

**POTT'S SPINE : A PROSPECTIVE STUDY (2003 –  
2007) OF ANALYSIS OF TREATMENT AND  
OUTCOME OF  
40 PATIENTS**

*Dissertation*

*Submitted in partial fulfillment of the degree of*

***M.Ch. (NEUROSURGERY)***

*Branch II five-years course examination of*

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**DEPARTMENT OF NEUROSURGERY  
STANLEY MEDICAL COLLEGE  
TAMILNADU DR.M.G.R. MEDICAL  
UNIVERSITY. CHENNAI.**

**AUGUST 2007**

## **CERTIFICATE**

This is to certify that this dissertation titled **“POTT’S SPINE – A PROSPECTIVE STUDY (2003 – 2007) OF ANALYSIS OF TREATMENT AND OUTCOME OF 40 PATIENTS** By **Dr. V. SARAVANAN.** in partial fulfillment of the requirements for **M.Ch. Branch – II (Neurosurgery)** Examination of the Tamilnadu Dr. M.G.R. Medical University to be held in AUGUST 2007. The period of study was from August 2003 to March 2007.

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## DECLARATION

I, **Dr. V. SARAVANAN** solemnly declare that this dissertation titled, “ **POTT’S SPINE : A PROSPECTIVE STUDY OF ANALYSIS OF TREATMENT AND OUTCOME OF 40 PATIENTS**” is a bonafide work done by me at Govt. Stanley Medical College & Hospital during August 2003 to March 2007 under the guidance and supervision of my Chief **Prof. K. DEIVEEGAN, M.S., M.Ch. (Neuro)** Professor and Head of the Department of Neurosurgery.

The dissertation is submitted to Tamilnadu, Dr. M.G.R. Medical University, towards partial fulfillment of requirement for the award of **M.Ch. Degree (Branch – II) in Neurosurgery five years course.**

Place : Chennai.

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Date: :

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## AIM OF THE STUDY

To analyse the symptoms and signs, the neurological status at presentation, radiological and intraoperative findings, and treatment outcome both conservative and surgical in the management of Pott's spine.

To compare the results of the study with related works available in the literature.

## INTRODUCTION

Spinal tuberculosis is common in the developing countries and also seen sporadically in the developed countries. Of late, the incidence is on the increase, world over, with the emergence of AIDS. About 60% of cases are below the age of 20 years in developing countries.

In developed countries the older people are more commonly affected, and about 20% of the patients have multiple lesions.

In countries like Asia and Africa where the incidence is so great, that in many places, facilities are inadequate for the treatment of the case load.

Despite improved diagnostic procedures, it is sometimes difficult to isolate the organism, and hence, to make a diagnosis. It may be necessary to approach the lesion directly, to perform a biopsy and take pus for culture and guinea pig inoculation, in order to make or confirm the diagnosis. Koch's postulate still holds good. The earlier the diagnosis is made, the better the prognosis.

Adequate treatment is most important, as inadequate treatment leads to deformity and limb weakness, both of which have a

grave prognosis and lower life expectancy and poor quality of life.

#### INCIDENCE OF SPINAL TB IN INDIA:

Indian Council of Medical Research states that the current status of incidence of Tuberculosis is about 2 million cases every year. Pulmonary TB accounts for 85 percent and Extra pulmonary TB - 15percent. One to three percent of total TB patients have Bone & Joint tuberculosis. Spinal tuberculosis incidence is 50% of bone and joint TB i.e.,20,000 cases per year

Out of 20,000 cases of Spinal TB, 15% of patients (3000) present with neurological deficit and 85 % (17000) present without neurological deficit. ICMR study projects the workdays lost as 1.5 million days for TB spine and .5 million days for Pott's paraplegia. In Pott's paraplegia mean days to become ambulant is 185 days and mean days of hospitalization is 107days which is of great economic concern for a developing country like India.

#### PATHOGENESIS:

Tuberculosis of the spine is always secondary to an active primary focus elsewhere in the body. This fact dictated that the

patient must be examined as a whole and treated as a whole, and not only as a “case of spinal tuberculosis”

Tubercle bacillus that causes skeletal tuberculosis is by the human strain. The bovine type is probably responsible for less than 5%. Isolated cases due to atypical Mycobacteria are also seen. Key et al considered that tubercle bacillus spreads from the lung to the spine by way of the arterial blood supply exactly as the staphylococcus may spread to give rise to osteomyelitis.

Wilkinson (1) has postulated that the para-vertebral plexus of veins described by Batson may serve as a pathway of spread to the spine. It has been proved that infection to the spine by of Batson’s venous plexus, accounts for 10% and is usually from a focus in the kidney.

#### TYPES OF VERTEBRAL INVOLVEMENT:

1.PARADISCAL TYPE: Para discal(2) lesion begin in the metaphysis erode the cartilage and destroys the disc, resulting in narrowing of the space.

2.CENTRAL TYPE: Central type begins in the midsection of the body which get softened and yields under gravity and muscle action leading to compression, collapse and bony deformity.

3.ANTERIOR TYPE: Anterior lesions lead to cortical bone destruction beneath the anterior longitudinal ligament. Spread of the infection is in the subperiosteal and sub-ligamentous planes resulting in the loss of periosteal blood supply to the body with resultant collapse. Other factors such as periarteritis and endarteritis contributes to the collapses.

4.APPENDICLE TYPE: In appendicle type, 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.

Tuberculous spondylitis commonly occurs in the thoracic, followed by lumbar and cervical spines which more often occurs in the pediatric group.

#### BACTERIOLOGY:

Mycobacterium tuberculosis was discovered by Robert Koch in 1882. The salient features of Mycobacterium tuberculosis human type are as follows;

CHARACTERISTICS: It is rod-shaped , 1-2 microns long and 0.2 to 0.8 micron in diameter, straight or curved in shape with rounded ends arranged singly or in small clumps. It is non-motile, non sporing and non-encapsulated. It is stained by acid fast and gram-positive methods.

**STRUCTURE:** It is indistinguishable from bovine type but distinguishable from avian, cold- blooded and saprophytic types. There are three phage types. The G-C content of its DNA is 64.6%

**METABOLISM:** It grows in an optimum pH of 6.4 to 7.4 and optimum temperature of 37 centigrade in aerated medium with 5% carbon-di oxide.

**CULTURE MEDIA :** Commonly used Lowenstein-Jensen medium. Medium preferred nowadays is selective Kirchner (3) medium with the following formula:

Na <sub>2</sub> HPO <sub>4</sub> .12H <sub>2</sub> O	19G
KH <sub>2</sub> PO <sub>4</sub>	2G
MgSO <sub>4</sub> .7H <sub>2</sub> O	0.6G
NA <sub>3</sub> C <sub>6</sub> H <sub>5</sub> O <sub>7</sub> .2H <sub>2</sub> O	2.5G
L- ASPARAGINE	5G
GLYCEROL	20ML
O.4% PHENOL RED	3ML
DISTILLED WATER	TO 1 LITRE
PH 6.9 – 7.9	

Kirchner media were selective by the addition of polymyxin B200 units/ml carbenicillin 100mg/l trimethoprim 10mg/l and amphotericin B10mg/l All media were dispensed in wide-

mouthed, screw-capped (universal) 28ml bottles, the slopes in 5 ml and the Kirchner liquid medium in 10ml amounts.

**CULTURE:** Mycobacterium tuberculosis is grown in culture within 5-7 weeks. Cultures were identified as M tuberculosis by examining Ziehl- Neelson stained bacilli for acid fastness and testing for niacin production. Sensitivity tests by standard MRC methods were then set up to isoniazid, streptomycin and rifampicin.

**RESISTANCE:** It lives for 4 to 8 weeks in cultures. It is killed by moist heat at 60\* C in twenty minutes. The bacilli in dried sputum die in a few days. They are susceptible to sunlight and ultra violet light.

**PATHOLOGY OF SPINAL TUBERCULOSIS:** Spinal tuberculosis is a granulomatous disease. Marked exudative reaction(4) is a common feature of spinal tuberculosis. A cold abscess mostly comprised of serum, lymphocytes, caseous material, bone debris and bacilli, penetrates the ligaments and migrates along the facial planes often presenting far from the site of infection.

**MICROSCOPIC APPEARANCE:** Microscopically, there is central coagulative necrosis surrounded by epitheloid cells, Langhans giants cell and an admixture of lymphocytes and

plasma cells. There may be satellite lesions and perivascular infiltrations.

**CHEMOTHERAPY RESPONSE:** Debaumont<sup>(5)</sup> in 1966 showed that the total bacterial population of an infected may amount to less than one million organisms, where a positive sputum may produce up to 300,000 bacilli in 1 ml. Very few bacilli are recovered from the pus aspirated from psoas abscesses and very uncommon to find *M. tuberculosis* in the discharge from a sinus. Hence the incidence of the development of drug-resistant mutants in spinal disease is lower than in pulmonary tuberculosis as pointed by Canetti and Grosset which in turn is likely to make the spinal infection particularly responsive to chemotherapy.

**LOCAL SYMPTOMS AND SIGNS:**

**PAIN:** Back pain is a prominent (70%) feature with stiff spine and para-vertebral muscle spasm. Local pain is aggravated by activity even by coughing and straining, and relieved by rest. Referred pain may take various forms: it may radiate around the body as girdle pain or it may simulate occipital neuralgia, or manifest as sciatic pain. The usual cause is constriction of the nerve root in the scar tissue, eventual spontaneous resolution is the rule.

**RIGIDITY:** Rigidity of the spine associated with protective reflex contracture of the paraspinal muscles is a characteristic sign of tuberculosis of the spine. It is best seen in thoracolumbar disease. To demonstrate rigidity the patient is asked to pick up an object from the floor and he is seen to keep the spine straight, bending at knees and hips.

**POTT'S PARAPLEGIA:** This may be the first and only sign. The patient may complain of weakness of the limbs, the gait is incoordinate, stumbling and tripping may be observed. The cord may be involved in any phase, the active phase within the first 2 years (early onset paraplegia) or in later years after the disease has become quiescent( late onset paraplegia).

Motor functions are almost always affected before and to a greater extent than the sensory functions because the diseased area in the spine lies anterior to the cord thus being nearer to the cortico-spinal tract and anterior spinal artery.

Rapidity of involvement of the cord passes through the following stages: spastic motor paraparesis, spastic paraplegia in extension and paraplegia in flexion.

Sudden complete paralysis like the clinical picture of "spinal shock" may be caused by ischemia of the cord due to thrombo-embolic phenomenon or transection of the cord due

to pathologic dislocation or extremely rarely due to rapid accumulation of infected material.

The essential pathology of paraplegia associated with tuberculosis of the vertebrae in majority of the cases is pressure on the tissues of the cord, as follows: 1. inflammatory edema 2. Extra dural mass 3. Bony disorders 4. Meningeal changes (peridural fibrosis) 5. Infarction of spinal cord.

**GAIT:** In cases without paraplegia, the gait is changed. Short steps are taken and the knees and hips are kept flexed to avoid any jarring to the spine.

**ABSCESS FORMATION:** The appearance of a cold abscess may be the first sign. It is cold and painless, readily fluctuates, and is not tender on palpation. These abscesses migrate and gravitate.

#### **PHYSICAL SIGNS:**

**FACIAL EXPRESSION:** The patient may have an expression of anxiety and apprehension.

**KYPHOSIS:** This deformity is anterior angulation of the spine in an antero-posterior plane. It is a result of collapse, anteriorly of one or more vertebral bodies. It is most marked in the thoracic spine and much less evident in the lumbar and cervical spine.

**LATERAL DEVIATION (SCOLIOSIS):**This deformity has for many years been attributed to unilateral destruction of a vertebral body owing to invasion of that vertebral body from a tuberculous kidney on that side. Consequently it is most commonly found in the region of the first lumbar vertebra.

**COMPENSATORY LORDOSIS ABOVE AND BELOW THE KYPHOSIS:** Compensatory lordosis above and below the kyphosis appears in the growing child, owing to a reversal of the height/width ratio of the vertebral bodies and also to the inter-vertebral discs which become wedged, apex posterior and base anterior.

**DIAGNOSIS:**Suspicion is the first step in the diagnosis.

**PHYSICAL:** Examination should include the following:

- \*Careful assessment of spinal alignment.
- \*Inspection of skin, with attention to detection of sinuses
- \*Abdominal evaluation for subcutaneous flank mass
- \*Meticulous neurologic examination.

**INVESTIGATIONS:**

**ESR AND MANTOUX TEST:**

Erythrocyte sedimentation rate is often raised. The mantoux test is generally positive. Negative mantoux does not exclude tuberculosis of the spine.

