (44%) were female with an average age of 30.2 years (range was from 2 to 83 years). Eight of the patients (25%) were children while the rest were adults. The highest peak was in the 21-30 years age group. This is in agreement with observations from studies done in other developing countries concerning the incidence skeletal tuberculosis being higher in children, adolescents and young adults averaging 30% (Thamburaj, 2002). In the developed world however TB of the spine is mainly a disease of the elderly (Weaver and Lifeso, 1984).

### Symptoms

The commonest presenting complaint was back pain in 26 (81%) of patients (**Table 2**). This is in agreement with findings in other studies (Jellis 2002, Thamburaj 2002, Meddeb et al. 2002, Rasit, Razak & Ting, 2001, Gunja 1997) in which back pain was present in a majority of patients with an average of seventy percent. The pain in TB spine is consequent to the bone destruction that takes place (Nachimuthu *et al* 2000).

Deformity of the spine was present in 22 (69%) of patients. Weaver and Lifeso (1984) observed that the late destructive changes that are characteristically seen in children only develop late in older patients. Consequently, it seems prudent to recommend that young adult patients who present with back pain should be investigated thoroughly for possible early TB of the spine.

Weakness of the legs was a presenting feature in two-thirds of the patients (66%). To most patients this seemed to portend a serious illness and was the reason for most of them seeking medical attention. Constitutional symptoms of weight loss, fever and night sweats were seen in 17 (53%), 13 (41%) and 12 (38%) of patients. Similar observations were made by Jellis 2002 who stated that constitutional symptoms may be present for weeks or months before medical advice is sought.

Only 5 patients (15%) gave a past history of pulmonary TB while a positive history of TB contact was elicited in only 22% of patients.

### **Site of Involvement**

According to **Table 3** and **Table 4** one patient (3%) had a cervical lesion, 22 patients (67%) had thoracic lesions and 10 patients (30%) had lumbar lesions. One patient who was HIV-positive had non-contiguous lesions at two sites one in the mid-thoracic region and the other at L3. Categorizing the patients according to site involvement into those who were HIV positive (**Table 6**) and those who are HIV-negative, showed the affection of the thoracic and lumbar spine to be 54% and 46% respectively in the HIV-positive and 5% (1 out of 20) for the cervical spine, 75% (15 out of 20) for the thoracic spine and 20% (4 out of 20) for the lumbar spine in the HIV-negative patients. The reasons proffered for a higher rate of involvement of the thoracic spine are diverse and include the close proximity of the thoracic spine to the lungs and mediastinum making haematogenous spread easier coupled with the presence of valveless veins (of Bateson) which make spread more efficient.

The results in this study also agree with the observation by Jellis (2002) that in HIV-positive patients lumbar involvement is relatively more common.

### **Haematological Results**

All the eight paediatric patients had a haemoglobin count below the normal of 12g/dL with a group average was 9.8g/dL (**Table 5**). Eleven of the 15 adult male patients (73%) had a haemoglobin count lower than normal while the group average was 12.6g/dL whereas among the adult female patients four (44%) had a haemoglobin count less than the normal of 12g/dL. The average Hb for the adult female patients was 11g/dL. Anaemia in Tb of spine is caused by a number of factors among which are the chronicity of the infection, poor nutritional status resulting from a low socioeconomic status or as a result of loss of appetite and the presence of other concurrent infections or infestations

A total of 16 patients (6 paediatric and 10 adults) had a differential lymphocyte count higher than normal range of 20-45%. The average differential count for the paediatric patients was 49% while that of the adult patients was 43%. However a total of 30 patients (94%) had a differential count higher than the generally accepted average of 30%.

All the 32 patients had their ESR raised beyond the normal of 15mm/hr (by Westergren). Twenty-three patients (72%) had more than a three-fold rise of the ESR.

According to Jellis (2000) classically the diagnosis of spinal tuberculosis was made from history, clinical examination and haematological investigations (a relative lymphocytosis and high ESR) combined with a radiological appearance of the spinal lesion. Watts & Lifeso (1996) however warn that the ESR is neither specific nor completely reliable as most chronic inflammatory rise will lead to a rise in the ESR.

