A STUDY ON ANTERIOR DECOMPRESSION & STABILISATION OF DORSOLUMBAR SPINE BURST FRACTURES AND CARIES SPINE

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The request for an approval from the Institutional Ethical Committee (IEC) was considered on the IEC meeting held on 25.11.2005 at 2 P.M in Government General Hospital, Deans, Chamber, Chennai-3.

The members of the Committee, the Secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

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CERTIFICATE

This is to certify that this dissertation entitled **"A STUDY ON ANTERIOR DECOMPRESSION & STABILISATION OF DORSOLUMBAR SPINE BURST FRACTURES AND CARIES SPINE"** *submitted by* ***Dr. S.Raja Durai*** *appearing for Part II, M.S. Branch II – Orthopaedic Surgery degree examination in March 2009 is a bonafide record of work done by him under my direct guidance and supervision in partial fulfillment of regulations of The Tamil Nadu Dr.M.G.R. Medical University, Chennai.*

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INTRODUCTION

Spine is one of the intriguing regions in Orthopeadics where treatment for its pathology has drawn much controversy. Before the dawn of 20th century spine injuries were treated non-operatively. Later Harrington revolutionized spine care and rehabilitation with introduction of posterior instrumentation. Since then surgical techniques and instruments have proliferated to improve anatomical reduction and alignment of spinal column. But neurological recovery remained mostly unchanged over the results of non operative treatment. However root function and spinal cord function , in selected patients can be improved with appropriate surgery.

Dorsolumbar region constitutes the second most common site for spine fractures and burst fractures constitute 60% of dorsolumbar fractures.

Though the treatment of burst fractures associated with neurological injury is controversial, many investigators have reported favourable results with anterior decompression and stabilization surgery.

The other major pathology of spine for which anterior decompression and stabilization surgery is favoured at present is Caries spine.

WHO has declared TB as a global emergency in 1993 because it is out of control in many countries. In India approximately 10 million cases of tubercurlosis exists. 1-3% of of the 10 million have involvement of bone and joints. The commonest skeletal lesion is the vertebral lesion which accounts for 50% of all bone and joint tuberculosis.

The advent of modern day multi drug chemotheraphy has drastically changed the management and the results of the disease. chemotheraphy could eradicate the disease completely but cannot prevent the development of kyphotic deformity or neurological deficit precipitated by cord compression. The commonly used method of placing anterior strut grafting in the decompressed region corrects the deformity but could not maintain it because of graft resorption.Based on Oga et al study instrumentation started to be used even during active disease to prevent deformity. Anterior instrumentation was found to be more advantageous than posterior though it was away from disease focus, in many studies.

HISTORY

TB SPINE

1779 Sir Perceival Pott 1st gave detailed account of caries spine

1896 Chipault is 1st use laminectomy in pott's paraplegia

1894 Costro transversectomy was developed by menard and it has became absolute because of high incidence of sinus & secondary infections.

1917 Calve devised a method to aspirate contents of an absences without sinus formation.

1933 Norman capener did surgery involving excision of part of lamina and pedical from one side to enter spinal cord anteriolly & remove cause of pressure on the cord.

1934 Ito et al developed an approach similar to anterolateral approach for curretage of vertebral body for tuberculosis.

1947 Pott & Alexander evolved anterolateral decompression surgery, a modification of capener's operation here no lamina was removed but part of vertibral body was removed to access the spinal cord.

1956 Hodgson 1st introduced the concept of anterior decompression and stabilization through transthoracic approach.

DORSOLUMBAR BURST FRACTURE IN SPINE

3000 BC spine trauma was described by Edwin smith papyrus

625-690AD Paul of Aegina 1st introduced laminectomy for spinal cord injury unaware of controversy it would cause.

1930 Munro & Erwin advised laminectomy be delayed and reserved for selected patients only.

1920 Guttman condemned routine use of laminectomy and advocated conservative programme of postural reduction by extension of spine.

1963 Holdoworsh & Hardy agreed upon dangers of laminectomy and preferred early open reduction and internal fixation.

1975 Paul & Colleagues 1st described transthoracic approach to trauma spine.

1981 Techniques of transthoracic surgery & results are 1st published by Bohlman and associates.

Late 1980s Sophisticated anterior spine plate systems were developed for instrumentation.

AIM

To evaluate the effectiveness of anterior decompression & stabilisazion of dorsolumbar spine in terms of

1. Neurological recovery
2. Kyphotic angle correction
3. Bone graft fusion
4. Pain scale of denis
5. Work scale of denis

ANATOMY

The normal thoracic kyphosis ranges between 18 and 51 degrees and lumbar lordosis ranges between 42 and 74 degrees

Anterior elements

The vertebral bodies of thoracic and lumbar spine are relatively similar in cylindrical configuration although their dimension increase from cranial to caudal. Intervertebral disc height also progressively increase from cranial to caudal.

Disc

- Act as fluctuant shock absorbers
- Configuration of disc contributes to curvature of vertebral column, being thicker on convex side of curve of vertebral column.
- Maximum elasticity is present upto 3rd decade of life.
- Undergoes pressure of 10 to 15 Kg per Sqcm in standing position that decreases upto 50% in recumbent position.

Anterior longitudinal ligament

- Containts 2 layers - Superficial layer span several vertebra deeper fibers connect adjacent vertebra.
- Main function to restrict extension of spinal column.

Posterior longitudinal ligament

- Containts 2 layers - but it functions to limit over distraction of disc space during flexion.

POSTERIOR ELEMENTS

Pedicle

- Arises from posterior superior aspect of vertebral body - connecting anterior elements to posterior neural arch.
- Relatively thick cortex and short tubular morphology makes the pedicles the strongest portion of the vertebrae and an uncommon site of fracture.
- From each pedicle, laminae extend posteromedially to fuse in the midline to give rise to a spinous process.

Posterion ligament complex

- The ligamemtum flavum - elastic, yellow, collagenous tissue that spans interlaminar space.

- The stronger and more fibrous interspinous and supraspinous ligaments connect the spinous processes.

- Its integrity is critical to stability after trauma

Transverse processes

- Extend laterally from the junctional pedicle superior articular process and the pars interarticularis

- Important sites for ligamentous and paraspinal muscle attachments.

- Each costovertebral junction is stabilized by ligaments that attach to two adjacent vertebral bodies, as well as the transervers processes.

- This interaction is responsible for much of the increased stability of the thoracic spine compared to the cervical and lumbar spines.

Facets or Zygapophyseal joints

- Complex synovial articulations between the posterior elements of adjacent vertebrae.

- Coronal plane orientation in the upper and middle thoracic spine provides greater resistance to anteroposterior translation.

- While the more sagittaly oriented joints of the lower thoracic and upper lumbar spine allow greater flexion-extension flexibility with more resistance to medial-lateral translation.