## IMAGING STUDIES:

**PLAIN X-RAY:** Plain film evaluation of the tuberculous spondylo-diskitis may demonstrate loss of vertebral height or disc space interval, erosions, indistinction of the endplates, para-vertebral masses, and sequestrae. Lytic areas less than 1.5cm in diameter are not demonstrated.

At Least 30-40-% of calcium should be lost before it shows up as a radiolucent area on a plain X-ray, the process may take upto 6months.

Narrowing of the disc space is the earliest finding, and when associated with a loss of definition of the paradiscal margin, the diagnosis is obvious in para-discal type which is the commonest type.

In the central type, the loss of normal trabeculae may show areas of destruction. Occasionally body may be ballooned out as a result of the accumulation of inflammatory debris which expands the weakened cortical bone. In the anterior type, the infection begins beneath the anterior longitudinal ligament. The front and the sides of the body show erosion.

In the appendicular type erosion of the pedicle , lamina and spine is involved.

**CTSCAN:** CT scan is excellent for visualization of end plate destruction, fragmentation of the vertebrae and paravertebral abscesses and calcifications. Inflammatory collections and masses are best seen after the administration of intravenous contrast.

It shows body lysis and destruction at an earlier stage more accurately. Extension into the canal of epidural abscesses and bony fragments are demonstrated on axial images. CT Scan spine is also used for guiding percutaneous biopsy and post drainage follow –up.

**MRI SPINE:** Multiplanar capability and optimal tissue contrast make MR imaging the optimal modality for evaluation of spondylodiskitis. The entire spine and canal can be visualized , including the posterior elements. MRI is the obvious choice of investigation as it has higher sensitivity for early infiltrative disease including end plate changes and marrow infiltration than bone scan and plain film.

MR imaging affords excellent definition of epidural, paravertebral, and intraosseous abscesses and extent of cord compromise. Paravertebral abscesses may be large, and discharge through tracts well seen on multiple planes. Contrast MRI(6) aids in better delineation and also in differentiating the

lesion from the surrounding edema. T1 images show decreased signal from the lesion within the 30 days and narrowing of the disc space and also loss of signal from the nucleus pulposus. T2 may show increased signal from the involved body and the disc narrowing with normal, decreased or increased signal higher than normally seen.

In late chronic stage, signal is variable, T1 weighted images may show decreased or increased signal. Hyper intense signal on T1 in the setting of chronic infection may be specific to TB spine , the signal normalizes with treatment. The intravenous administration of contrast improves definition of epidural abscesses and masses and cord and nerve root compromise.

#### DIFFERENTIAL DIAGNOSIS:

- 1.PYOGENIC INFECTIONS(7).
- 2.TYPHOID SPINE.
- 3.BRUCELLA SPONDYLITIS.
4. MYCOTIC SPONDYLITIS.
- 5.SYPHILITIC INFECTIONS.
- 6.TUMOUR CONDITIONS.

Primary benign tumours like hemangioma , Giant cell tumour and aneurysmal bone cyst may clinically and radiologically have some resemblance with spinal tuberculosis.

Primary malignant tumour include Ewing Sarcoma, osteosarcomas, fibrosarcomas and chondrosarcomas.

Multiple Myeloma, Hodgkin's disease and leukemias and secondary malignant deposits in the vertebral column may also involve the vertebral column like spinal tuberculosis. Sparing of the inter-vertebral disc differentiates tumour from tuberculosis.

**TREATMENT:** In the last 20 years or so the approach to treatment of tuberculosis of the spine has changed greatly. There are two main schools of thought, those who treat the condition conservatively throughout and those who treat the condition surgically.

#### **CONSERVATIVE TREATMENT:**

Conservative treatment is based on the principles of H O THOMAS: rest-enforced, uninterrupted, and prolonged. Bed rest with anti-tubercular therapy alone have been found sufficient in most cases including early cases of paraparesis. Bed rest is advised for 4-6 weeks till the pain and spasm

disappear and general health improves. They are then allowed to get up, but wear braces which can be discarded after 6-8 weeks. The chemotherapy is continued for 18 months and is similar to intracranial tuberculosis. Drugs include Isoniazid 10mgs/kg ,Rifampicin 10mgs/kg, Pyrizanamide 25mgs/kg and Ethambutol 15mgs/kg for 18 months.

**SURGERY:** Surgical decompression is done in the following situations.

1. Neurological complications which do not start showing signs of progressive recovery to a satisfactory level after a fair trial of conservative therapy (4-6weeks)

2. Patients with spinal caries in whom neurological complications develop during the conservative treatment.

3. Patient with neurological complications which become worse while they are undergoing therapy with anti-tuberculous drugs and bedrest.

4. Patients who have recurrence of neurological complications

5. Patient with prevertebral cervical abscesses, neurological signs and difficulty in deglutition and respiration.

6. Advanced cases of neurological involvement such as marked sensory and sphincter disturbances , flaccid paralysis or severe flexor spasms.

7. Older patients with neural complications require earlier operative decompression to avoid hazards of prolonged recumbency and immobilization.

The various surgical procedures in the management of Pott's Spine done are:

1.Cold Abscess – Incision and Drainage

2.Laminectomy .

3.Posterior lateral decompression-costo transversectomy.

4.Anterior Stabilisation Procedure –Corpectomy +cage fixation with rib graft(8).

a.Trans thoracic – trans pleural Approach.

b.Trans thoracic – extra peritoneal Approach.

c. Anterior Cervical Approach .

## REVIEW OF LITERATURE

Tuberculosis is probably as old as man-kind. The Hebrews were the first people to prescribe the eating of flesh of tuberculous animals.

Thirty one cases of skeletal and mummy pathology resembling tuberculosis ascribed to the 3700 to 1000 B.C. were reviewed by Morse et al (1964).

In ancient India, the Atharvans (1800-1000 B.C.) used to treat cases of skeletal tuberculosis with sunshine and “Sipudru”, a herbal preparation. Numerous hymns in Atharva Veda refer to pathology of spinal tuberculosis.

“In pre-columbian bronzes from Peru, in effigy water bottles and from the pictographs of the cliff dwellers, all pre – Columbian, the picture of Pott’s Disease is portrayed” (Webb, 1936).

In the Greeco- Roman period, Hippocrates(9), Celsus and Caelius, Aurelianus have written on tuberculosis (Sharpe 1962). The Hippocratic text “on Articulations” was the first to suggest a possible relationship between the spinal deformity and pulmonary disease (Bick 1948).

Hippocrates and Galen tried to correct the kyphotic deformity due to spinal caries by manual pressure, traction and mechanical appliances, but with little success.

Dalechamps (1513) a French Surgeon and an editor of Galen, redescrined vertebral caries. He described caries and paralysis of lower extremities in 1570 antedating Percival Pott (1779) by a little over two centuries.

Percival Pott in 1779 published his famous monograph in which he pointed out that the destruction of the vertebral bodies was the cause of paraplegia in spinal tuberculosis. He laid the foundation of surgical treatment of the condition when he wrote : “the remedy for this most dreadful disease consists merely in procuring a large discharge of matter”.

Chipault in 1896 was the first to use laminectomy in pott’s paraplegia which was basically an unsound procedure. Fraser later on performed the operation of laminotomy which was mechanically even less adequate than laminectomy and finally in 1937 abandoned the operation altogether as later results were disappointing (Griffiths et al 1956).

Menard<sup>(10)</sup> in 1894 developed costo- transversectomy which fell into general disrepute because of high incidence of sinus

formation and of secondary infection and was finally given up even by menard.

Spine was approached anteriorly by Muller in 1906.

Albee and Hibbs in 1912 introduced the concept of posterior spinal fusion in the management of pott's paraplegia.

Henderson in 1917 drew attention to the fact that posterior fusion does nothing to the diseased focus: to quote him "neither the Hibbs nor the Albee type of operation for ankylosing the diseased area in tuberculosis of the spine is in any sense a radical operation for the extirpation of the focus of the disease"- an observation as true to-day as then.

Fang and Ong introduced a transoral approach to c1c2 and a trans thyrohyoid approach to C2-C4.

Obalinski performed posterior mediastinotomy for the evacuation of tuberculous Paravertebral abscess.

Fraser in 1914 stated regarding the pathogenesis of Potts spine that healthy bone has greater resistance to tuberculous infection and where healthy bleeding bone is close to the tuberculous focus. The bone with yellow marrow which Fraser postulated was devitalized by an exotoxin produced by the tubercle bacillus is really bone which has undergone aseptic necrosis.

Calve in 1917 devised a method to aspirate the contents of an abscess without sinus formation.

Girdlestone<sup>(11)</sup> in 1923 gave a lucid description of the spinal joints and emphasized that the Hibbs and Albee fusions are posterior spinal fusions and that they can only prevent flexion if the lateral columns of the spine are intact.

Ito et al 1934 devised an approach similar to anterolateral decompression for the curettage of the vertebral body for tuberculosis.

Seddon<sup>(12)</sup> in 1938 analysing his results with ninety two patients – thirty two treated by spinal fusion and sixty conservatively came to the conclusion that adult tuberculosis of the spine is best treated conservatively and that provided there is no associated visceral lesion the prognosis is good.

Dott and Alexander evolved the operation of anterolateral decompression, a modification of Capener's operation, his approach being a little more anterior and involving removal of a part of the body of the vertebra to gain access to the spinal canal, no part of the lamina was removed.

Bosworth and compos in 1955 felt that most reliable treatment is immobilization and early posterior spinal arthrodesis.

Paus in 1964 reported complete working capacity in 35 percent of 37 cases treated by ambulatory regime with anti-tubercular drugs. Of 86 cases treated by him by radical operation and anti-tuberculous drugs, 88 percent had complete working capacity.

Somerville and Wilkinson in 1965 treated 130 lesions by direct operation and achieved sound healing in 92 percent and reported relapse or recurrence in 12.5 percent of healed cases.

J.R. Donaldson<sup>(13)</sup> and C.E. Marshall in a series of 560 operated cases came to the conclusion that posterior fusion is in no way a radical procedure for tuberculosis of the spine but it is a safe procedure.

Donaldson and Marshall also suggested that direct approach to the bodies of the vertebra is necessary when any of the following conditions are present:

1. When in doubt as to the diagnosis
2. When there is very large abscess.
3. When the disease is present in a child.
4. When there is a sequestrum that interferes with osteosynthesis of the bodies.
5. When a posterior fusion has been done and failed.

In Friedman's (1966) series spontaneous recovery from paraplegia was seen.

In Tuli's series (1969) spontaneous recovery of neural complication was observed in 48 percent of cases on anti tubercular drugs and bed rest alone.

Medical research Council Working Party on Tuberculosis of the spine has given four reports in the treatment of pott's spine.

1. The First report (1973a) described a study in Masan, Korea Where the objective was to compare in-patient and out-patient chemotherapeutic treatment. The groups were compared three years after treatment started and it was found that there was no significant difference of response either between in-patients and out-patients or in those treated with three drugs as compared with two.

2. The second report (1973b) based on the study in Pusan<sup>(14)</sup>, Korea was to assess the effect of plaster of paris jacket on ambulatory out-patients. A random allocation was made to chemotherapy with streptomycin for three months and PAS plus isoniazid for 18 months (SPH) or to PAS plus isoniazid for 18 months (PH). At the end of three years the results for patients with a plaster jacket and for those without such support were closely similar.

3. The Third report is based on a study in Bulawayo Rhodesia<sup>(15)</sup>, in which 130 African patients with a diagnosis of tuberculosis of the spine were allocated at random to operation of a simple debridement of the spinal focus or to ambulatory treatment from the start. A second random allocation was made with chemotherapy either with PAS plus isoniazid for 18 months with a streptomycin supplement for the three months (SPH) or no such supplement (PH). There was little difference in progress between the SPH and PH series, at three years 84 percent of 45 SPH and 86 percent of 44 PH patients has a favourable response.

4. The Fourth report is based on a study in Hong Kong which is a controlled trial of anterior spinal fusion<sup>(8)</sup> and debridement in the surgical management of tuberculosis of the spine in patients on standard chemotherapy. 150 Hongkong patients with a diagnosis of tuberculosis of the thoracic or lumbar spine were allocated at random to operation by radical resection of the spinal lesion and insertion of autologous bone graft (rad. Series) or by simple debridement of the spinal focus (Deb. Series).

All the patients were treated with isoniazid plus PAS for 18 months and daily streptomycin for the first 3 months. At 18

months 89 percent of the Rad and 79 percent of the Deb patients had a favourable response to the originally allocated treatment. The corresponding percentages at 3years were 87 and 86 percent.

Adendorff et all (1987) in general observed that potential of neural recovery was related to the degree of cord compression. They treated majority of their adult patients with neural deficit or even those without neural deficit by anterior operation combined with bone grafting.