### **Neurological Status**

As shown in **Fig. 2**. 17 patients (53%) presented with marked neurological deficit (Frankel grades A B & C) while 15 patients (47%) presented with almost normal neurological status (D & E). This implies that the majority of patients seen at UTH present late when neurological complications are established. This results from the patients seeking medical care in other institutions for a long time before they are referred for specialist treatment. Most of the patients would have been on treatment for backache usually with non-steroidal anti-inflammatory drugs (NSAIDs) before being referred. Those that seek medical advice on their own at UTH are prompted to do so when paresis or paralysis has set in because this portends an ominous sign signifying a serious illness.

### **Outcome of Treatment**

With the institution of conservative management at admission (for 2 months), comprising strict bed rest nursing in the prone position, relatively better diet and anti-tuberculosis chemotherapy patients recover well. By the end of this intensive phase of treatment most the patients would have sufficiently recovered to allow their discharge on outpatient treatment. **Fig. 3**. shows that at the end of this period the distribution had

changed to only 10 (31%) with marked neurological deficit and 22 (69%) with almost normal neurology. However 3 patients (9%) deteriorated from Frankel grade B to A while 4 (13%) remained static with one patient at grade A and 3 patients at grade B. The patient who remained static at grade A was a 66-year old man who developed severe decubitus ulcers and died 6 months after commencement of anti-tuberculosis treatment from pneumonia and sepsis. The 3 patients who deteriorated from Frankel B to A (2 male and 1 female) underwent surgical decompression using the Hong Kong operation and subsequently fully recovered. Of the 3 patients who remained static at Frankel B, 2 underwent anterior decompression while the third patient who was HIV-positive was maintained on conservative treatment. One of the 2 patient who underwent decompression recovered fully 5 months postoperatively while the other one died from indeterminate causes a day postoperatively after being extubated. He however exhibited signs of respiratory embarrassment prior to death. A postmortem could not be carried out as relatives refused consent.

The HIV-positive patient who remained static at Frankel B improved to Frankel D eight months after commencement of treatment.

These findings are similar with those of Lifeso (1985) who reported that chemotherapy alone produced good results even in patients with neurological problems. However controversy concerning surgical and non-surgical treatment of TB spine rages on with some authors (Vidyasagar & Murthy, 1994) advocating that while it is of no major concern if patients with tuberculous lesions undergo a delayed operation conservative

treatment is unwise in patients who have spinal cord compression and who do not have obvious extraspinal tuberculosis. Othman *et al.* (2001) take a moderate approach and advise that treatment of TB spine using surgical and non-surgical treatment gives favourable results. However, surgical treatment is superior in relieving pain, allowing early ambulation, less deformity and early recovery from neurological deficit.

### **Surgical Treatment**

Five patients (16%) had surgical treatment for TB spine (**Table 11**). The indications for surgery were deterioration of neurological status and complete lack of improvement on conservative treatment. These are among the indications proposed by Ho and Leong (1994) and MRC (1978, 1974a). The outcome of surgery was that three patients went on to complete recovery; one patient stagnated at Frankel C for 5 months (up to the time of analyzing the data) and one patient died. Paradoxically the patient who stagnated at Frankel C had a histology result that showed 'chronic inflammatory reaction' in which Tuberculosis was not confirmed (**Table 12**). The lack of improvement in this HIV-negative patient in the light of the histology report could be that he had some other spinal pathology like brucellosis, eosinophilic granuloma, staphylococcal and salmonella osteomyelitis, discitis, tumour deposit and trauma (Jellis, 2000). Trauma was however ruled out on the basis of the history while the physical examination did not reveal any possible site of a tumour.

The positive histology result of 4 out of 5 specimens (80%) seems to conform to the findings of Shanthly *et al.* (1999) in which of twenty specimens obtained from patients diagnosed at TB of the spine only 16 (80%) yielded positive biopsy findings.

Although no deliberate attempt was made to reduce the kyphosis during the operation, surgery improved the mean kyphosis from 40° (range 27°-52°) to 22.5° (range 15°-30°). Surgery seems to partially correct the kyphosis in TB spine. This is because the tricortical graft acts as a strut that partially straightens the angulated spine at the site of vertebral collapse.

### **TB spine and HIV status**

**Tables 5 and 6** show that there were a total of 12 patients (38%) who were HIV-positive. Among the paediatric patients there were two patients (25%) who were HIV-positive while 10 (42%) were HIV-positive among the adult patients. Jellis (2000) found rates of 66% and 16% in adults and children respectively. The findings correlate in that the rate is higher in adult patients as compared to children although the small number of patients in this study could explain the difference in numbers.