SPINAL CANAL AND CANAL COMPROMISE

- Anterior borders: vertebral body, intervertebral disc, posterior longitudinal ligament.
- Lateral borders: pedicles, medial aspect of facet joints .
- posterior borders: ligamentum flavum, laminae.

Spinal canal compromise is most commonly due to posterior bony retropulstion from a burst fracture of the vertebral body, less commonly due to anteriorly displaced, lamina fracture Hematomas and disc hemiations, TB abscess, granulations are potential nonbony sources of neural compression.

BLOOD SUPPLY TO SPINAL CORD

One anterior and two posterior spinal arteries supply these spinal cord. Anterior spinal artery supplies anterior 2/3 of spinal cord and posterior 1/3 supplied by posterior spinal artery. Both arteries are supplied by anterior and posterior radicular arteries which enter spinal canal throuth intervertebral foramina. These radicular arteries derive blood from respective level arteries like vertebral artery inter costal arteries ileolumbar arteries and sacral artery of importants is the

arteria radicular aris magna or great spinal artery of Adam Kiewize which orginates from left intercostel or lumbar artery between T9 to L2 where it joins nerve root sleeve and becomes intradural. The knowledge of the course of the artery is important while doing anterior approach lest it may be injured resulting in permanent neurologic deficit.

T2 to T10 is watershed zone deriving its proximal blood supply from antegrade vessels in upper thoracic spine and distally form retrograde flow from artery of Adam Kiewize.

THORACOLUMBAR SPINE MOTION (WHITE AND PUNJABI ET AL)

Flexion and extention of 4 degrees permitted at each intervertebral level where as 12 degrees allowed in D12-L1 level and 15degrees at each lumbar level.

Lateral bending decreases from 8 degrees in thoracic spine to 2 degrees in upper lumbar segments.

Axial rotation at T1 to T8 is 8 and T9 to L5 is 2 degrees

CLASSIFICATION

Based on Holdsworth's work, Kelly & Whitesides developed 2 column concepts.

1. Anterior column: Anterior and posterior longitudinal ligaments, vertebral body, disc.
2. Posterior column: Posterior neural arch, Facet joints and posterior ligament complex.

DENIS CLASSIFICATION

Based on 3 column concepts. Types

1. Compression fracture
2. Burst fracture
3. Chance fracture
4. Fracture dislocation

Burst fracture

It is further subdived by denis into 5 types.

A. Both endplates affected

B. Superior endplate only affected

C. Inferior endplate affected

D. Type A plus with some rotation

E. Type A plus lateral translation of vertebra

AO CLASSIFICATION

It contains 3 basic groups

A. Compressive fractures

B. Distractive fractures

C. Roatation fractures

MC CORMACK ET AL (LOAD SHARING CLASSIFICATION)

It indicates when posterior stabilization fails and the need for anterior column fixation

It gives point values to each one of these

A. Communition

B. Apposition of bony fragments

C. Kyphosis

It score is >6 than anterior stabilization is needed.

CARIES SPINE

CLASSIFICATION

Depending on Location

- Paradiscal - involves inferior endplate of superior vertebra, disc and superior end plate of inferior vertebra.
- Central type - Vertebral body is involved some times it goes for concentric collapse or balooned out
- Anterior type - infection starts beneath the anterior longitudinal ligament
- Appendicial type - Posterior arch elements are effected
- Synovial type - Affects synovium of atlanto axial joints and facet joints

Classification of tuberculous paraplegia
(Griffith, Seddon and Roaf)

Group A Early onset paraplegia

Occures in acute phase of disease, with in 2 years of onset of disease

Compression of spinal cord is due to edema, granulation tissue, abscess

Ischemia of cord also causes early onset paraplegia

Group B	Late onset paraplegia Occures 2 years after onset of disease Due to recurrence of disease or mechanical pressure on cord which is due to tuberculous debris or sequestra, internal gibbus, vertebral canal stenosis

Classification of tuberculous paraplegia (Goel, Tuli, Kumar)

Type I	Patient is not aware of any motor weakness Physician detects plantar extensor / ankle clonus
Type II	Patient is aware of motor deficit but manages to walk with support
Type III	Patient is bedridden and cannot walk because of paralysis in extention Sensory deficit is < 50%
Type IV	Type III features plus flexor spasms or paraplegia in flexion or flaccid paralysis or sensory deficit > 50% or sphincter involvement is present

BIO-MECHANICS

According to Punjab et al >2.5 mm translation is present between any two adjacent vertebra indicates instability

PATHO-MECHANICS

Flexion force

If centre of rotation is near posterior longitudinal ligament compressive load acts on anterior spine and distractive force acts on posterior spine.

If the centre of rotation is anterior to vertebral body distractive force acts on both anterior and posterior spinal elements (eg. Seat belt injury).

Extension force

Less common then flexion injuries it produces tensile force on anterior spine and compressive force on posterior spine.

Axial load,

It associated with extension load, causes characteristic burst fracture.

BIOMECHANICS OF SPINE INSTRUMENTATION

Spinal implants are used to apply, corrective forces, to maintain the correction achieved, and to provide the necessary rigidity to optimize rates of arthrodesis. All spinal implants serve as temporary internal splints. The failure to achieve union will result in prolonged cyclical loading which ultimately results in fatique failure of the implant. These devices share loads with the spine in a dynamic relationship in which the implant initially bears most of the load. Implant loading gradually diminishes as healing progresses and should be minimal after consolidation of the fusion mass.

Via their attachment sites to the spine both anterior and posterior implants may apply corrective forces including distraction, compression and translation.

Posterior implants gain purchase through placement of hooks on the pedicles, laminae, or transverse process or by threading of wires around the lamina or through the bases of the spinous process and by placement of transpedicular screws.

Posterior fixation, works at an increasing distance from the axis of intervertebral rotation, affords greater, leverage and resistance to motion about the instantaneous axis of rotation. Inadequate anterior

column support however, leads to a potentially unstable mechanism and an instrumentation load - bearing configuration.

Anterior devices generally rely on single vertebral body screws. As the bone-implant interface is within the cancellous vertebral body, these systems may be inherently less stable than posterior constructs. Mechanical studies assessing anterior vertebral screws have revealed maximal stability is achieved with bicortical purchase but with the addition of a staple penetration of far cortex is not necessary.

EVOLUTION OF ANTERIOR SYSTEM:

The first system was developed by Dwyer and included vertebral body screws and a braided titanium cable, used in scoliosis correction. Significant loss of correction occurred in upto 40% of patients. The flexibility of the system resulted in nonunion in upto 33% of cases.

Second system is the Zielke system, which used a semi-rigid, 3.2 mm threaded rod. This method relies on compression.

The need for further refinement led to the solid rod systems. The first was the Texas Scottish Rite Hospital (TSRH) system. A solid rod (4.8mm or 6.4mm) is precontoured and placed within the screws and tightened.