Rajasekaran and Shanmugasundaram (1987) calculated that future (Y) of kyphotic deformity in tuberculosis could be reasonably predicted by using the formula  $Y = a + bx$  where x is the initial loss of vertebral bodies and a and b are the constants 5.5 and 30.5 respectively.

Hsu et all (1988) reviewed 22 patients 7years after treatment by anterior decompression and fusion in patients suffering from paraplegia of late onset. The response to anterior decompression was better in patients who had evidence of active disease 9 out of 12 recovered completely and 3 significantly.

In Tuli's series of 400 patients (1987-2000) operated according to the criteria middle path regime show much better neural recovery. At one year after the operation, outcome was complete recovery in 85 percent, partial recovery enabling ambulation with some support in 8 percent and negligible recovery(wheel chair bound) in 7 percent.

Upadhyay<sup>(17)</sup> et al (1994) and moon et al (2002) found no difference in the results of deformity in the lumbar spine between the group that had anterior radical surgery" and the group that was treated by anterior curettage and debridement.

Moon et al (2002) in one of the recent analysis of lumbar spine disease treated by modern anti-tubercular drugs obtained spontaneous inter-corporal bone block formation in nearly 70 percent of patients at 18 months and in 88 percent at 36 months.

## MATERIALS AND METHODS

This prospective study is based on about 40 patients with Pott's spine who had been treated in the Department of Neuro - Surgery, Government Stanley Hospital, Chennai. Study was during the period between August 2003 to March 2007.

### ORGANIZATION AND CONDUCT OF THE STUDY:

#### INCLUSION CRITERIA: ( Definition of Eligible Cases)

The patients were eligible for the study if the following conditions were present.

1. Clinical and radiographic evidence of tuberculosis of any vertebral body from C1 to S1 both inclusive.
2. Evidence of activity of the disease clinically and or radiographically(18).
3. Availability of the patient for observation over a period of 2years.
4. Patients with Neurological involvement from mild weakness (paresis) to gross weakness (plegia).

#### EXCLUSION CRITERIA:

1. The patient were not eligible for the study if any one of the following were present:

- 2.Children <10years of age and old patients > 60 years of age.
- 3.Total destruction equivalent to six or more vertebral bodies.
- 4.Tuberculosis of the spine associated with tuberculoma brain/meningitis / tuberculous arthritis of other joints.
- 5.A History of previous treatment for Tuberculosis for more than 12 months .
- 6.Serious non- tuberculous disease likely to prejudice the response to treatment or its assessment.
- 7.Any contra- indication to any of the methods of treatment under comparison.

#### PRETREATMENT INVESTIGATIONS:

The investigations done during the onset of the treatment are the following:

- 1.Full clinical neurological examination.
- 2.Basic blood investigations Blood TC, DC, ESR, Hb, Blood sugar, urea, creatinine, serum electrolytes. Blood grouping and typing
- 3.HIV screening was done for all the patients.
- 4.Examination of the urine for albumin, sugar and deposits.
- 5.An intra-dermal (mantoux )Test with 1 tuberculin Unit (TU) of a purified protein derivative (PPD) in 0.1ml of solution containing Tween.

6.X-ray Chest – PA view

7.Anterior posterior and Lateral X-rays of the whole spine.

8. CT Spine and MRI Whole Spine screening.

9.Examination of three sputum specimens from any patient with radiographic evidence of pulmonary tuberculosis.

10. Examination of pus by Gram Stain and by Ziehl-Neelson technique and Histo-pathological study of Granulation tissue and bony sequestra is advocated after surgical procedure.

## DIAGNOSTIC STUDY

**IMAGING OF SPINAL TUBERCULOSIS:** All patients were radiographically evaluated using X-ray anterior- posterior and lateral views, CT spine axial, sagittal, coronal views with reconstruction, and MRI whole spine screening, to identify the A) level of vertebral involvement. B) Number of vertebrae involved C) the total vertebral loss, obtained by adding together the losses including fractional losses in all the affected vertebrae. D) the angle of spinal deformity based on that described by Dickson (1967) which gives a simple geometric expression of the angle of kyphosis (MRC Working Party on TB of the spine 1974). E) the activity of the disease, F) the presence of pre-vertebral and para vertebral abscess.

**ANGLE OF KYPHOSIS<sup>(19)</sup>:** Angle of kyphosis ( K) is measured by drawing a line along the posterior margins of the bodies of the healthy vertebrae above and below the site of disease (Dickson 1967). Another method is by determining the angle between the upper end-plate of the normal vertebra proximal to the affected vertebrae and the lower end-plate of the normal vertebra distal to the affected vertebrae.

## CLASSIFICATION OF RADIOGRAPHIC ACTIVITY

### 1.ACTIVE DISEASE

- a. loss of cortical outline.
- b. Rarefaction of the affected bodies.

### 2.INACTIVE (QUIESCENT) DISEASE .

a).Bony fusion of the affected vertebral body, that is i)continuity of trabeculae between the vertebral bodies, and in case of bone grafts traversing them when they are still detectable or ii) stout bony bridges, best seen in the antero-posterior view, projecting up to 2 centimetres wide of the vertebral bodies and showing evidence of trabulacular continuity even though separated from the bodies by a small space, often no more than a hairline.

b). Sclerosis of the contiguous surfaces of the affected vertebrae with reduction or disappearance of the intervening disc space.

### 3.DISEASE OF DOUBTFUL ACTIVITY:

a). The appearance of marginal sclerosis where there had been so much destruction of the vertebral bodies that there was no close apposition of the vertebrae above and below the focus of disease.

MANAGEMENT OUTLINE:

CONSERVATIVE TREATMENT: All patients who are treated by us have been evaluated based on the clinical presentation and the neurological status and radiological correlation of the neurological status. The patients who would be on conservative treatment is decided upon after taking into account of the clinico - radiological classification of Tubercular- spondylitis, by kumar (1988) who has classified as follows.

STAGE	CLINICO-RADIOLOGICAL FEATURES	DURATION OF SYMPTOMS
I pre-destructive	Straightening of curvatures Spasm of perivertebral muscles Scintiscan showing hyperemia MRI shows marrow edema	< 3months
II Early Destructive	Diminished disc space +paradiscal erosion {Knuckle <10) MRI shows marrow edema and break of Osseous margins CT scan shows marginal erosions or Cavitation	2-4 months
III Mild Angular Kyphosis months	2-3 vertebrae involved (K: 10-30 deg)	3-9
IV Moderate Angular kyphosis	>3 vertebrae involved (K:30-60 deg)	6-24 months
V Severe Kyphos 24months	>3 vertebrae involved	>

(K:>60deg)

K is the angle of kyphosis as measured by the technique of Dickson (1967)  
Stage III, IV, V all have vertebral bodies destruction and collapse + appreciable  
Kyphosis(20).

Stage III, IV, V diagnosis is clear on conventional X-rays Ct Scan, and MRI

Criteria for conservative treatment:

1.All patients presenting only with back pain incidentally  
picked up by clinical examination and MRI spine.

2.Stage I, II, III, of clinico - radiological classification of  
kumar without neurological involvement.

3.Pott's paraplegic patients not willing for surgery and patients  
with co-morbid conditions Like renal failure not fit for surgery.

Patients who are put on conservative treatment are advised  
absolute bed rest for 6-8weeks till the pain and spasm of back  
muscles disappear and general health condition improves.

Chemotherapy includes four drug regime for 18 months.

Drugs are Isoniazid 10mgs/kg, Rifampicin 10mgs/kg,  
Pyrizanamide 20mgs/kg and Ethambutol 15mgs/kg . The aim

is to attack the persisters, slow growing or intermittently  
growing or dormant or intracellular mycobacteria and to  
increase the protective immunity. All replicating sensitive  
mycobacteria are likely to be killed by this bactericidal regime.

The doses and drugs were modified according to the weight of  
the patient, existing co-morbidities and any adverse reactions.

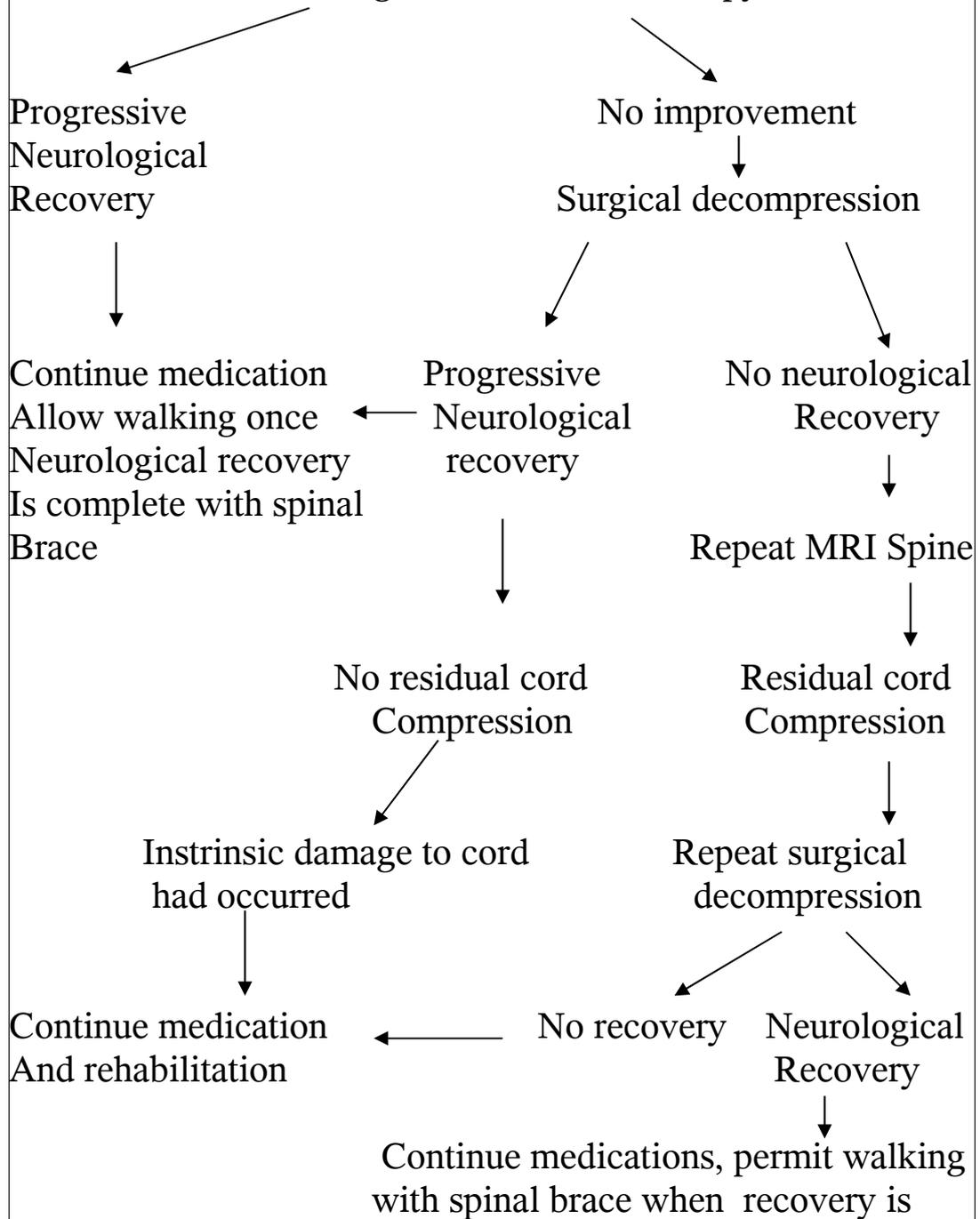
Supportive therapy with multivitamins, hematinics if necessary and high protein diet were advised.

Gradual mobilization of the patient is encouraged in the absence of neurological deficit with the help of suitable spinal braces as soon as the comfort at the diseased site permits.

They are made ambulant with spinal braces, like SOMI brace for cervico-dorsal, Taylor brace for dorso-lumbar region. Braces are used for 3-6 months and stoppage of usage is decided upon with the clinical and radiological improvement.

THE ALGORITHM FOR MANAGEMENT OF POTTS DISEASE WITH NEUROLOGICAL COMPLICATIONS<sup>(21)</sup>.

Tuberculous paraparesis or quadriparesis  
 Absolute Bedrest for 6-8 weeks , supervision with  
 Multidrug antituberculous therapy



complete .

**SURGICAL TREATMENT:** We follow the middle path regime as advocated by Tuli. We do not decompress every case and we limit surgical decompression to the following situations:

1. Neurological complications which do not start showing signs of progressive recovery to a satisfactory level after a fair trial of conservative therapy (six to eight weeks).