According to **Tables 8 and 9** eleven (55%) of the HIV-negative patients had a markedly impaired neurological status (Frankel grades A, B & C) at the onset of treatment while six (50%) of the HIV-positive patients fell in the same category. On treatment the number of HIV-negative patients with marked neurological deficit reduced to eight (40%) while in the HIV-positive group the number reduced to two (16.7%). The HIV-positive patients responded normally to treatment. The drawback however was the inability to do CD4 counts in order to determine the stage of the disease. Jellis (2002b) and Leibert *et al* (1996) did not notice any difference with regard to response to treatment

of TB spine by HIV-positive and HIV-negative patients on conservative treatment although Jellis (2002a) reports that there seems to be a higher incidence of recurrence in the HIV-positive patients.

## CONCLUSIONS

1. The age for the patients with TB of the spine was from 2 to 83 years with an average age of 30.2 years. Of these 18 (56%) were male and 14 (44%) were female. The highest peak was in the 21-30 years age group. A quarter of the patients were children while the rest were adults.
2. Most of the patients with TB of the spine at UTH present late after neurological deficit has set in. Back pain, deformity of the spine and weakness of the legs are the main presenting symptoms. Low haemoglobin count, relative lymphocytosis and raised ESR are common haematological features.
3. The thoracic spine is the most commonly affected site in both HIV-negative and HIV-positive patients.
4. There is a relatively higher rate of involvement of the lumbar spine in the HIV-positive patients
5. Both HIV-negative and HIV-positive patients respond well to conservative management of TB spine although some eventually need surgical debridement with the indications for surgical treatment being deterioration of neurological status on conservative management and stagnation of neurological status. Surgical treatment partially corrects the angular kyphosis.

6. The criteria for diagnosing TB spine are approximately 80% accurate based on the histology confirmation.

## RECOMMENDATIONS

1. All children, adolescent and young adult patients presenting with back pain should have a detailed history, physical examination and investigations that should include plain radiographs of the affected part of the spine, FBC and ESR, and closely followed up in order to diagnose TB of the spine early.
2. The diagnostic criteria used in this study could be adopted for the diagnosis of TB of the spine as they have been shown to be at least 80% accurate .
3. Patients who present with TB spine at UTH and fail to respond to conservative management should be considered for CT or fluoroscopy guided biopsy of the lesions to rule out other pathological processes which TB of the spine can mimic such as tumour deposits, trauma, staphylococcal and salmonella osteomyelitis, brucellosis and discitis especially if surgery is not immediately possible.
4. Conservative treatment should continue to be the mainstay of treating TB of the spine and surgical management only resorted to when and as indications arise because the majority of patients (84%) respond to conservative management..
5. The treatment regime currently being used by the orthopaedic units at UTH of rifampicin, isoniazide, ethambutol and pyrazinamide in the intensive phase (first 2 months of treatment) and only rifampicin and isoniazide in the continuation phase

(subsequent 6 months or more depending on response) should continue to be used as it seems to be effective if complied with.

6. There should be proper notification of patients with TB of the spine and accurate documentation with regard to site and neurological status by specialists following up the patients and their response to treatment so as to generate a National database.
7. The existing diagnostic facilities at UTH should be improved and new ones such as immunological studies and MRI introduced so as to enhance accuracy of diagnosis.
8. There is need to have another study on the larger scale which will determine the stage of disease using CD4 counts (and viral loads if possible) in the HIV-positive patients and how they respond to surgical management.