Most recently the dual rod constructs have been developed to further enhance rigidity while restoring the sagittal contour. The Kaneda multi- segmental system used two semi-rigid, 4mm rods that are attached to triangulated vertebral body screws. The screws are placed through a vertebral plate at each level, improving the pull out strength by 50%.

Oga et al,(1993) have conducted a study using six stainless steel discs and proved that biofilm formation by tubercule bacilli is less, so that antibacterial drug penetration on the tuberculosis bacillus is more and that implant can be used in a tuberculous focus, without an increase in the risk of infection.

BURST FRACTURE

Neurological Injury pattern:

Retropulsion of middle column bone fragments is pathognomic of thoracolumbar burst fractures and represents the major risk to the neural structures. As the cord ends at L1, and the cauda equina roots cascade off the cord over many segments closely approximated to the distal end of the cord, a variety of neurological structures may be damaged - with a variety of neurological abnormalities. Whilst cord injuries are frequently regarded as complete (total loss of cord function), and incomplete, the certainty of outcome of neural function does exist for cauda equina injuries, where the roots behave more like peripheral nerves with potential for later recovery.

Severe neural injuries above L1 will damage the lower spinal cord resulting in an upper motor neurone picture of spastic paralysis. Similar severe neural injuries below L1 may result in a lower motor neurone flaccid paralysis. Neural injuries between these two extremes may result in complex patterns of injury further complicated when lesions are incomplete. An interesting variation, usually associated with L1 injuries, is the conus paraplegic. Injury to the tip of the cord, the conus, results in paralysis of the sacral segment. Loss of bladder

and bowel control occurs, yet the patient's cauda equina roots originating proximal to the conus may be spared, given near normal lower limb function. If the conus injury is severe the sacral paraplegia will be of a lower motor neurone variety, with disruption of the reflex arc, and thus a different pattern of bladder and bowel control failure. This pattern of injury also results in failure to achieve erection in the male.

SPINAL CORD INJURY:

The role of surgery in the treatment of both neurologically impaired and intact patients is controversial. Cord injury consists of the primary contusion, secondary injury due to cellular changes at the injury site, and the effects of ongoing neural compression. The first mechanism is amenable only to preventative treatment. The secondary injury response is under intensive investigation for effective agents that may modify this process. The use of Methylprednisolone in the immediate post injury phase has been shown to improve outcomes in the NASCIS studies (Bracken et al 1990), but this improvement has not been substantiated in other studies and its role remains controversial. The role of surgery for any ongoing compression remains controversial. It is intuitively attractive to consider that decompression of damaged and compressed neural structures could reduce cellular and neuronal deformity, decompress vascular

structures and decompress cells and neurones in the cord. Clinical studies have suggested that effective cord decompression after injury is associated with improved outcomes. A number of authors have suggested that anterior decompression results in better neural recovery than non-operative treatment or posterior decompression (Clohisy [1992], Bohlman [1992], Bradford [1987], McAfee [1985], Transfeldt 1990). Gertzbein (1992) summarized this data by suggesting that although non-operative treatment is associated with improved neural function, anterior decompression is associated with more rapid and better neurological recovery. Unfortunately review of these studies reveals that the methodology does not stand up to the vigorous evaluation required for evidence-based practice.

CONSERVATIVE OR SURGICAL TREATMENT:

Equally effective neural recovery has been demonstrated with conservative management of these injuries (Katoh 1996) and critical literature reviews have cast doubt about the real benefit of surgical decompression (Boerger 2000). In reality the role of surgical decompression is likely to remain unclear, and the ever present call for randomised prospective studies remain unfulfilled. What is clear is that late decompression, once natural recovery has ended, is associated with further improvement in neural function (Transfeldt

1990). The role of active decompression is also supported by animal studies (Fehlings 1999), where a meticulously controlled experimental environment can be developed. Such studies have shown benefit from early and late decompression.

ANTERIOR OR POSTERIOR SURGERY:

Accepting the defects of clinical evidence, many practitioners will use the evidence from late decompression, or from animal studies, to justify early decompression in spinal cord or cauda equina injuries. As noted above the evidence suggests anterior decompression will be more effective for anterior neural compression such as occurs in a burst fracture. The disadvantage of posterior approaches to achieve anterior decompression include the need to resect major portions of the neural arch (often uninjured) to obtain access to the middle column, working around an already damaged neural structure risking increased neural damage, and ineffective anterior decompression as compared with that achievable by anterior approaches. Finally it is difficult to reconstruct the anterior and middle columns after a posterior approach has been used to decompress a burst fracture, and there is a significant incidence of construct failure (McLain 1993).

Indirect decompression by distraction in posterior approach

- Fails after first week of fracture (Rockwood ,2001)
- Depends on intact posterior longitudinal ligament and annulus fibrosis which are usually torn in burst fractures
- In the burst fracture the penetration of neighboring discs into the corpus of the vertebra will cause the delay of the union of the fracture and in this way it will lead to late device failure

MANAGEMENT OPTIONS:

Burst fractures without neurological deficit:

The management options for thoracolumbar burst fractures include non-operative and operative care. The latter can be divided into anterior, posterior or combined approaches. It is clear that in burst fractures without neural injury, there is little to choose from between non-operative care and posterior surgery with short segment pedicle fixation devices. Non-operative care can be limited to two weeks of bed rest followed by bracing and mobilization. There is often slight settling of the fracture with the development of a mild kyphosis but this does not correlate with inferior clinical results and seldom results in any clinically detectable deformity. Late pain of

significance is uncommon and the development of secondary neurological deficits is rare (Weinstein 1988).

Posterior surgery with pedicle screw constructs over a short segment stabilizes the fracture and allows early mobilization, much as non-operative regimes do. Recent prospective randomised studies comparing these two treatment options suggest there is no clinical advantage of surgery over non-operative care (Wood [2000], Shen [2001], Alanay [2001]). Surgery corrects deformity but modest recurrence is common, even with attempts to perform trans-pedicular bone grafting, as the anterior column remains deficient (Alanay 2001). It should be emphasised that this modest recurrence of kyphosis in the operated group is also not of clinical relevance. Patients who have operative treatment of thoracolumbar burst fracture from a posterior approach may require later removal of the instrumentation. This is balanced, by a very small number of these patients who, when treated non-operatively, develop disabling pain and need to have late anterior reconstruction.

Burst fractures with neural injury:

Anterior Surgery:

When neural injury does occur in association with a burst fracture, it is our preference to perform anterior surgery with

corpectomy and reconstruction. The rationale for this is that the ongoing neural compression may recover better with effective decompression. Admittedly the evidence and support of the surgical approach, as discussed above, is not absolute.

Relative indications for anterior surgery also include severe comminution, fragmentation, kyphosis and AP malalignment (Denis Type D injuries). In older patients with medical comorbidities, who sustain thoracolumbar burst fractures with significant neurology; we may well prefer a posterior approach, accepting that the patient may be more suited to a shorter less extensive surgical procedure not requiring a thoracotomy.