2. Patients with spinal caries in whom neurological complications develop during the conservative treatment.

3. Patients with neurological complications which become worse while they are undergoing therapy with antituberculous drugs and bedrest.

4. Patient who have a recurrence of neurological complication

5. Patients with prevertebral cervical abscesses , neurological signs and difficulty in deglutition and respiration

6. Advanced cases of neurological involvement such as marked sensory and sphincter disturbances, flaccid paralysis or severe flexor spasms.

## VARIOUS SURGICAL PROCEDURES DONE BY US:

During the period 2003 -2007 we have operated on 26 patients following the middle path regime as advocated by Tuli . The various surgical procedures done during the period 2003-2007 were:

- 1.Cold Abscess – Incision and Drainage
- 2.Laminectomy .
- 3.Posterior lateral decompression-costo transversectomy.
- 4.Anterior Stabilisation Procedure –Corpectomy +cage fixation with rib graft.
  - a.Trans thoracic – trans pleural Approach.
  - b.Trans thoracic – extra peritoneal Approach.
  - c. Anterior Cervical Approach .

## ANTERIOR SPINAL FUSION:

### PRINCIPLES OF ANTERIOR SPINAL FUSION:

There are two principles in the present day treatment of spinal tuberculosis.

First, is to eradicate all the avascular contents of the abscess, which are pus, sequestrated intervertebral discs, bony sequestra, sloughs, and granulation tissue, particularly lying on the duramatter and also lining the abscess. The diseased area is

directly attacked and helps in removing large quantities of diseased tissues.

Second, is the procedure of anterior fusion, using any autogenous bone transplant and spinal instrumentation.

#### ANTERIOR APPROACH TO THE CERVICAL SPINE:

We have approached C2-D1 cervical spine by anterior approach. If only one or two vertebral bodies are to be exposed a short transverse incision at the appropriate level like Hyoid bone corresponds to C2, Thyroid cartilage corresponds to C4C5, and Cricoid cartilage corresponding to C6 is taken as landmark. If several vertebral bodies are to be exposed oblique incision along the anterior border of sterno- cleido mastoid muscle is made.

Patient is kept supine with a sand bag in between the scapulae. For all patients we operate we give a traction of about 3 to 6 kg of traction through skull tongs. We prefer to operate from the right although it is stated in the literature that in left sided approach there is less chance of injury to the recurrent laryngeal nerve as recurrent nerve arises from the vagus at the level of the subclavian artery on the right and recurs below the subclavian artery and ascends between trachea and oesophagus. Left recurrent nerve arises at the level

of aortic arch and recurs around the arch to ascend in a like manner as on the right. Damage to the recurrent nerve is less likely to happen with the left-sided anterior approach, because of its longer vertical course, and definite location can tolerate retraction better. We had only 2 patients in our series who developed huskiness of voice which improved within 2 weeks.

A transverse skin incision is made at the level of the vertebrae to be operated beginning the incision at the midline and extending it laterally for about 7 to 10cm well over the belly of the sternocleidomastoid muscle. The skin and platysma are cut transversely in the same line. The superficial layer of deep cervical fascia covering the sternocleidomastoid is cut in the longitudinally to expose the sternomastoid. The middle layer of deep cervical fascia is lifted up with forceps and cut in the longitudinal manner to enter the plane of loose areolar tissue between the carotid sheath and trachea and oesophagus. Then by blunt dissection the plane between the sternomastoid and carotid sheath laterally and oesophagus and trachea medially is retracted by Langan retractors.

Anterior surface of the cervical bodies are now visualized by retraction of carotid sheath with its contents and sternomastoid muscle towards the left. The prevertebral fascia

is cut longitudinally to expose the longus colli muscles and anterior longitudinal ligament. A longitudinal cut made in the anterior longitudinal ligament in the midline of the exposed vertebral bodies may open the perivertebral abscess and diseased vertebrae. The pus, granulation tissue, sequestered vertebra are removed both by suction and using rongeurs or pituitary punch .

The sympathetic chain which lies between the transverse processes of vertebral bodies and longus colli muscle fibres are protected by avoiding retraction over the longus colli muscle. Tuberculous abscess and the diseased vertebrae are dealt with as required to decompress the cord. We then use iliac bone graft harvested during the course of the surgery and we tricorticate the bone and design the length and width of the graft as required. The bone graft is fixed to the cervical spine locking plate at the middle so that tightening the middle screw after fixing the plate may sometimes compress the cord .

The CSLP plate is then fixed at the upper and lower end by 16mm cervical screws. CSLP plate with screw is confirmed by intra operative cervical X-rays. Wound is closed over a suction drain after complete hemostasis.

The most extensive decompression and arthrodesis for tuberculous quadriplegia which we have performed from lower border of C4 to lower border of C7. Complications which may be associated with this operation are hematoma formation, injury to esophagus , trachea, dura, recurrent nerve, vagus nerve, sympathetic chain and vertebral artery.

**ANTERIOR TRANS THORACIC TRANSPLEURAL APPROACH FOR D1 TO L1(22):** The chest is usually opened on the left side where it is easier to handle aorta. On the right side the inferior vena cava being more delicate is liable to be damaged while exposing the vertebral bodies. We have approached through the left thoracotomy in all our patients although it is stated that one may approach through the right thoracotomy where X-rays show an unusually large abscess on the right side or when left thoracotomy is difficult because of pulmonary complications, or prior operation.

For the left thoracotomy approach we place the patient in the right lateral position and the surgeon stands on the dorsal side of the patient. An incision is made along the rib which is the landmark in the midaxillary line which lies opposite the center of the lesion i.,e 8<sup>th</sup> rib for the D8 lesion. In patients with severe kyphosis operative view is better if a rib is

removed along the line of incision and a sandbag or a bridge is used under the involved vertebrae to spread the ribs apart. A J-shaped parascapular incision is required for lesions from C7 to D8 so that the scapula can be lifted off the chest wall and the appropriate rib can be selected for opening the chest. The muscles and the periosteum are cut over the selected rib from the costochondral junction to the posterior part of the rib. The selected rib is resected subperiosteally and the rib is separated from the parietal pleura by rib rasperator and the lung is retracted by self retaining retractor. In the last 5 patients we operated we used double lumen endotracheal tube which helps in the collapse of the lung usually left completely not requiring unnecessary retraction. Having freed the lung it is retracted anteriorly displaying the aorta and paravertebral bulge or the diseased area of the vertebral column.

A plane is to be developed now between the descending aorta and the paravertebral abscess/diseased vertebral bodies. For this intercostals vessels and branches of hemiazygous veins opposite the site of disease have to be identified through the pleura dissected and cut between 2 ligatures.

The paravertebral abscess present is opened by a T- shaped incision with the vertical limb at the center of the diseased

bodies and the horizontal limb of the T placed vertically medial to the lateral parts of the divided intercostals vessels. This expose the diseased part of the vertebral bodies with pus , granulation tissue and sequestrated bone. Use of Chisels, curets, rongeurs, nibblers and suction would be required to clear the diseased tissues. The diseased area is adequately debrided and good decompression done to visualize the durameter. Then spine is stabilised using the rib (allograft) harvested during thoracotomy is broken into pieces such that it fills the titanium cage to be implanted . The titanium cage is fixed in the removed diseased segment and stabilized using single rod with 2 mono axial screws fixed to the normal vertebral bodies above and below the diseased segment .In all our patients we have used rib graft harvested during thoracotomy in the cage, unwarranting iliac crest bone graft. An intercostal catheter is inserted through a small stab incision in the seventh or eighth intercostals space in the mid-axillary line and is connected to an underwater seal for 2-3 days. Chest is closed in layers. Earliest evidence of fusion and remodeling in adults was between 12 and 18months postoperatively.

**ANTERIOR LATERAL EXTRA PERITONEAL APPROACH TO THE LUMBAR SPINE:** Approach is usually from the left side because on the right side inferior vena cava lies just anterior to the psoas major muscle. With the patient in right lateral position a semicircular incision convex laterally is given with the center of the incision opposite to the vertebral body to be exposed. The procedure involves opening the diaphragm if the lower dorsal- upper lumbar vertebral body are to be dealt with. The skin flap is retracted medially and paraspinal muscles (iliocostalis lumborum and longissimus dorsi muscles ) cut transversely down to the transverse processes to expose the vertebral body. Retract the cut paraspinal muscles proximally and distally with self-retaining retractors. At this stage psoas major muscle will come into view. Care is taken to protect the important vessels in front of psoas, aorta on the left side and inferior vena cava on the right side, and the lumbar nerves which run from above downwards within the substance of the posterior part of the psoas in the exposed area. Then the sides of the bodies of the diseased lumbar vertebrae is exposed for debridement , curettage, decompression, and bone grafting using iliac bone graft as needed.

#### ADVANTAGES OF ANTERIOR APPROACH:

1. The tension of the abscess is removed. Tension and pressure from an abscess have a deleterious effect on bone and this effect is arrested. This is particularly useful in young people with paresis or paralysis who have radiologically significant pus compressing the cord.

2. The material removed confirms the clinical diagnosis.

Considerable necrotic material is removed. Sequestra of bone and cartilage which could act as a barrier to osteosynthesis are removed.

3. In the immediate post operative period the graft is stable because of the contact pressure of the superior and inferior bodies upon it.

4. The posterior elements are left intact and can be used for a posterior fusion should this be necessary because of failure of the anterior fusion.

#### DISADVANTAGES OF ANTERIOR APPROACH:

1. It is an extensive operation and is more dangerous than a posterior fusion.
2. Anterior fusion takes more time and more whole blood transfusion and involve more specialist like the neurosurgeons, cardiothoracic surgeons and neuroanesthetist.,etc.
3. Anaesthesia is much more critical in the anterior approaches and the anaesthetist must be competent to manage open chest operations.

#### COSTOTRANSVERSECTOMY<sup>(24)</sup>:

This procedure was done by us in the earlier year before the introduction of titanium cage and was usually done for patients where the spinal cord compression is more likely from prevertebral and paravertebral abscess than sequestered vertebrae with lesser degree of kyphosis. The site of decompression is as a rule satisfactorily localized from the standard anteroposterior and lateral X-rays. The ribs articulating with diseased vertebrae serve as the guide to the placement of the incision. Ribs are best identified by counting from below. For high dorsal lesions counting from first rib is more convenient.

A semicircular incision (convex laterally) is made starting from the midline about 6cm proximal to the center of the diseased area, it is curved distally and laterally to a point about 9cm from the midline and continues distally and medially to the midline about 6cm to the center. The skin flap along with the deep fascia is elevated and retracted medially upto the midline. Elevation of the flap along with the deep fascia minimizes the bleeding from the superficial fascia. The paraspinal muscles of the back like the Trapezius, Latissimus dorsi are divided transversely starting from its lateral border coming up to the bases of the transverse processes of the diseased vertebrae. Medial part of 2 to 3 ribs which are articulating with the diseased vertebrae, and their transverse processes dissected subperiosteally. Two or three ribs about 8cm from the transverse processes are cut with a bone cutting forceps or a rib shear after completely freeing it subperiosteally. A small curved gouge (Capner's type ) is very useful for separating the transverse processes from the vertebral end of the ribs. Curved gouge is gently pushed medially all around the rib up to its articulation with the vertebral column. The exposed transverse processes are resected from their base first. The rib is now held from its

lateral free end and is gently rotated and priced out subperiosteally till it is completely detached. If there is a paravertebral abscess it would have lifted up the periosteum and the anterior longitudinal ligament from the anterior and lateral surfaces of vertebral bodies and discs. A frank abscess present would open out at this stage and pus is suctioned out to avoid contamination after taking a few ml for Gramstain, bacterial c/s and culture for tuberculous bacilli. If removal of the medial end of the rib does not drain out a suspected fluid abscess further exploration is done with the finger through the bed of the medial end of the rib to enter into the abscess cavity. When the abscess cavity is found with liquid pus, semi-solid caseous material, small sequestra and necrotic debris can be dislodged with the finger and removed by suction. The paraspinal muscles are then sutured and skin closed in layers after achieving complete hemostasis.

**LUMBAR LAMINECTOMY:** This procedure is done with midline incision. The lumbosacral fascia is cut in midline. Paravertebral muscles are retracted subperiosteally. Spine and lamina are delineated from the paravertebral muscles. Spine and lamina are removed to decompress the dura and to let out the pus if found to compress the cord and granulation tissue if

present is removed with rongeurs and Kerrison punch. Sequestered bone if present is removed. Complete hemostasis is achieved and skin closed in layers without drain.

**COLD ABSCESSSES:** The palpable (peripheral) cold abscess if needed can be drained by standard surgical approaches, like incision at the summit of highest point of fluctuation of the abscess. Psoas abscess may be drained by anterior approach by making an 8 to 10cm incision on the iliac crest one cm behind the anterior superior iliac spine.