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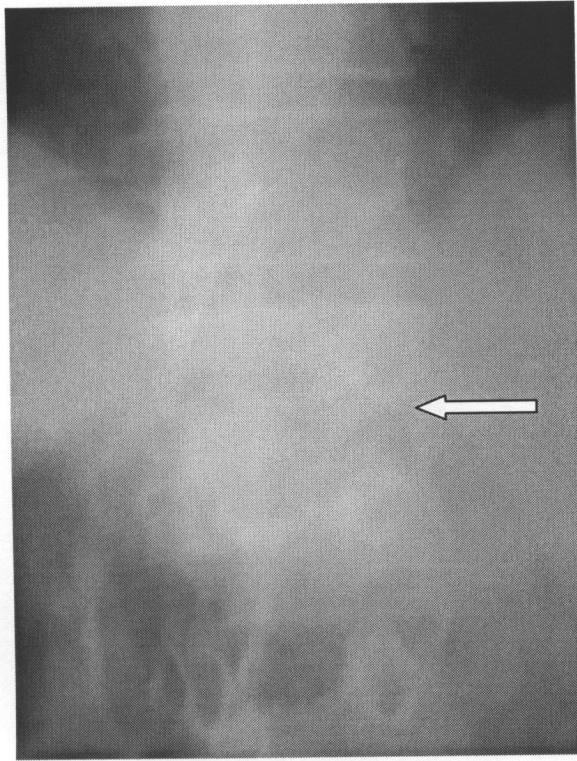
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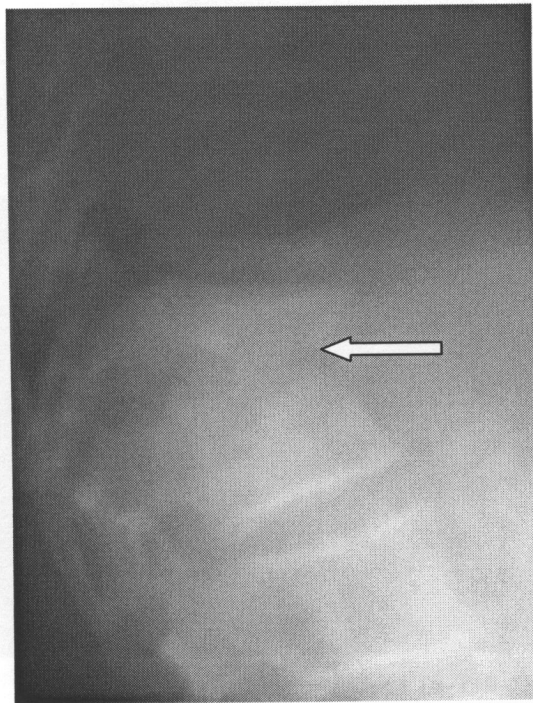
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**APPENDIX I**



**Radiograph 1. AP view of lesion at T12-L1**



**Radiograph 2. Lateral view of Lesion at T12-L1**

**APPENDIX II**



**Photograph showing gibbus at T8-T10**

## APPENDIX III

### INFORMED CONSENT FORM

I \_\_\_\_\_ of \_\_\_\_\_ give my consent  
(Surname) (First name) (Residential Address)

for the participation of \_\_\_\_\_ who is related to me as  
\* (Surname) (First name)

\_\_\_\_\_ in ) the study entitled: *TB of the Spine: Presentation*  
\*\*(Relationship)

*Management and Factors Influencing Outcome at the UTH, Lusaka, Zambia.*

I have been informed that the principal investigator is *Dr J C Munthali of the Dept. of Surgery at UTH, Lusaka, Zambia.*

#### **Objectives of the study**

The main objectives of the study have been explained to me as follows:

1. To determine the age and sex distribution of TB of the spine
2. To determine the clinical presentation of TB of the spine with regard to symptoms and signs
3. To evaluate the frequency of involvement of the various parts of the vertebral column.
4. To evaluate the clinical response of patients to the standard treatment method.
5. To determine any correlation between TB of the spine and HIV status
6. To determine the correlation between HIV serological status and response to treatment.

*I am satisfied/not satisfied with the explanation.*

#### **Blood investigations**

It has been explained to me that I will need to give blood samples, which will be drawn through puncture of any vein in my body that will be deemed suitable for the purpose.

The samples drawn shall be used for the following tests:

1. Full Blood Count
2. Erythrocyte Sedimentation Rate
3. HIV serology, CD4 count and viral load

*I agree/do not agree to these investigations.*

#### **Sputum investigations**

It has also been explained to me that I will need to provide three specimens of sputum on 3 consecutive days to be tested for pulmonary TB and I agree to do so.

### **Radiological investigations**

It has been explained to me that I will need to have the following radiological investigations:

1. Chest X-ray
2. Two X-ray views of the diseased part of my spine; a lateral and an anteroposterior view.
3. Should these investigations not be informative enough to provide a diagnosis I may have to be subjected to a bone scan which has been explained to me as an investigation in which radioactive dye is injected in any of my veins and serial X-rays taken of various parts of my body.

*I agree/do not agree to these investigations.*

### **Possible risks**

The possible risks have been explained to me as:

1. Possible adverse reaction to the drugs on the treatment regime as may be the case in some individuals.
2. Possible adverse reaction to the isotope that may be injected into my veins should a bone scan be deemed necessary.
3. Possible failure to improve or even possible deterioration of my condition.

### **Possible benefits**

The benefits have been explained to me as:

1. Close follow-up and appropriate rational intervention whenever necessary.
2. Contribution to the body of knowledge on TB of the spine.