The advantages of anterior surgery include direct atraumatic decompression of the spinal canal when neural injury has occurred, and the ability to reconstruct the anterior column deficiency. Disadvantages of anterior surgery include the more extensive approach required, lack of familiarity to many spinal surgeons, the potential for thoracotomy pain, and the potential for pulmonary complications.

Where anterior surgery has achieved decompression via vertebral body corpectomy, the reconstruction requires an anterior

column reconstruction and the application of internal fixation to stabilize the reconstruction, normally from the vertebral body above to that below the corpectomy.

Corpectomy reconstruction options must provide support to the anterior and middle columns as the major biomechanical function. Options include autogenous bone graft, long bone allograft, and titanium mesh cages. Autologous bone graft options include iliac crest, fibula or rib. All of these have problems with donor site morbidity and non-optimum shape for reconstruction. The narrow shape of the rib and fibula may cause subsidence through the adjacent end plates. Iliac crest provides the best option, and has been successfully used in large series (Kaneda 1997). However iliac crest may be limited in supply, of poor structure and shape, and result in major iliac crest deformity. Occasional translational instability after the use of iliac crest grafting has led to the use of other more appropriately shaped anterior column reconstruction options.

Long bone allograft segments, packed with autograft, are a useful alternative (Finkelstein 1999). Alternatively the use of titanium mesh cages has allowed optimum biomechanical function for anterior column support, along with bone grafting with cancellous autograft, which is packed into the centre of the cage. This attractive option

allows easy contouring of the cage to fit the corpectomy site, the use of the cancellous bone resected from the fracture site, and no graft site morbidity. The cylindrical cages fit around the strong peripheral rim of the vertebral body endplate (Grant 2001), and because of their shape are resistant to translation or toggle. The serrated ends of the cage likely resist axial rotation.

. Kyphosis can be reliably corrected when necessary, and any significant kyphosis recurrence or implant settling into adjacent vertebrae is minimal and clinically unimportant. when the cage is placed obliquely at the corpectomy site surgery fails to align the proximal and distal vertebrae in both the sagittal and coronal planes. The cages are then placed in a tilted position and this has led to instrument failure and non-union.

Screws should achive bicortical fixation, sparing the discs above and below the proximal and distal vertebrae. Such constructs minimize the reconstruction length and the length of the fused segment.

CARIES SPINE

The commonest age of occurrence is the first three decades of life but it can occur at any age and has been reported from 1st year of life to among those 80 years old. The disease occurs most frequently in both the sexes.

In most cases, the lesion is insidious in onset and only rarely is there an acute manifestation. The most common general symptoms are weight loss, lassitude and evening rise of temperature. Locally, there is stiffness, painful restricted joint movements in all the planes and severe spasm of the surrounding muscles. If the lesion has been present for a sufficiently long time, a cold abscess occurs in the soft tissues, tracking its way through the inter muscular planes. A deformity, in the spine can be present as kyphosis along with local tenderness and proximal Lymphadenopathy.

Tuberculosis of the spine can occur

- Usually secondary to tuberculosis elsewhere by haemotogenus or lymphatic spread, most commonly through Batson's prevertebral venous plexus.

- By contiguous extension from a pulmonary abscess, commonly leading to thoracic spondylitis.

- As primary infection. This is being increasingly reported, possibly by ingested bacteria - reaching here by haematogenous route from gastro-intestinal tract.

It the lesion has been present for a sufficiently long time, a cold abscess occurs in the soft tissues, tracking its way through the inter muscular planes. Since the cold abscess is the most common and important finding for establishing the diagnosis of tuberculosis of the spine, the anatomical path of the cold abscess is of great importance. In any region, prevertebral accumulation of pus is a very noticeable feature.

A thoracic cold abscess is quit frequently prevetebral or posterior mediastinal in location. It could, however, track along the intercostals nerves to present at the following sites:

Anterior end of intercostals space

Abdominal wall behind the rectus sheath.

Midaxillary line and

Along the posterior division of the intercostals nerve lateral to the sacro.-spinalis muscle mass.

In lower thoracic lesions, below D1O, the cold abscess might take various routes. The absces can track along

Behind the lateral lumbo-costal arch of the origin of the diaphragm and present in the per nephritic space or in the layers of the anterior abdominal wall.

Behind the medial lumbo-costal arch of the origin of the diaphragm and enter the psoas sheath and present as a psoas cold abscess, palpable above the inguinal ligament or on the medial aspect of the thigh, if it traverses below the inguinal ligament.

It can go behind the median arcuate ligament of the origin of the diaphragm along the aorta and its branches and can, thus have wider sites of presentation, as the lumbar cold abscess does.

A lumbar cold abscess can spread along the aorta and its branches to present at the (1) Ischiorectal fossa (2) in the buttock, under the gluteus maximus (3) along the psoas sheath or (4) in lumbo-dorsal (Petit's) triangle. It can also track down along the femoral or obtrurator artery and present on the medial side of the

thigh; femoral triangle; popliteal fossa or on the medial side of tendo achilles.

Neurological symptoms of spinal tuberculosis may be subtle, but will progress on time. Compressive myelopathy is the most common neurological manifestation of pott's spine.

Regarding treatment, literature remains controversial. Compere and Jerome, Chandler and Page [1935] described their experiences with spinal arthrodesis through posterior approach. Mayer and Adams and Bailey (2002) et al. compared the conservative treatment to posterior arthrodesis in children, concluding that no treatment was superior to each other at the acute phase of the disease. However, in the late phases of the disease, when 3 or more vertebrae are collapsed, arthrodesis has shown to be a better approach, determining a lower kyphosis progression.

At present, surgery for those patients with neurological deficit at the acute phase of the disease is limited to cases of conservative treatment failure, fast onset, recurrent paraplegia, uncontrolled spasticity, painful paraplegia, spinal tumor syndrome, and instability confirmed by image. Anterior approach is recommended for all cases except when the posterior neural arch alone is involved or for spinal

tumor syndrome. In the late phase, surgery is recommended in cases of severe kyphosis on thoracolumbar spine.

In the conservative treatment, deformity can evolve to 15º. Of these patients, 3 to 5% present with a >60º deformity. Deformity progression has two phases: phase 1 - active phase of the disease; phase 2 - after cure. That worsening is influenced by the severity of baseline deformity, injury level and patients age. Kyphosis above 30º, thoracolumbar involvement, and age below 15 show higher potential to progress. For each destructed vertebral body, a kyphosing of 30 to 35º exists. Surgery is indicated to avoid this complication.

In surgical approach, we are faced with a new controversy: decompression and anterior, posterior or combined arthrodesis. The posterior fusion was introduced by Hibbs and Albee (1961) Decompression plus anterior fusion was introduced by Muller in 1906 and Hodgson and Stock in 1956 and became popular after Hodgson. The advantage of the posterior surgery is that it presents less morbidity, while the anterior surgery can potentially decompress vertebral channel directly, provide debridement and fix deformities.