**POST OPERATIVE MANAGEMENT:** Intravenous antibiotics like cefotaxime, and gentamicin were given on the night before surgery and one hour before surgery and continued for 7 days. For major procedures like anterior thoracotomy and spine stabilization procedures intravenous antibiotics like TAZOFAST ( piperacillin + tazobactam) 4.5gm iv bd with gentamicin 60mg iv bd given for 10days. All patients with stabilisation procedure were sedated with injection Pentazocin and injection Phenergan on the first post operative day. Parenteral analgesic Diclofenac sodium with injection Ranitidine was given for the initial 2 days and later on converted to oral analgesic for another 7 days. Antibiotics were continued until suture removal for all the patients.

Patients whose pre – operative neurological status power grade 4 were ambulated on the 10<sup>th</sup> post operative day depending on the post operative pain, tolerance of the patients and nature of the surgery. Patients with poor neurological status before surgery like grade 0 to 2 were given physiotherapy post operatively and made ambulant once the neurological status improved. The patients with poor neurological status pre operatively ,after stabilisation procedures were referred to Govt Rehabilitation centre, K.K. Nagar for neurological rehabilitation and advised regular follow –up at Neuro –Surgical Op Govt Stanley Hospital. Patients in whom anterior cervical corpectomy done were advised to wear cervical collar for 4 to 8 weeks. In patients where anterior thoracotomy and stabilisation with cage done were advised to wear Taylor’s brace constantly for the next 3 to 6 months.

All patients were given intense physiotherapy with the help of physiotherapist. All patients were advised to attend out patient department once in 2 weeks for first one month post operatively and at least once in a month for the next 6 months and once in 3 months for the subsequent 3 years.

## RESULTS

### INCIDENCE AND AGE AT PRESENTATION:

Of the 40 patients, studied 17 patients were males and 23 patients were females. The maximum number of cases were in the age group between 11 to 20 years of which 5 were males and 6 were females. The youngest patient was 13years, female and the oldest patient was 60years ,a female. We had least number of cases 6 in number in the age group 31 to 40years.

### CLINICAL PRESENTATION: NEUROLOGICAL

#### SYPMTOMS:

**BACK ACHE:** Of the 40patients, 39 patients had back pain along with other symptoms. The shortest period was 4 weeks and the longest period was 12 months. Back pain accounts for about 97.5% in our series.

**MOTOR WEAKNESS:** In our study, 35 patients had motor weakness with a percentage of 87.5. The shortest period was 4 weeks and the longest duration was 10 months before reporting to our department. In all our patients motor weakness preceded sensory disturbances.

**SENSORY DISTURBANCES:** In our series, 32 patients had sensory disturbances in the form of benumbed sensation,

hyperaesthesia, dermatomal pattern of sensory loss, asymmetrical sensory loss involving one limb more than the other, etc accounting for 80%. 15days is the shortest period and 5months is the longest period .

**BLADDER AND BOWEL INVOLVEMENT:** In our study bladder and bowel involvement was noticed in 12 patients out of 40 comprising 30%. The earliest period was 7days and the maximum period of bladder /bowel disturbances noticed in our series is 2months. Bladder disturbances was in the form of urinary hesitancy, inability to empty bladder completely, inability to appreciate bladder filling and over flow in continence etc. UMN type of bladder was seen in 11 patients and LMN type of bladder was seen in 1 patients. Bowel disturbances was in the form difficulty in evacuation and about 11 patients had constipation and 1 patient had bowel incontinence.

**ASSOCIATED SYMPTOMS:** In our study symptoms like fever, loss of appetite, loss of weight, cough with expectoration, headache and neck pain were also analysed. About 25 patients had fever which was intermittent , low grade,more in the evening relieved by anti pyretics like paracetamol. 8 patients had loss of appetite due to nausea,

vomiting immediately after taking food and abdominal discomfort. Weight loss was noticed in 9 patients only. 9 patients had cough with expectoration . Nature of the sputum was yellowish white, thick occasional frothy and foul smelling. 2 patients had difficulty in breathing .

6 patients in our series had headache which was more predominant in patients with cervical potts disease. Neck pain was seen in 9 patients .

**TRAUMA:** In our series about 9 patients had H/o Trauma. In 2 patients accidental fall has deteriorated the neurological status from grade 4 to grade 0. One patient sustained fall from cot while on treatment and her neurological status deteriorated from 4- to grade 0.

**LOCAL CLINICAL SIGNS :** In our series, 27 patients had gibbus which accounts for 67.5%. Kyphosis was seen in 5 patients and scoliosis was seen in 4 patients.

#### **LOCALISATION OF LESION;**

In our study analysing the level of lesion in 40 patients, the maximum involvement was in the thoracic spine and least in the cv junction, and sacrum. 25 patients had lesion in the thoracic spine, 6 patients in the cervical spine and two patients in the thoraco –lumbar spine. One patient each, at

the level of CV junction, Cervico -thoracic and sacrum level. About 62.5% of patients had lesion at thoracic spine.

LOCALISATION OF LESION IN OUR 40 POTT'S PATIENTS:

METHOD OF PRESENTATION OF LESIONS:

In our series, 38 patients had contiguous lesion and in two patients we noted skip lesions. Contiguous lesion accounts for 95 % and the remaining 5% was skip lesions.

TOTAL NO OF VERTEBRAE INVOLVED BY POTT'S DISEASE IN 40 PATIENTS

In our series , total no of vertebra involved by Pott's disease in 40 patients was 97. T9T10 vertebrae has been involved maximum no of times -9 followed by T5,T6,T11 which has been involved 8 times. Only one patient had C1C 2 Pott's spine.

TOTAL NO OF VERTEBRAE INVOLVED IN 40 PATIENTS

In our series , maximum no of vertebrae involved in 40 patients were analysed and it was found that 29 patients had 2 vertebral involvement. 6 patients had 3 vertebrae and 5 patients had 4 or more than 4 vertebral body involvement. About 72.5 % patients had at least 2 vertebral body

involvement. In our series we found that single vertebra involvement was not seen in any patients.

**RADIOGRAPHIC CHARACTERISTICS:** Using the X-ray , CT and MRI spine , of 40 patients it was found that 38 patients had radiographically active disease process. Only in two patients, we found that the disease process had apparently healed. These two patients were conservatively treated. As a whole in 95% of patients, disease was apparently active and only in 5% of patients disease had apparently healed when they first presented.

Radiographically, disc space narrowing was seen in 38 patients and vertebral body destruction was seen in 36 patients, involvement of posterior elements was seen in 5 patients , pre and paravertebral abscess was seen in 26 patients

**DURATION OF NEUROLOGICAL SYMPTOMS AT PRESENTATION:** In our series of 40 patients , only one patient was neurological normal at presentation. Majority of patients about 14 had neurological symptoms for 6 months. 6 patients had neurological symptoms for more than 6 months.

**DURATION OF ATT DRUGS TAKEN AT PRESENTATION/TAKEN BEFORE SURGERY:** In patients who have been treated conservatively, about 42.86% patients had taken ATT drugs for atleast 2 months at presentation and 28.58% patients had taken ATT drugs for 3months. The minimum period that ATT drugs had been taken is 1 month and the maximum period is 5 months in the conservatively treated patients.

In patients who had been treated surgically, the duration of ATT drugs taken before surgery varied from a minimum period of 1month to a maximum period of 10 months. About 50% of patients (13) have taken ATT drugs for a period of 2months and 30.77% of patients (8) have taken ATT drugs for a period of 3months. Only 7.69% of patients have taken ATT drugs for a period of more than 6 months.

**VARIOUS SURGICAL PROCEDURES DONE BY US:** During the period 2003 -2007 we have operated on 26 patients following the middle path regime as advocated by Tuli .

Cold abscess drainage was done for one patient who had L4L5 potts Spine with abscess lumbosacral region. The patient was put on ATT drugs after pus culture & sensitivity at Tuberculosis Research Centre, Chetpet.

Laminectomy was done for 5 patients with involvement of posterior elements with abscess in the spinal canal.

In 8 patients we have done posterior lateral decompression costo- transversectomy. Selection for costo-transversectomy is based upon the MRI findings where the pre and para vertebral abscess is more than the vertebral involvement compressing the cord.

We have done 12 anterior decompression and stabilisation procedure where we have done corpectomy of the diseased bone and complete wound debridement of the diseased area with evacuation of the pus, removal of granulation tissue and sequestered bone and Cage fixation with rib graft. In 9 patients we have taken trans thoracic trans pleural approach and in one patient we have done transthoracic extraperitoneal approach for L1L2 level. In 2 patients we have done anterior cervical approach , corpectomy of the diseased bone and stabilisation with iliac bone graft with cervical spine locking plate.

**VARIOUS APPROACHES AND SURGERY AT VARIOUS LEVELS.** We had done laminectomy for 5 patients. Two patients had lesion at lumbar level and one patient each at cervical , thoracic and sacral level.

In anterior cervical corpectomy, most commonly involved vertebrae in our series are C4,C5,C6.

In anterior stabilisation procedure, trans thoracic extra pleural approach was done in patients who had involvement of thoracic vertebrae. The most common involvement being T9T10. In one patient in whom we did anterior transthoracic extra peritoneal approach and stabilisation with cage , the lesion was at L1L2. In 8 patients in whom costo- transversectomy done we noticed involvement of thoracic vertebrae mostly at T5T6 level .

#### **INTRAOPERATIVE FINDINGS:**

During the surgical procedure, the intraoperative nature of lesion was identified and documented. In 24 out of 26 patients operated , the most common intraoperative picture was pus (92.31%) which was thick, yellowish, non- foul smelling in nature. Granulation tissue was seen in 21 patients (80.77%). Sequestered bone was mostly seen in all patient who under went anterior thoracotomy procedure as we were

able to see pus, granulation tissue and sequestered bone forming a mass at the level of involved vertebrae.

#### COMPLICATIONS: IMMEDIATE / EARLY

In our series, 2 patients had dural tear intra operatively with CSF leak, 1 patient in anterior cervical corpectomy procedure and other patient in anterior thoracotomy procedure. Dural tear was very small and dural tear was closed with fat onlay graft. There was no CSF leak post operatively.

One male patient had post operative basal pneumonitis on the third post operative day. One female patient had post operative lung collapse which improved within 5 days after elective ventilation in ICU for 3 days.

One patient had consolidation LT lung (lower lobe) which was treated with antibiotics and bronchodilators for 2 weeks.

One female patient developed acute renal failure post operatively which improved over days but subsequently her renal failure worsened . She died of uremic pericarditis.

One elderly female patient with Hypertension and diabetes had sudden post operative hypotension due to autonomic dysfunction . Her BP was persistently low 70/50

mmHg even after blood transfusion, inotropic agents and sympathomimetic agents. She succumbed to the autonomic dysfunction and she expired on the 3<sup>rd</sup> post operative day.

Two patients who had been operated, both anterior thoracotomy procedure died of cardiorespiratory arrest. One patient died due to autonomic dysfunction due to diabetes mellitus and the other patient died because of anesthetic complications.

In our series, we did not encounter any injuries to intra abdominal great vessels or viscera.

#### COMPLICATIONS: DELAYED

Nine patients developed superficial wound infection and these patients were treated with appropriate antibiotics after pus culture and sensitivity and daily sterile dressing of the wound. All the nine patients improved but two patients developed sinus formation over the wound site. For the two patients, pus was sent for AFB culture and sensitivity to TUBERCULOSIS RESEARCH CENTRE, CHETPUT for analysis. In two patients, tubercle bacillus was found resistant to isoniazid and rifampicin but sensitive to streptomycin, pyrazinamide, ofloxacin and ethionamide. Appropriate

sensitive drugs inj. Streptomycin ,pyrazinamide and ofloxacin were given and the sinus disappeared.

All the patients who underwent surgery were catheterised pre-operatively at the time of intubation. Catheter removed on the 3<sup>rd</sup> post operative day after giving bladder training by intermittent blockage of the catheter. Patients in whom bladder was involved pre-operatively , Foley catheter was in situ as long as patient was able to appreciate bladder filling and able to initiate micturition reflex after intermittent blockage of the catheter and removed only after giving bladder training.

Six patients developed urinary tract infections and in them urine was sent for culture and sensitivity and appropriate antibiotics were given which was continued for 10 days. Two patients whose neurological status didn't improve went home with catheter in situ.

One patient who had caries spine of D10D11 spine developed herpes zoster of D9 dermatome. He was treated with Tab.Acyclovir 400mg 5times daily for 5days and with Tab. Carbamazepine. Patient subsequently improved with treatment.