### **My rights in the study**

It has been explained to me that the information obtained from me and the results obtained from the investigations conducted on me for this study shall remain strictly confidential and that participation in this study will not attract any additional expenses on my part.

I have also been informed that should I decide to withdraw from the study I shall be allowed to do so without forfeiting my right to optimal care for the condition with which I have been diagnosed.

I understand that I may not derive therapeutic treatment from participation in this study.

\_\_\_\_\_  
*Signature (or thumb print) of Patient/Parent/Guardian*

\_\_\_\_\_  
*Date*

\_\_\_\_\_  
*Signature of Principal Investigator/Representative*

\_\_\_\_\_  
*Date*

\_\_\_\_\_  
*Signature of Witness*

\_\_\_\_\_  
*Date*

\* To write 'myself' if the patient is the one giving consent

\*\* The relationship of the patient to the one giving consent



**TREATMENT**

(DRUG, DOSE, DATE OF COMMENCEMENT)

INH: ..... RIFAMPICIN: .....

PYRAZINAMIDE: ..... ETHAMBUTOL: .....

ADVERSE REACTIONS: YES/NO DATE : ..... TYPE:.....

SURGERY (DATE) ..... TYPE OF OPERATION:.....

INDICATION:.....

FINDINGS:.....

RECOVERY PERIOD (COMPLICATIONS):.....

NEUROLOGICAL RECOVERY (DATES AND FRANKEL GRADES).....

DATE OF DISCHARGE FROM WARD: .....

DATE OF DEATH: ..... CAUSE:.....

**TB DIAGNOSIS:**

CLINICAL & X-RAY: ..... BONE SCAN: ..... HISTOLOGY:.....

CULTURE: .....

## APPENDIX V

### NEUROLOGICAL ASSESSMENT CHART

NAME: \_\_\_\_\_

AGE/SEX: \_\_\_\_\_

FILE NO.: \_\_\_\_\_

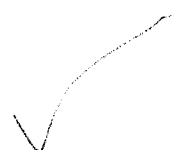
D.O.A.: \_\_\_\_\_

DIAGNOSIS: \_\_\_\_\_

<b>1. MUSCLE POWER</b>													
DATE OF ASSESSMENT													
LIMB		R	L	R	L	R	L	R	L	R	L	R	L
HIP	FLEXORS												
	EXTENSORS												
	ABDUCTORS												
	ADDUCTORS												
KNEE	FLEXORS												
	EXTENSORS												
ANKLE	PLANTARFLEXORS												
	DORSIFLEXORS												
	INVERTORS												
	EVERTORS												
I.P JOINTS	FLEX. HALLUCIS LONG.												
	FLEX. DIGIT. LONG.												
	EXT. HALLUCIS LONG.												
	EXT. DIGIT. LONG.												
<b>2. SENSATION</b>													
TOUCH													
PAIN													
PROPRIOCEPTION													
TEMPERATURE													
VIBRATION													
<b>3. REFLEXES</b>													
KNEE													
ANKLE													
<b>4. BOWEL &amp; BLADDER CONTROL</b>													
BOWEL													
BLADDER													

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**APPENDIX VI**

**FOLLOW-UP**

DURATION SINCE DISCHARGE FROM WARD:.....

DATE: ..... WT: ..... KG

CURRENT DRUG REGIME:.....  
.....  
.....

TAKING DRUGS: YES/NO.....

ACTIVITY STATUS: 0 / 1/ 2 / 3 / 4 /

SYMPTOMS.....  
.....  
.....

**RADIOGRAPHS**

ISQ: .....SPREADING: ..... HEALING: .....

VERTEBRAE NOW INVOLVED: ..... KYPHUS ANGLE: .....

**INVESTIGATIONS**

HB: ..... WBC: ..... LYMPH: .....

NEUT: ..... EOS: ..... MON: .....

BAS:..... ESR: ..... PLT: .....

MCV:..... MCH:.....

CD4: ..... VIRAL LOAD:.....

CXR: .....

AAFB:.....

X-RAY SPINE: AREAS AFFECTED (STATE VERTEBRA/E):  
.....

BONE SCAN: AREAS AFFECTED (STATE VERTEBRA/E): .....

**ASSESSMENT**

TB SPINE: ISQ: .....SPREADING: .....DETERIORATING:.....

RETROVIRAL STATUS: ISQ: .....IMPROVING:.....DETERIORATING:.....