Hodgson and Stock (1960) showed that the anterior surgery with autologous rib graft determined a more significant reduction of

the disease duration than conservative treatment alone, draining the caseous abscess and allowing for a faster bone fusion.

Govender(2002) and Ozdemir(2003) showed that homologous grafts from a bone library associated to anterior instrumentation are superior to autologous ribs grafts, presenting a lower rate of graft migration in expense of a late union.

Chen (2002) et al. and Klöckner and Valencia (2003) suggested that for 1-level tuberculosis spondyloscitis, the most effective surgery would be through anterior approach, but when 2 or more levels were affected, the best approach would be a combination of anterior and posterior. Thus, these authors reported lower kyphosis progression.

Currently, conservative treatment is provided with 3 chemotherapy drugs: Rifampicin, Isoniazide and Pirazinamide. The duration of antibiotic therapy is also controversial in literature. Moon et al.concluded, in their study in 2002, that at least 12 months of antibiotic therapy are required. Parthasarathy and Sriram (1999) et al conducted a study sponsored by the Chennai Tuberculosis Research Center (Madras) reporting that patients treated with antibiotic therapy alone for 6 months, 9 months or surgery had the same favorable

functional evolution (94%, 99% and 90%, respectively), with no statistically significant difference.

However we follow DOTS regime(RNTCP) because of its effectiveness in short course- two months intensive phase treatment with 4 drugs- isoniazid, rifampicin,pyrazinamid,ethambutol, and 4 months continuation phase with 2 drugs- isoniazid, rifampicin. Drugs should be taken thrice weekly.

The incidence of neurological involvement in patients with spinal tuberculosis is 10 - 46%

INVESTIGATIONS

RADIOGRAPHIC APPEARANCE:

Antero posterior and lateral views

The paradiscal lesions shows a reduction in disc space before osseous destruction occurs, but focal osteoporosis is seen easier than disc space reduction. One of the most important diagnostic radiological criteria is the delineation and study of paravertebral shadows.In the dorsal region, below the 4th dorsal vertebra typical fusiform ‘Bird Nest’ abscess is commonly seen.

Specific radiological appearance in the spine may include, an aneurysmal type scalloping along the anterior margin of the vertebral body, mostly as a route of cold abscess under the anterior longitudinal ligament.

‘Rarely, lateral curvature of the spine (scoliosis) may be seen but the most common is kyphotic deformity i.e., increase in the antero-posterior Curvature

AP view - detects changes in coronal alignment as well as changes in interpedicular distance and space between spinous process in burst fractures.

TB focai <1.5 cm in diameter is not visible in x-rays according to schmorl. Atleast 30-40% of calcium was been removed from particular area to show radio lucency in x-rays

Lateral view - saggital mal alignment can be studied carefully

Cobb's angle can be measured for kypotic deformity

Vertebral body height loss can be assesed

Posterior vertebral body line alignment can be measured

CT scan - demonstrate canal compromise but may miss translational deformity in axial cuts so saggital and coronal reconstruction images are needed to assess fracture fully.

MRI scan - Indicated if

Neurological deficit that either does not correspond to the level of bony or ligament injury or is present in the absence of bony or ligamental injury.

Also help to visualize disc herniations, epidural hematomas and spinal cord edema.

Both CT and MRI are used to diagnose posterior spinal disease, TB of carnio vertebral and cervico dorsal and sacro iliac joints and sacrum

SURGICAL TECHNIQUE

A) APPROACH AND POSITIONING

The patient should be in a direct lateral position, shoulders and hips perpendicular to the floor, to assist with accurate screw placement. The kidney rest is at the apex of the thoracolumbar deformity and is elevated so as to prevent the spine sagging between the chest and the pelvis when in the lateral position. In this position the abdomen of more obese patients will sag away from the spine The approach is from the left side (away from the vena cava) unless surgery is late for a mal-union where there is a coronal plane abnormality. In that situation the fracture should be approached from the concave side so as to distract that side at the time of reconstruction .

B) INCISION LEVEL

Generally the rib resected in the thoracotomy and thoracoabdominal incision should be two levels above the vertebra above the fracture (i.e. that will be instrumented proximally). It is generally easier to dissect from proximal to distal. Some variation may be required depending on the obliquity of the ribs and this should be assessed from pre-operative lateral x-rays. If the incision is not ideally placed proximal or distal ribs may be osteotomized to improve

display. Fractures of T11 and above require thoracotomy only. Fractures of T12 to L2 generally require a thoracoabdominal approach and fractures of L3 can be managed through a 12th rib incision that does not require opening of the chest.

To reach TB thoracic lesions between the seventh cervical and the fourth thoracic vertebra, a periscapular approach similar to that used for a first - stage thoracoplasty is employed. The side of the approach is usually right ride for lesion above D5.

For lesions below the level of the fourth thoracic vertebra, the approach to usually on the left side. Usually approach is thro' the ribbed 2. levels above the apex of the lesion.

For thoraco-lumbar region between the eight thoracic and third lumbar segments. The ninth rib is removed and as a rule, the diaphragm is divided along its posterior attachment.

Another satisfactory approach is described by Fey. The eleventh rib is removed, providing satisfactory access to lesions from the eleventh thoracic down to second lumbar vertebra. In this procedure for adequate exposure of the vertebral bodies the psoas muscle must be detached at its upper end and turned downward.

For disease involving the second to the fourth or fifth lumbar vertebra, the twelfth -rib incision is also used.

C) VERTEBRAL COLUMN DISSECTION

Through incision in the bed of rib index, middle finger is introduced into the pleural cavity and the opening is extended by cutting the parietal pleura and thus lung is freed from parieties.the lung is retracted anteriorly displaying aorta and any perivertebral bulge or the affected area of vertebral column. Segmental vessels should be ligated over the three levels (fracture and proximal and distal vertebrae for instrumentation). The segmental vessel should be ligated at the mid-lateral level of the vertebral body. The surgical exposure should demonstrate the anterior and lateral side of the body from where the approach is being made. In the lumbar spine the psoas needs to be mobilized. It can be dissected off the vertebral body where it originates above and below each disc. The use of a Cobb elevator along the disc will allow the psoas to be gradually diathermied away from its origin, allowing the concavity of the vertebral body wall to be displayed and the segmental vessels to be ligated. The psoas muscle may obstruct an adequate view of the vertebral body and the decompression. Once it has been mobilized the

muscle can often be held out of the way by a Steinmann pin inserted into the lower vertebra below the fracture.

In the chest, the rib head of the relevant vertebral bodies should be resected, so as to allow identification of the pedicle and the foramen, and to assist with anatomical landmark identification. Anteriorly the vertebral body should be displayed beyond the mid line. Dissection is best achieved at the level of the disc where there is minimal vascularity. The soft tissue can be then raised off the vertebral body as a sleeve. Vertebral body bleeding from adjacent vertebra is controlled with diathermy and bone wax.