Two patients developed jaundice with elevated bilirubin and elevated liver enzymes . In those two patients ATT drugs were stopped for 2 weeks until the bilirubin and liver enzymes became normal and ATT drugs re-introduced in them without complications.

Two patients developed paralytic ileus and patients were treated by keeping them nil oral and Ryle's tube aspiration, observing for bowel movements periodically. Both patients improved on the 3<sup>rd</sup> post operative day and oral feeding started then.

Five patients developed pressure sores over sacrum and buttocks. They were treated by frequent changing the position of the patients, pus for culture and sensitivity and appropriate antibiotics and daily dressings with chlorhexidine antiseptic gauze. In four patients pressure sores healed. In one patient pressure sore improved and patient sent home with the advice of daily dressing with chlorhexidine antiseptic gauze.

In our series, no patient developed deep vein thrombosis and its complications.

## DURATION OF INPATIENT CARE: CONSERVATIVE & SURGERY:

In this series, 14 patients who were seen in Neuro-surgical op and decided to be treated conservatively with ATT drugs and with dorso-lumbar corset/ cervical collar were never admitted .They were treated as out- patients.

26 patients were surgically treated and in them about 10 patients were hospitalized for 2-4 weeks and 14 patients who were as in patients for 1-2 months had undergone major surgical procedure like anterior thoracotomy and spine stabilisation with titanium cage with rib graft. Only two patients whose neurological status didn't improve after surgery were hospitalized for more than 2 months.

## FOLLOW- UP AND OUTCOME:

All the 40 patients were followed up to a maximum period of 36 months and the minimum period of 6 months. The follow up study included detail questioning of symptoms improvement and neurological examination with a view to find out how much improvement followed the conservative treatment as well as after surgery or whether there was any deterioration or the condition remained status quo.

In our series, only 10 patients had full follow –up till 36months. About 4 patients had the least follow –up period of 6months. In our study, 6 patients had follow-up for 6-12 months, 12 patients for 12-18 months and 8 patients for 18 -24 months . Only 25% had follow – up for 3 years. About 30 patients had follow up over a period of 1 to 3 years.

#### POST TREATMENT : IMPROVEMENT OF NEUROLOGICAL STATUS:

In all patients the neurological outcome after conservative and surgical treatment were analysed and it was found that in the conservatively treated patients, back pain improved in 11 patients(78.6%) and pain didn't improve in 3 patients (21.4%). Back pain improved in 20 patients (76.9%) and 6 patients (23.1%) had no improvement in back pain in the surgically treated patients .

Improvement in the motor power were evaluated both for conservative as well as surgically intervened patients. In surgically treated group 20 patients(76.9%) had improvement in motor power as compared to the pre-operative motor power and 6 patients (23.1%) had no improvement in motor power after surgery. In those patients who have been treated conservatively 11 patients (78.6%) had improvement in motor power and 3 patients (21.4%) had no improvement.

In conservatively treated patients, 12 patients (85.7%) had improvement in sensation and 2 patients (14.3%) has no improvement in sensation. In the surgically treated group, 22 out 26 patients (84.6%) operated had improvement in sensation and 4 patients (15.4%) had no improvement.

Bladder and bowel not involved in 20 patients (76.9%) were surgically treated and 9 patients (64.3%) were managed conservatively. In those involved, 4 patients (15.4%) had improvement and 2 patients (7.7%) had no improvement in the surgically treated patients. In the conservatively treated patients 5patients (35.6%) had improvement in bladder/bowel .

OUTCOME STATUS: The outcome status for 40 Pott's spine patients has been classified as :

#### STATUS

A.UNFAVOURABLE - Death with active spinal disease. Failure of chemotherapy and surgery.

B.STILL NOT FAVOURABLE: Physical activity limited and not quiescent radiographically.

C.FAVOURABLE: None of the above mentioned factors present.

#### CONSERVATIVE TREATMENT: - 14 PATIENTS

Of 14 patients, 8 patients had favourable outcome. In 3 patients , outcome was still not favourable. 3 patients had unfavourable outcome.

#### OUTCOME STATUS: SURGERY: – 26 PATIENTS

Of 26 patients, 22 patients had favourable outcome. In 2 patients outcome was still not favourable. 2 patients had unfavourable outcome.

OUT-COME ANALYSIS -: CHI SQUARE TEST: The outcome of various variables namely the neurological status in the surgically treated and conservatively managed patients using CHI SQUARE TEST ANALYSIS.

#### OUTCOME STATUS FOR POTT'S SPINE AFTER STATISTICAL ANALYSIS OF DATA:

Considering the favourable and unfavourable status for treatment of POTT'S SPINE Shows that

1.Surgically treated patients have better favourable outcome (84.6%) than conservatively treated patients (57.1%).

2.Outcome status both for conservatively treated patients and surgically treated patients is favourable in about 71% in our series, following the Middle path Regime as advocated by Tuli.

3. Patients with neurological symptoms less than 6 months have 16 times more favourable outcome than patients with neurological symptoms more than 6 months.

4. Patients with motor power grade 0 have 1.8 times more favourable status if they are treated surgically than conservative treatment.

5. In our series, considering the favourable status and unfavourable status for treatment of Pott's spine Surgically treated patients are having 5 times more favourable status than conservative patients.

## DISCUSSION

### AGE INCIDENCE AND SEX:

In our series, 40 Pott's spine patients were studied, in which 17 patients (42.5%) were males and 23 patients (57.5%) were females. The male:female ratio is 1:1.35. In Tuli's series the pott's spine disease was equally distributed among both sexes. In his series of the total patients, 52 percent were males and 48 percent were females. The figures of other workers regarding sex distribution is almost similar( Shaw 1963, Wilkinson 1949, Paus 1964, Friedman 1966, Hahn 1977, Lifeso 1985).

In our series, majority of our cases were in the age group between 10 to 20 years of which 12.5 percent (5) were males and 15 percent (6) were females. Our series matched the Tuli's series where he had majority of cases in the age group between 10 to 20 years.

In Tuli's series 11 percent males and 12 percent females were in the age group 10 to 20 years. Schmorl and Junghanns (1959) stated that it occurred in the first decade of life in 50 percent of all cases in his series and in only 25 percent did it appear after the age of 20. Paus 1964 reported that among the Korean patients 42 percent were below the age of 15 years and the rest were more than 15 years of age. Martin (1970)

reported 33.6 percent below the age of 16 years before the year 1956 and 21.4 percent below the age of 16 years after this period.

#### NEUROLOGICAL SYMPTOMS/COMPLICATION:

In our series, the incidence of neurological symptom/complication is 56.87%. Bailay et al (1972) reported an incidence of 43 percent. The overall incidence in various series has been reported to be between 10 and 30 percent, (Bosworth 1953, Cleveland 1935, Girdlestone 1950, Griffiths 1952, Risko 1963, Ferrand 1967, Tuli 1967).

#### REGIONAL DISTRIBUTION OF TUBERCULOUS LESION IN THE VERTEBRAL COLUMN:

In our series of 40 patients, the order of frequency of involvement of tuberculous lesion in the vertebral column has been dorsal-25 patients (62.5%), cervical-6 (15%), dorsolumbar -2 (5%) and CV junction, dorso lumbar and sacral each having 1 patients (2.5%). The order of frequency in Paus 's (1964) series of 141 cases has been lumbar (50), dorsal(35), dorsolumbar (25), lumbosacral(22), cervico-dorsal (8), sacral (1) and cervical (nil).

The regional distribution of tuberculous lesions in vertebral column in Tuli's series (1965-74) expressed as percentage has

been dorsal-42 percent, lumbar -26,dorsolumbar -12, cervical -12, cervicodorsal – 5 and lumbosacral -3 percent.

#### NUMBER OF VERTEBRAE INVOLVED;

In our series, it was found that 29 patients had 2 vertebral involvement, 6 patients had 3 vertebrae and 5 patients had 4 or more than 4 vertebral body involvement.

On an average involvement of 4.4 vertebrae was seen in our series. Hodgson and Stock(1960) reported an average involvement of 3.4 vertebrae. A figure of 3.8 was given by Mukopadhaya and Mishra (1957).Average number reported in children was 3.4 by martin (1970).In Tuli's series , average number of vertebrae involved in each lesion was 3 for children and 2.5 for adults.

#### PEAK VERTEBRAL BODY INVOLVEMENT:

In our series, the peak vertebral involvement was at T9,T10 . In Cleveland's (1942) series the peak incidence was at 11<sup>th</sup> thoracic vertebra, the incidence curve falling away more or less smoothly in each direction along the vertebral column. In Hodgson's series (1969) the peak incidence was observed at L1 and the curve has a uniform fall proximal and distal to this level.

**ASSOCIATED EXTRA-SPINAL TUBERCULOUS LESIONS:** In our series, we had 3 cases of Tuberculous cervical lymphadenitis, one case of left frontal Pott's puffy tumour, one case of pulmonary tuberculosis, and 3 cases of cold abscesses. None of our patients had tuberculous osteomyelitis of other bones in addition to the vertebral focus. The detection of associated visceral tuberculous lesions (in lungs, urogenital organs and lymph nodes) in the series of other workers (Konstam 1962, Friedman 1966, Wilkinson 1949, Sanchis-Olmos 1948, Paus 1964) has been reported to be high between 40 and 50 percent. Ten out of 64 patients of spinal tuberculosis of Friedman's series (1966) had tuberculous osteomyelitis of other bones in addition to the vertebral focus.

**SKIPPED LESIONS:**

In our series, 38 patients had contiguous lesion and 2 patients we noted skip lesions. Contiguous lesion accounts for 95% and 5% were skip lesions. In Tuli's series the average incidence was 7 percent.

**CONSERVATIVE TREATMENT:**

Of 40 patients 14 patients were conservatively treated, 8 patients had good neural recovery. Evidence of clinical healing

was seen in 71.4 percent . In our series 57 percent had favourable outcome , 21 percent had unfavourable outcome . In 21 percent patients had no improvement in neurological status. In our series the mortality was 14 percent in the conservatively treated patients. Outcome status both for conservatively treated patients and surgically treated patients is favourable in about 71% in our series, following the Middle path Regime as advocated by Tuli.

The Medical Research Council Extensive trial on treatment of Tuberculosis of the spine (1978) considering relatively early disease, concluded that Pott's paraplegia from active disease could be managed conservatively by anti-tuberculous drugs alone.

The overall incidence of healing by conservative antituberculous therapy in Tuli's (1973) series varies between 83 percent and 96.8 percent. The series treated by modern antitubercular drugs (Konstam and Blesovsky 1962, Dickson 1967 , Prabakar 1989 with ambulatory regime had good neural regime between 60-70 percent and 83-90 percent had good clinical healing and they had mortality 5-15 percent.

**SURGERY:** In Pott's disease compression is almost from the front and decompression should therefore be from the anterior aspect, approached by a thoracotomy or a costo-transversectomy. The view that laminectomy is contra – indicated for Pott's paraplegia was well expressed by Griffiths in 1979. Our results show that when the compression is related to active disease, the prognosis is much better, the response to decompression being faster and more complete than if the compression was due to bony ridge.

**OPERATIVE FINDINGS:**

In our series, intra operative findings in 26 patients who were surgically operated, pus was encountered in 24 patients , granulation tissue in 21 patients and sequestered bone in 12 patients. In Louis et all (1994) series, in the 22 surgically operated patients pus or caseous material was seen in 10 patients, granulation tissue in 7 patients, sequestra was seen in 6 patients, healed bony ridge in 2 patients and dural fibrosis in 4 patients.

In Konstam and Blesosky's (1962) series 28 of 56 cases operated 90 percent had neurological recovery with a mortality of 15 percent.

In Friedman's series (1966) 10 of 23 paraplegic patients needed operations, 3 (13.2 percent) underwent costo transversectomy and 10 (43.3 percent) anterior lateral decompression and the functional recovery was 82 percent.

In Tuli's series 118 Patients who were operated out of 200 patients 69 percent had full functional recovery 13 percent had partial recovery sufficient to enable them to walk with moderate degree of support and 12 percent died.

**OUTCOME:** In our series, of 26 patients surgically treated 22 patients had good neurological recovery and evidence of clinical healing was seen in 84.5 percent.

Surgically treated patients have better favourable outcome (84.6%) than conservatively treated patients (57.1%).

Patients with neurological symptoms less than 6months have 16 times more favourable outcome than patients with neurological symptoms more than 6 months.

Patients with motor power grade 0 have 1.8 times more favourable status if they are treated surgically than conservative treatment.