D) VERTEBRECTOMY

Firstly, the disc above and below the vertebra is resected back to the posterior portion of the disc. The vertebral body is then removed at the front and the left side back to the canal. Curettes are used,. Dissection into the canal starts inferiorly and should be carried across to the opposite side so that the neural elements do not bulge out and obscure the view. The maximum compression of the neural elements is normally at the proximal level of the involved vertebral body. Dissection proceeds proximally to resect the fragment that is wedged between the two pedicles. This can be removed with curettes.

The remainder of the discs above and below the fracture are resected to demonstrate posterior longitudinal ligament.

The pedicles on each side must be identified to identify the lateral extent of the decompression. The canal above and below the relevant disc should be palpated to confirm decompression. Dissection must be far enough across the vertebral body to allow central seating of a cage or reconstruction device It is important to preserve the end plates of the adjacent vertebra. Haemostasis can be obtained with gel foam, in the canal.

E) RECONSTRUCTION

The screws of the stabilization device must be placed above and below the vertebra resected. They should be placed parallel to the relevant end plates. Additional information regarding the alignment of the discs above and below that resected can be gained by placing of a needle in the next distal disc. It is important to check the correct position of the trunk, so as that screws are placed in the correct plane. When screws are placed it is important that the screws are longer rather than shorter, so that the opposite cortex of the body is engaged to obtain maximum biomechanical strength. The corpectomy site should be distracted and this is best done with vertebral body spreaders rather than overloading the screws. The screws can be used

to stabilize the distraction when the reconstruction device is placed. Cages offer an excellent option and can be sized to fill the corpectomy space. They must be filled with bone, normally obtained from the vertebral body resection, or augmented with rib graft (Figure 8). A cage should be placed anteriorly and centrally and obviously must be clearly away from the canal normally the removal of the distraction instruments will allow adequate compression but further compression can be achieved stabilizing the vertebrectomy reconstruction device..

F) CLOSURE

Chest drains (two) are required if thoracotomy has been performed. Strong absorbable sutures can be useful to re-approximate the ribs and this is assisted by lowering of the kidney rest.

G) POST-OPERATIVE MANAGEMENT

The patient should be nursed supine and log rolled for comfort. The chest drains are removed when x-rays show that the lung is expanded and the drainage reduced.. Because anterior fixation requires stabilization in the relatively weak vertebral bodies especially in caries spine, post-operative immobilization is routine. A TLSO is then applied and maintained for three months after surgery. Patient can be mobilised out of bed after 1 week.

MATERIALS AND METHODS

Twenty two patients who were operated with anterior decompression and stabilization of thoracolumbar spine pathology in Govt. General Hospital, Chennai with follow up of minimum six months were included in the study.

Among those operated with anterior decompression and stabilization,

Dorsolumbar burst fractures - 12 cases

Caries spine - 10 cases

SEX RATIO

	Fractures	***caries spine***
Male	11	4
Female	1	6

AGE

Age	***Burst fractures***	***Caries spine***
Range	18-65 Years	10-45 Years
Mean age	34.25 Years	29.5 Years

The interval from injury to surgery was an average 18 days in burst fracture pts

The average duration of caries spine with which they presented to us was 3.2 months

MODE OF INJURY

Fall from tree	5 cases
Fall from height (buildings)	3 cases
Road traffic accidents	3 cases
Fall from ladder	1 case

Associated trauma

- bilateral calcaneal fracture and pubic rami fracture -- 1 case.
- Radial neck fracture – 1 case
- Olecreanon fracture – 1 case

In caries spine one thoracic spine involvement is associated with osteoarticular TB knee.

LEVEL OF VERTEBRA AFFECTED

Fractures	
Fracture Level	***No. of Cases***
# D8, D9	1
# D11, D12	1
#D12	3
# L1	2
#L2	3
#L3	1

caries spine	
D3,D4	2
D4	1
D5, D6, D7	1
D9, D10	1
D10, D11	1
D12, L1	3
L1, L2	1

Caries spine types

Paradiscal Type	9 cases
Central	1 case

Contiguous Caries spine Involvement:

3 vertebra involvement	1 case
2 vertebra involvement	8 cases
1 vertibra involvement	1 case

Classification of burst # by Denis type:

Denis types	*No. of cases*
A	***3***
B	***7***
C	1
D	1

Burst fracture patients:

	Canal compromise	*Vertebral body height loss*
Range	52.70 to 67.46	29.98 to 58.69
Mean value	59.57	35.75

Neurology

Frankel et al grade	*Burst fractures*	*Caries Spine*
Grade A	7	1
Grade B	2	2
Grade C	1	4
Grade D	1	3

INCLUSION CRITERIA:

We included cases of burst fracture affecting dorsal and lumbar vertebrae presenting with neurologic deficit and canal compromise > 50%

Tuberculous spondylitis affecting dorsal and lumbar vertebra are also included. The indication for surgery were neurologic deficit , vertebral body destruction with significant angulation with or without cold abscess. All caries spine patients took ATT for a minimum period of 6 months.

EXCLUSION CRITERIA:

Patients with no neurologic deficit and those with severe

medical comorbidities were excluded from the study

ANALYSIS OF RESULT

NEUROLOGICAL IMPROVEMENT

It is assessed by Frankel et al grade (universally used by many studies)

a. Total sensory and motor deficit present
b. Sensations present but motor loss present
c. Sensations present and motor power is 3/5 or less
d. Sensations present and motor power is > 3/5
e. Normal neurological function present

KYPHOSIS

Kyphotic angle is measured by cobb's angle

Superior endplate of immediate superior normal vertebra and inferior endplate of immediate inferior normal vertebra is considered for analyzing the angle.

FUSION OF GRAFT

The clinical and radiological evidence of successful fusion are defined as absence of local pain and tenderness over the site of fusion, correction loss and instrumentation failure and presence of trabecular bone bridging between the grafts and the vertebrae.

PAIN SCALE:

According to Denis et al (1984)

A - No pain

B - Occasional pain with no need for medication

C - Moderate pain with accasional medication

D - Severe pain with frequent medications and occasional abscence from work

E - Incapacitating pain with chronic medication

WORK SCALE:

According to Denis et al (1984)

A - Return to previous employment - heavy labour

B - Return to previous employment - sedentary labour

C - New less demanding job - full time work

D - New less demanding job - part time work

E - No work - completely disabled

IMPLANT FAILURE:

This condition is suspected if increased pain and kyphosis, worsening neurology status occurs in follow up.

It is assessed by follow up x rays

OBSERVATION & RESULTS

NEUROLOGY:

All the patients included in the study had preoperative neurologic deficits.

In trauma spine, out of 12 cases, 5 cases, (41.6%) with incomplete spinal cord, injury improved to Frankel grade D/E neurology (walking with/without support).