## CONCLUSION

- 1.The incidence of Pott's disease in our series is more in the age between 11-20 years.
- 2.The incidence of Pott's disease is more in the females than the males in the series.
- 3.Systemic illness like Hypertension, Diabetes mellitus, Liver disease associated are not found to modify the outcome in the treatment of Pott's spine and increase the morbidity in the Surgically treated patients.
- 4.In our series H/o Trauma has not modified the outcome of the patients in both conservatively as well as surgically treated patients.
- 5.Surgically treated patients have better favourable outcome (84.6%) than conservatively treated patients (57.1%).
- 6.Outcome status both for conservatively treated patients and surgically treated patients is favourable in about 71% in our series, following the Middle path Regime as advocated by Tuli
- 7.In our series, Patients with neurological symptoms less than 6 months have 16 times more favourable outcome than patients with neurological symptoms more than 6 months.

8. Patients with motor power grade 0 have 1.8 times more favourable status if they are treated surgically than conservative treatment.

9. In our series, considering the favourable status and unfavourable status for treatment of Pott's spine Surgically treated patients are having 5 times more favourable status than conservative patients.

## LIMITATIONS OF THE STUDY

- 1.The sample size is small (40).
- 2.This study is not a randomized controlled study as there is no control groups included.
- 3.This study did not include children < 10years and old patients > 60years of age.
- 4.This study did not include procedure for spinal deformity (post surgical) in the treatment of the Spine.
- 5.This study did not include posterior stabilization procedure.
- 6.Patients with total destruction of five or more vertebral bodies were excluded from the study.
- 7.Pott's spine patients who had co - morbid conditions like liver disease, renal failure, etc were excluded. Hence overall results of the treatment of Pott's spine with co –morbid conditions could not be evaluated.
- 8.The study didn't accounts for surgical management of Cranio-vertebral junction Tuberculosis(25).
- 9.This study didn't include radiological signs which predict late increase in deformity(26) and radiological signs of improvement on treatment.

10. Duration of follow-up of patients is only for 3 years and the total number of patients who have completed follow-up is very less. The study needs long term – follow up.

11. This study didn't take into account of cases of recurrence of Pott's disease.

12. This study did not evaluate the post treatment bony fusion in the follow – up .

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TABLE -1

VARIOUS SURGICAL PROCEDURES DONE BY US:

SURGICAL PROCEDURE	APPROACH	NO OF PATIENTS
COLD ABSCESS-I&D		1
LAMINECTOMY		5
ANTERIOR STABILISATION PROCEDURE – CORPECTOMY +CAGE FIXATION WITH RIB GRAFT	TRANSTHORACIC TRANSPLEURAL	9
	TRANS THORACIC EXTRAPERITONEAL	1
ANTERIOR CERVICAL APPROACH		2
POSTERIOR LATERAL DECOMPRESSION	COSTO TRANSVERSECTOMY	8

TABLE -2

SURGICAL APPROACH	LEVEL AT WHICH SURGERY DONE	NO OF PATIENTS
ANTERIOR CERVICAL CORPECTOMY – STABILISATION WITH ILIAC BONE GRAFT AND CSLP	C5C6	2

TABLE -3

SURGICAL APPROACH	LEVEL AT WHICH SURGERY DONE	NO OF PATIENTS
TRANSTHORACIC TRANS PLEURAL	THORACIC	9
TRANSTHORACIC EXTRA PERITONEAL	LUMBAR	1

TABLE – 4

SURGICAL APPROACH	LEVEL AT WHICH SURGERY DONE	NO OF PATIENTS
COSTO TRANSVERSECTOMY	THORACIC	8

TABLE – 5

SURGICAL APPROACH	LEVEL AT WHICH SURGERY DONE	NO OF PATIENTS
LAMINECTOMY		
	CERVICAL	1
	THORACIC	1
	LUMBAR	2
	SACRAL	1
COLD ABSCESS-I&D	LUMBAR	1

## RESULTS

### TABLE -6

INCIDENCE AND AGE AT PRESENTATION:

AGE AT PRESENTATION	MALE	PERCENTAGE %	FEMALE	PERCENTAGE %
1-10	-	-	-	-
11-20	5	12.5	6	15
21-30	4	10	4	10
31-40	2	5	4	10
41-50	3	7.5	5	12.5
51-60	3	7.5	4	10

### TABLE -7

NEUROLOGICAL SYMPTOMS AT PRESENTATION:

SYMPTOMS AT PRESENTATION	NO OF PATIENTS	PERCENTAGE %
BACK PAIN	39	97.5
MOTOR WEAKNESS	35	87.5
SENSORY LOSS	32	80.0
BLADDER INVOLVEMENT	12	30.0
BOWEL INVOLVEMENT	12	30.0

TABLE -8

ASSOCIATED SYMPTOMS AT PRESENTATION:

SYMPTOMS AT PRESENTATION	NO OF PATIENTS	PERCENTAGE %
FEVER	25	62.5
WEIGHT LOSS	9	22.5
LOSS OF APPETITE	8	20
COUGH WITH EXPECTORATION	9	22.5
HEADACHE	6	15
NECK PAIN	9	22.5
H/O TRAUMA	9	22.5

TABLE - 9

LOCAL CLINICAL SIGNS AT PRESENTATION:

LOCAL SIGNS	NO OF PATIENTS	PERCENTAGE %
GIBBUS	27	67.5
KYPHOSIS	5	13
SCOLOSIS	4	10

TABLE -10

LOCALISATION OF LESION IN OUR 40 POTT'S PATIENTS:

LEVEL OF LESION	NO OF PATIENTS	PERCENTAGE
CV JUNCTION	1	2.5
CERVICAL	6	15.0
CERVICO-THORACIC	1	2.5
THORACIC	25	62.5
THORACO-LUMBAR	2	5.0
LUMBAR	4	15.0
SACRAL	1	2.5

TABLE -11

METHOD OF PRESENTATION OF LESIONS:

NATURE OF LESION	NO OF PATIENTS	PERCENTAGE %
SKIP LESION	2	5
CONTIGUOUS	38	95

TABLE -12

TOTAL NO OF VERTEBRAE INVOLVED BY POTT'S DISEASE IN 40 PATIENTS:

VERTEBRA	NO OF TIMES- EACH VERTEBRA INVOLVED	
C1	1	
C2	1	
C3	3	
C4	2	
C5	4	
C6	4	
C7	3	
T1	1	
T2	3	
T3	2	
T4	3	
T5	8	
T6	8	
T7	3	
T8	5	
T9	9	
T10	9	
T11	8	
T12	4	
L1	2	
L2	2	
L3	2	
L4	5	

L5	4	
S1	-	
S2	1	
S3	1	
S4	-	
S5	-	
	TOTAL	97

TABLE – 13

TOTAL NO OF VERTEBRAE INVOLVED IN 40 PATIENTS:

NO OF VERTEBRAE INVOLVED	NO OF PATIENTS	PERCENTAGE %
1	1	2.5
2	29	72.5
3	6	15
4 OR >4	4	10

TABLE -14

RADIOGRAPHIC CHARACTERISTICS AT PRESENTATION:

RADIOGRAPHIC CHARACTERS	NO OF PATIENTS	PERCENTAGE %
DISEASE APPARENTLY ACTIVE	38	95
DISEASE APPARENTLY HEALED	2	5

TABLE -15

DURATION OF NEUROLOGICAL SYMPTOMS AT PRESENTATION:

DURATION OF NEUROLOGICAL SYMPTOMS	NO OF PATIENTS	PERCENTAGE %
NEUROLOGICALLY NORMAL	1	2.5
1MONTH	-	-
2MONTHS	1	2.5
3MONTHS	4	10.0
4MONTHS	7	17.5
5MONTHS	7	17.5
6MONTHS	14	35.0
>6MONTHS	6	17.5

TABLE -16

DURATION OF ATT DRUGS TAKEN AT PRESENTATION/TAKEN BEFORE SURGERY:

DURATION OF ATT DRUGS COMPLETED	NO OF PATIENTS	PERCENTAGE %
CONSERVATIVE	14	
1MONTH	2	14.29
2MONTHS	6	42.86
3MONTHS	4	28.58
4MONTHS	2	14.29
5MONTHS	-	-
SURGERY	26	
1MONTH	1	3.85
2MONTHS	13	50.00
3MONTHS	8	30.77
4MONTHS	1	3.85
5MONTHS	-	-
6MONTHS	1	3.85
>6MONTHS	2	7.69

TABLE -17

VARIOUS SURGICAL PROCEDURES DONE BY US:

SURGICAL PROCEDURE	APPROACH	NO OF PATIENTS	PERCENTAGE %
COLD ABSCESS-I&D		1	3.85
LAMINECTOMY		5	19.23
ANTERIOR STABILISATION PROCEDURE – CORPECTOMY +CAGE FIXATION WITH RIB GRAFT	TRANSTHORACIC EXTRAPLEURAL	9	34.62
	TRANS THORACIC EXTRAPERITONEAL	1	3.85
ANTERIOR CERVICAL APPROACH		2	7.69
POSTERIOR LATERAL DECOMPRESSION	COSTO TRANSVERSECTOMY	8	30.77

**TABLE -18**  
**VARIOUS APPROACHES AND SURGERY AT VARIOUS LEVELS:**

SURGICAL APPROACH	LEVEL AT WHICH SURGERY DONE	NO OF PATIENTS	
LAMINECTOMY			
	CERVICAL	1	
	THORACIC	1	
	LUMBAR	2	
	SACRAL	1	
ANTERIOR CERVICAL CORPECTOMY – STABILISATION WITH ILIAC BONE GRAFT AND CSLP		2	
TRANSTHORACIC TRANSPLEURAL	THORACIC	9	
TRANSTHORACIC EXTRA PERITONEAL	LUMBAR	1	
COSTO TRANSVERSECTOMY	THORACIC	8	

**TABLE -19**  
**INTRAOPERATIVE FINDINGS:**

NATURE OF LESION	NO OF PATIENTS	PERCENTAGE %	
PUS	24	92.31	
GRANULATION TISSUE	21	80.77	
SEQUESTERATED			

BONE	12	46.15	
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TABLE -20

COMPLICATIONS:

COMPLICATIONS ENCOUNTERED	NO OF PATIENTS	
<b>IMMEDIATE</b>		
DURAL TEAR-CSFLEAK	2	
BASAL PNEUMONITIS	1	
CONSOLIDATION	1	
LUNG COLLAPSE	1	
AUTONOMIC DYSFUNCTION - HYPOTENSION	1	
ACUTE RENAL FAILURE	1	
CARDO RESPIRATORY ARREST	2	
<b>DELAYED</b>		
WOUND INFECTION	9	
DELAYED SINUS FORMATION	2	
URINARY TRACT INFECTION	6	
HERPES ZOSTER	1	
HEPATITIS	2	
PARALYTIC ILEUS	2	
PRESSURE SORES	5	

TABLE -21

DURATION OF INPATIENT CARE:CONSERVATIVE & SURGERY:

DURATION OF INPATIENT CARE	NO OF PATIENTS	PERCENTAGE %
NEVER ADMITTED TO HOSPITAL	10	25
<2WEEKS	4	10
2-4 WEEKS	10	25
1-2 MONTHS	14	35
>2MONTHS	2	5
MORTALITY	4	10

TABLE -22

FOLLOW- UP:

DURATION OF FOLLOW -UP	NOOF PATIENTS	PERCENTAGE %
0-6 MONTHS	4	10
6-12MONTHS	6	15
12-18MONTHS	12	30
18-24MONTHS	8	20
24-36MONTHS	10	25

TABLE -23

POST TREATMENT : IMPROVEMENT OF NEUROLOGICAL STATUS:

NEUROLOGICAL STATUS		TREATMENT			
		SURGERY		CONSERVATIVE	
		NO. OF PATIENTS	%	NO. OF PATIENTS	%
BACK PAIN	1. NOT IMPROVED	6	23.1 %	3	21.4 %
	2.IMPROVED	20	76.9 %	11	78.6 %
MOTOR POWER	1.NOT IMPROVED	6	23.1 %	3	21.4 %
	2.IMPROVED	20	76.9 %	11	78.6 %
SENSORY	1.NOT IMPROVED	4	15.4 %	2	14.3 %
	2.IMPROVED	22	84.6 %	12	85.7 %
BLADDER/BOWEL	1.NOT INVOLVED	20	76.9 %	9	64.3 %
	2.STATIONAR Y	2	7.7%		
	3.IMPROVED	4	15.4 %	5	35.7 %
OUTCOME	1.UN FAVOURABLE	4	15.4 %	6	42.9 %
	2.FAVOURAB LE	22	84.6 %	8	57.1 %