Out of 5 cases, one case had injury at D-12 level other had injury below L_1 level.

7 cases (58.3%) with complete spinal cord injury remained the same at follow up.

KYPHOSIS

Kyphotic angle correction in degrees.

	Pre-op	***Follow up***	***Correction obtained***
Burst Fracture	19.9	13.4	6.5
Canine spine	29.78	18.56	11.22

FUSION OF BONE GRAFT:

- Interbody fusion was present in almost all cases except in one burst fracture patient. He had full recurrence of kyphosis again.

- The average time for fusion is 3 to 8 months after surgery.

IMPLANT FAILURE:

Only one case of screw breakage was present in a caries spine patient.

WORK SCALE:

In burst facture patients,

Patient - gone for new jobs (W3 scale)	- 3 patients
Wheel chair life leading patients (W5 scale)	- 7 patients
Patients - not gone for job even though neurology improved to grade D	- 2 patients

PAIN SCALE:

- 23% of patients need occasional medication for back pain.

- No patient had incapacitating pain

COMPLICATIONS:

- Bed score - 2 patients.
- Rod slipping of screw in one case
- Superficial wound infection - 3 patients
- No other major intraoperative/post operative complications was encountered.
- No iatrogenic spinal cord injury has occurred.

Reconstruction of the anterior column

Out of 22 causes,

- Rib graft was used in 2 cases patients - high graft subsidence and recurrence of Kyphosis was present in one case.
- Cage with bone graft was used in 4 patients (2 caries spine and 2 trauma spine)
- Rest of the cases - tricortical iliac graft was used.
- Case illustration

CASE I:

Sekar, 38/M had burst Fracture treatment. After surgery with cage his neurology improved from Frankel Grade D to Grade E. His kyphotic angle is corrected from 40^{o} to 20^{o} and he has gone for new job.

CASE II:

Jeyaram 65/M, had burst fracture D12. After surgery, his pre-op neurology of frankel grade a remained the screw. His kyphotic angle is cemented from 20 to 11^{o}. He leads a wheelchair life.

CASE III:

Tamilselvi 30/F had caries spine D12L1. Her neurology improved from frauled grade D to grade E. Her kyphotic angle is connected from 45^{o} to 15^{o}. She is able to do household works.

CASE IV:

Muniyan 45/M had D10 D11 caries gpine. His pre-op neurology of Franked grade B remained the same. His kyphotic angle is connected from 30^{o} to 10^{o}. He has been rehabilitated with walker and weight relieving callipers.

CASE V:

Kumar 38/M, had D5D6D7 caries spine. His pre-op neurology of franted grade A improved to grade E postoperatively. His kyphotic angle is connected from 40 to 20^{o}. He is employed in new job.

DISCUSSION

The primary goal in providing care for patients with thoracolumbar pathology must include preservation of life and protection of neurologic function and restore alignment and stability of spine. Upholding these goals while managing thoarcolumbar pathologies is both challenging and controversial to spinal surgeon. Anterior decompression and stabilization surgery stills good in this scenario. The results of our study are discussed along with literature review in this section.

NEUROLOGY:

In trauma spine:

Those patients who have complete cord injury (Frankel Grade A) will not recover. This is the universal law as the neural structures are completely destroyed.

So in all studies, excluding grade A patients, other patients showed at least one grade improvement in neurology.

Studies	***Neurology recovery***
Dunn[15] et al (1984)	100%
Haas and Blauth[25] et al (1991)	50%
Been[5] et al (1991)	90%
Kanneda and Hiroshi Taneichi[31] et al (1997)	96%
Present study	100%

In Caries Spine:

Studies	***Neurology recovery***
Li – Yang Dai and Lei jang [34] et al (2005)	95%
Teoman Benli and Ahmed Alanay [53] et al(2005)	95.8%
Saikiran[51] & vaishya et al (2002)	90%
Present study	80%

In TB spine, 2 things need to be mentioned:

- Even patients with Frankel Grade A neurology can improve totally.
- Comparatively low improvement rates noted in our study may be due to small number of patients in caries spine group.

Tuli[54] et al and Mehta[28] & Bhojraj et al (2004) have mentioned that irreversible spinal cord injury due to tuberculosis endarterities, gliosis, meningomyelitis might be the reason for non-improvement of neurology even after surgical debridment and stabilisation.

KYPHOSIS:

Studies	*Pre-op*	*Follow up*	*Correction obtained*
Esses & Botsford[16] et al (1990)	18.2	3.5	14.7^{o}
Stephens & and Devito [52] et al (1992)	4.9	4	0.9^{o}
Kanneda and Hiroshi Taneichi[31] et al (1997)	19	7	12^{o}
Naohisa & Eiji Albe[43] et al (1999)	21	4.4	16^{o}
Present study	19.9	13.4	6.5

Pre-op Kyphosis angle in our study is higher than other studies except Naohisa study and the correction obtained is lower than other studies except Stephens et al study.

The reasons for lower amount of Kyphotic correction are described in tab 12.

Teoman Benli[53] and Ahmed Alanay et al (2005) stressed that,

1) Stiffness of instrumentation vary with graft in place.

2) In terms of restoration of sagittal plane alignment, rate of failure and rate of fusion, factors such as bone quality, alignment and quality of graft-vertibral body interface are more important than difference in rod or plate style instrumentation.

CARIES SPINE:

Kyphosis has been a common complication with chemotherapy alone, although the British. Medical council working party reported encouraging results from this study.

Since Hodgson and Stock's report[26] in 1960, anterior arthrodesis has been advocated as the treatment of choice for tuberculosis of spine. For successful anterior radical surgery, they showed that surgical extirpation of the tuberculous focus and its replacement with a bone graft in structurally sound position were the key to effectiveness.

Studies	***Correction obtained***
Li-Yang Dai and Lei jang [34] et al (2005)	85.93%
Yilmaz & Selek [58] et al (1999)	64%
Ahmed Muktar & Medhar [1] et al (2003)	35.71%
Yogesh Pithwa & Ganesh chauhan[59] et al (2005)	50%
Sundaraj & Behera [19] et al (2003)	35.16%
Present Study	37.6%

Our study is comparable to Indian studies but well low when compared to Li and Yilmaz study.

The reasons for lower amount of Kyphotic correction may be due to

Tab 12

• Not getting adequate distraction of adjacent vertebra specially in TB because of anterior longitudinal ligament contracture, edematous soft adjacent bone
• Difficulty in using precisely sized and aligned bone graft/ cage because of irregular graft-vertebra interface especially in TB
• single rod system could not tolerate enough distraction of vertebra.
• screw fixed in partially described debrided vertebra in modified Hong Kong surgery is not strong enough to hold the correction because of poor bone density

We favour anterior instrumentation which is advantages than posterior because:

1. Both instrumentation and grafting done as single stage surgery through the same incision minimising blood loss and surgery time.