TABLE -24

OUTCOME STATUS: CONSERVATIVE TREATMENT - 14 PATIENTS

OUTCOME	NO OF PATIENTS	PERCENTAGE
FAVOURABLE	8	57.14
STILL NOT FAVOURABLE	3	21.43
UNFAVOURABLE	3	21.43

TABLE -25

OUTCOME STATUS: SURGERY – 26 PATIENTS

OUTCOME	NO OF PATIENTS	PERCENTAGE
FAVOURABLE	22	84.6
STILL NOT FAVOURABLE	2	7.7
UNFAVOURABLE	2	7.7

TABLE -26

OUT-COME ANALYSIS -: CHI SQUARE TEST:

		TREATMENT				significance
		SURGERY		CONSERVATIVE		
		no. of patients	%	no. of patients	%	
AGE IN GROUP	11-20	9	34.6 %	2	14.3 %	$\chi^2=6.75$ P=0.15
	21-30	6	23.1 %	2	14.3 %	
	31-40	3	11.5%	3	21.4 %	
	41-50	6	23.1 %	2	14.3 %	
	51-60	2	7.7%	5	35.7 %	
GENDER	male	13	50.0 %	4	28.6 %	$\chi^2=1.71$ P=0.19
	female	13	50.0 %	10	71.4 %	
HYPERTENSION	no	21	80.8 %	9	64.3 %	$\chi^2=1.32$ P=0.25
	yes	5	19.2 %	5	35.7 %	
DIABETES	no	22	84.6 %	10	71.4 %	$\chi^2=0.99$ P=0.32
	yes	4	15.4 %	4	28.6 %	
H/O TRAUMA	no	20	76.9 %	11	78.6 %	$\chi^2=0.01$ P=0.91
	yes	6	23.1 %	3	21.4 %	
DURATON OF SYMPTOMS BEFORE SURGERY	< 6 months	22	84.6 %	12	85.7 %	$\chi^2=0.01$ P=0.92
	> 6months	4	15.4 %	2	14.3 %	
DURATION OF ATTDUGS BEFORE	< 3 months	23	88.5 %	12	85.7 %	$\chi^2=0.06$

<b>SURGERY</b>	<b>&gt; 3 months</b>	<b>3</b>	<b>11.5%</b>	<b>2</b>	<b>14.3%</b>	<b>P=0.80</b>
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**TABLE -27**

**OUT-COME ANALYSIS: TREATMENT – CONSERVATIVE VS SURGERY**

	<b>TREATMENT</b>				<b>SIGNIFICANCE</b>	
	<b>SURGERY</b>		<b>CONSERVATIVE</b>			
	<b>no. of patients</b>	<b>%</b>	<b>no. of patients</b>	<b>%</b>		
<b>PRE OP-MOTOR GRADE</b>	<b>0</b>	<b>1</b>	<b>3.8%</b>	<b>1</b>	<b>7.1%</b>	<b>χ2=1.49 P=0.83</b>
	<b>3</b>	<b>5</b>	<b>19.2%</b>	<b>3</b>	<b>21.4%</b>	
	<b>4</b>	<b>17</b>	<b>65.4%</b>	<b>9</b>	<b>64.3%</b>	
	<b>4+</b>	<b>1</b>	<b>3.8%</b>	<b>1</b>	<b>7.1%</b>	
	<b>4-</b>	<b>2</b>	<b>7.7%</b>			
<b>Group Total</b>		<b>26</b>	<b>100.0%</b>	<b>14</b>	<b>100.0%</b>	

**TABLE -28**

	<b>TREATMENT</b>		<b>SIGNIFICANCE</b>
	<b>SURGERY</b>	<b>CONSERVATIVE</b>	

		no. of patients		no. of patients	%	
POST OP POWER	0	3	11.5%	2	14.3%	$\chi^2=0.95$ P=0.92
	3	4	15.4%	2	14.3%	
	4	9	34.6%	3	21.4%	
	4+	9	34.6%	6	42.9%	
	5	1	3.8%	1	7.1%	

**TABLE -29**

**OUT-COME ANALYSIS: TREATMENT –  
CONSERVATIVE VS SURGERY:**

		TREATMENT				Significance
		surgery		conservative		
		No. Of patients	%	no. of patients	%	
BACK PAIN	Not improved	6	23.1%	3	21.4%	$\chi^2=0.01$ P=0.91
	Improved	20	76.9%	11	78.6%	
MOTOR POWER	Not improved	6	23.1%	3	21.4%	$\chi^2=0.01$ P=0.91
	Improved	20	76.9%	11	78.6%	
SENSORY	Not improved	4	15.4%	2	14.3%	$\chi^2=0.09$

<b>BLADDER/BOWEL</b>	<b>Improved</b>	<b>22</b>	<b>84.6</b> <b>%</b>	<b>12</b>	<b>85.7</b> <b>%</b>	<b>P=0.93</b>
	<b>Not involved</b>	<b>20</b>	<b>76.9</b> <b>%</b>	<b>9</b>	<b>64.3</b> <b>%</b>	
<b>OUTCOME</b>	<b>Stationary improved</b>	<b>2</b>	<b>7.7%</b>			<b>χ<sup>2</sup>=2.94</b> <b>P=0.23</b>
		<b>4</b>	<b>15.4</b> <b>%</b>	<b>5</b>	<b>35.7</b> <b>%</b>	
	<b>Un favorable</b>	<b>4</b>	<b>15.4</b> <b>%</b>	<b>6</b>	<b>42.9</b> <b>%</b>	<b>χ<sup>2</sup>=3.84</b> <b>P=0.05</b> <b>Significant</b>
	<b>favorable</b>	<b>22</b>	<b>84.6</b> <b>%</b>	<b>8</b>	<b>57.1</b> <b>%</b>	

**TABLE -30**

**MULTIVARIATE LOGISTIC REGRESSION ESTIMATE OF ADJUSTED ODDS RATIO:**

	<b>SIGNIFICANCE</b>	<b>ODDS RATIO</b>	<b>95% CONFIDENCE INTERVAL</b>
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<b>TYPE OF TREATMENT SURGERY VS CONSERVATIVE</b>	<b>.048</b>	<b>5.37</b>	<b>2.02</b>	<b>10.28</b>
<b>DURATION OF SYMPTOMS BEFORE TREATMENT &lt; 6 MONTHS VS &gt; 6 MONTHS</b>	<b>.035</b>	<b>16.1</b>	<b>10.06</b>	<b>22.82</b>
<b>PRE MOTOR GRADE 0 VS OTHERS</b>	<b>.040</b>	<b>1.80</b>	<b>1.23</b>	<b>7.495</b>

**TABLE -31**

**COMPARISON OF CLINICAL HEALING BY CONSERVATIVE TREATMENT EXPRESSED AS PERCENTAGES:**

<b>REGIME OF TREATMENT</b>	<b>MORTALITY</b>	<b>NEURAL RECOVERY</b>	<b>CLINICAL HEALING</b>
<b>ORTHODOX PRE-ANTIMICROBIAL Alvik(1949) Fellander (1955)</b>	<b>30 -50</b>	<b>40-60</b>	<b>33 - 44</b>

Bakalim(1960) Kaplan (1959)				
CONSERVATIVE AMBULATORY (DUAL DRUGS) Konstam and Blesovsky (1962) Dickson (1967) Prabakar (1989)	5 - 15	60-70	83 - 90	
CONSERVATIVE NON AMBULATORY(TRIPLE DRUGS) Stevenson and Manning (1962) Friedman (1966)	0 - 10	60 -80	93 -96	
MIDDLE PATH REGIME Roaf (1958) Tuli and Kumar (1971)	0 - 10	75-80	95	
IN OUR SERIES	14	57	71.4	

TABLE -32

COMPARISON OF CLINICAL HEALING BY SURGICAL  
TREATMENT EXPRESSED AS PERCENTAGES:

REGIME OF TREATMENT	MORTALITY	NEURAL RECOVERY	CLINICAL HEALING
UNIVERSAL SURGICAL EXTIRPATION			

Hodgson and Wilkinson (1961) Stock (!962) Paus (1964) Prabakar (1989)	0 -10	75 - 80	80-96
Donaldson and Marshall (1965)	2	86	90
Adendorff and Boeke (1987)	4	92	96
MIDDLE PATH REGIME Roaf (1958) Tuli and Kumar (1971-2000)	0 - 10	75-80	95
Louis and Cheng (1994)	9	55	73
IN OUR SERIES	11.5	84.6	88

## PROFORMA

### PATIENT DATA:

Case No :

Name :

Age/ Sex :

IP No:

Address:

Date of admission:

Date of Surgery:

Date of Discharge:

### CLINICAL DATA:

#### HISTORY :

##### CHIEF PRESENTING SYMPTOMS;

- 1.Back pain./Neck pain.
- 2.Weakness of limbs
- 3.Sensory disturbances.
- 4.Bladder/bowel disturbances.

##### ASSOCIATED SYMPTOMS:

- 1.Fever.
- 2.Weight loss.
- 3.Loss of Appetite.
- 4.Cough With expectoration.
- 5.Headache.

##### H/O TRAUMA.

##### PAST HISTORY:

1. H/O TUBERCULOSIS.

2. H/O COLD ABSCESS.
3. CERVICAL LYMPHADENOPATHY.
4. TB MENINGITIS.
5. H/O PREVIOUS SURGERY.

PERSONAL HISTORY:

H/O HYPERTENSION, DM ,ANEMIA, SEIZURE,  
AND CHRONIC FATIGUE SYNDROME.

FAMILY HISTORY:

H/O TUBERCULOSIS IN THE FAMILY.

OCCUPATIONAL HISTORY:

DRUG HISTORY:

H/O CHRONIC DRUG INTAKE i.e, tuberculosis

ON EXAMINATION:

- 1.General examination
- 2.Higher Functions.
- 3.Cranial nerves Examination.

SPINOMOTOR SYTEM:

	RIGHT	LEFT
UPPER LIMB		
1.TONE		
2.NUTRITION		
3.POWER		
	SHOULDER	
	A.Flexion	
	B.Extention	
	C.Adduction	
	D.Abduction	

ELBOW

- A.Flexion
- B.extension

WRIST

- A.Flexion.
- B.Extension

FINGER GRIP

LOWER LIMB

- 1.TONE
- 2.NUTRITION
- 3.POWER

HIP

- A.Flexion.
- B.Extension.
- C.Adduction
- D.Abduction.

KNEE

- A.Flexion.
- B.Extension

ANKLE

- A.Dorsiflexion.
- B.Plantar flexion.
- C.Inversion.
- D.Eversion.

TOES

- A.Dorsiflexion.
- B.Plantar flexion.

SENSATION:

RIGHT

LEFT

## UPPER LIMB

TOUCH

PAIN AND TEMPERATURE

VIBRATION AND POSITION SENSE

## LOWER LIMB

TOUCH

PAIN AND TEMPERATURE

VIBRATION AND POSITION SENSE

## PERINEAL SENSATION

## REFLEXES:

### SUPERFICIAL REFLEXES

RT

LT

1. Corneal

2. Conjunctival

3. Pharyngeal

4. Abdominal

5. cremasteric in males

6. Plantar

### DEEP TENDON REFLEXES

1. Jaw jerk

2. Biceps

3. Supinator

4. Triceps

5. Knee

6. Ankle.

## STRAIGHT LEG RAISING TEST:

## CROSSED SLR TEST:

## PATRICK'S TEST:

GAIT:

LOCAL EXAMINATION:

Spine tenderness

Muscle spasm

Gibbus

Kyphosis/Scoliosis

Scar

Neuro cutaneous markers.

Peripheral Nerve thickening.

DIAGNOSIS

INVESTIGATIONS

1. BASIC BLOOD INVESTIGATIONS

2. X-RAY CHEST –PA VIEW.

3. X-RAY CERVICAL/THORACIC/

LUMBO –SACRAL SPINE AS REQUIRED.

4.CT SPINE

5.MRI SPINE

DURATION OF ATT DRUGS TAKEN AT PRESENTATION;

DURATION OF NEUROLOGICAL SYMPTOMS

TREATMENT:

CONSERVATIVE : DRUG REGIME

## MOBILISATION WITH CORSET.

### SURGERY:

1.COLD ABSCESS – INCISION & DRAINAGE

2.LAMINECTOMY

3.ANTERIOR CERVICAL APPROACH - CORPECTOMY  
+CAGE FIXATION WITH ILIAC BONE GRAFT.

4.ANTERIOR LATERAL THORACOTOMY –CORPECTOMY  
+CAGE FIXATION WITH RIB GRAFT.

5.COSTO-TRANSVERSECTOMY.

### INTRA-OPERATIVE FINDINGS:

POST-OPERATIVE EVENTS;  
COMPLICATIONS:

NEUROLOGICAL STATUS:

### CONDITION AT DISCHARGE:

NEUROLOGICAL STATUS:

### FOLLOW-UP