2. No risk of graft slipping out on turning the patient for posterior instrumentation.

3. Decreased length of fusion.

4. Decreased peri operative complications & mortality.

Recently Rajasekeran et al (2006) and and Mehta & Bhojraj[28] et al (2004) studies popularized a new method in India where anterior decompression of spinal cord was done by posterior approach by transpedicular route and posterior instrumentation and fusion done.

Disadvantage of this method is the need to sacrifice one spinal nerve and one pedicle and but it avoids thoractomy, a great boon to those with medical co-morbidities.

Finally, bone grafting the corpectomy site without instrumentation is doomed to fail in kyphosis. It has been confirmed by Rajasekaran and Soundrapandiyan[50] et al & Yogesh pithwa and Ganesh chauhan[59] et al study (2005) and Mehta & Bhojraj[28] et al (2004) studies. In our study 2 caries spine cases were not instrumented and one patient had gross recurrence of kyphosis and the other who is not weight bearing has not developed significant kyphosis correction loss. we could not mobilize patient till radiological fusion was achieved.

FUSTION OF GRAFT

Studies	*Pseudo arthrosis rate*
1. Kostuik[47] et al(1988)	3%
2. Kanneda and Hiroshi Taneichi[31] et al (1997)	7%
3. Naohisa Miyakoshi and Eiji Albe[43] et al	0%
4. Dunn[15] et al (1984)	6%
5. Haas and Blauth[25] et al (1991)	0%
6. Our study	4%

Our study results are favourable than that of Kanneda & Dunn et al and comparable with Kostuik et al studies and lower then Haas & Naohisa et al studies. As noted by Kanneda et al, incorrect placement of bone graft may be the cause for pseudoarthrosis. Posterior correction and instrumentation need to be done for those cases to enhance the stability.

Implant failure

Studies	*Rate of implant failure*
Dunn[15] et al (1984)	6%
Kanneda and Hiroshi Taneichi[31] et al (1997)	6%
Haas and Blauth[25] et al (1991)	5%
Present study	4%

Our results are favourable than other studies at average follow up period of 11.5 months. But long term follow up is necessary.

Screw breakage that occurred in one patient had good bone graft fusion and so functionally patient had no difficulty.

Return to work

Studies	***Percentage of people returned to work***
Kanneda and Hiroshi Taneichi[31] et al (1997)	96%
Kostuik[47] et al (1988)	94%
Stephens and Devito [52] et al (1992)	94%
Carl and Tromanhauser [8] et al (1992)	69%
Our study	
Caries spine	80%
Burst # spine (excluding Frankel grade A patient)	75%

In caries spine, because of small number of patients in our study, difference of 20% being unemployed happened.

Complications

- *In Mc Donnel and steven[36] et al (1996) study,*

Vertebrectory by anterior approach produces major complications like lung involvement in 12% cases and minor complication like genitourinary disturbances in 29% cases.

- *In Kanneda and Hiroshi Taneichi[31] et al(1997) study*

Studies	***Complication rate***
Inferior vena cava injury	0.7%
Deep wound infections	0.7%
Postop atelectasis	6%
Genitofemoral nerve injury	0.7%
Minor Complications	
Superficial wound infections	2%
Sympathetomy effect on Ipsilateral lower limb	10%

- *In Teomen Benli[53] and Ahmed Alanay [2] et al(2005)*

Aortic injury	1.7%
Iliac vein injury	1.7%
Deep wound infection	3.4%

- *In Prabhaka and Dhavan [35] et al (2001)*

  Deep would infections 5.6%

In our study, so far no major complication has occurred. Minor complications like superficial infections in. 14% patients and bed scre in 9.5% patients had occurred

Rod has pulled out of screw in one case. That was identified early and refixed promptly in post operative period

Screw penetration into adjacent disc has occurred but it has not produced any disc degeneration effect. It could be avoided by good exposure of vertebra to facilitate full orientation. Intraoperative verification with C' arm will improve the screw placement.

Average surgery time is 3 hours and average blood loss is 400ml. This is comparable with results of 4½ hr surgery time and 450ml of blood loss for anterior surgery in spine, in Yogesh Pithwa and Ganesh chauhan[59] et al study.(2005)

- Timing of surgery has not affected the neurology outcome in trauma spine.[Transfeldt[55] (1990)and Bradford[7] et al (1987)]
- But delaying surgery more than 3 weeks in burst fracture leads to difficulty in doing corpectomy because of fracture healing.

CONCLUSION

Anterior decompression and stablisation with anterior instrumentation with single rod system,

- definitely improves neurology in incomplete spinal cord injury patients and most of caries spine patients.

- though the kyphotic correction achieved is low, functionally (pain & work scale wise) patient has little difficulty.

Suggestions from this study:

- Early surgery in burst fracture spine.
- Good exposure of pathology (one normal vertebra above & below the pathology to be exposed).
- Avoid screw placement in partially debrided vestebra.
- Avoid screw penetration into adjacent disc space.
- Dual rod system should be used atleast below D_{10} level.(large vertebral space available)

BIBLIOGRAPHY

1. Ahmed M. Mukhtara, Medhar M. Farghalyb, Shaban H. Ahmeda Interbody Fusion and Posterior Instrumentation Med Princ Pract 2003;12:92-96

2. Ahmed Alanay A, Acaroglu E, Yazici M, Oznur A, Surat A. Short-segment pedicle instrumentation of thoracolumbar burst fractures: does transpedicular intracorporeal grafting prevent early failure? Spine. 2001 Jan 15; 26(2): 213-7.45.

3. Bailey HL, Gabriel SM, Hodgson AR, Shin IS. Tuberculosis of the spine in children. 1972 [classical article]. Clin Orthop Relat Res. 2002; (394):4-18.

4. Bailey HL, Gabriel SM, Hodgson AR, Shin IS. Tuberculosis of the spine in children. 1972 [classical article]. Clin Orthop Relat Res. 2002; (394):4-18.

5. Been, H. D.: Anterior decompression and stabilization of thoracolumbar burst fractures by the use of the Slot-Zielke device. Spine, 16:70-77, 1991

6. Bracken MB, Shepard MJ, Collins WF, et al. A randomised controlled trial of methylprednisone or naloxone in the treatment of acute spinal cord injury. N Eng J Med 322:1405-1411, 1990

7. Bradford DS, McBride GG. Surgical management of thoracolumbar spine fractures with incomplete neurologic deficits. Clin Orthop. 1987 May;(218): 201-16.

8. Carl, A. L.; Tromanhauser, S. G.; and Roger, D. J.: Pedicle screw instrumentation for thoracolumbar burst fractures and fracturedislocations.Spine, 17(8S): S317-S324, 1992.

9. Chen W, Wu C, Jung C, Chen L, Niu C, Lai P. Combined anterior and posterior surgeries in the treatment of spinal tuberculosis spondylitis. Clin Orthop Relat Res. 2002; (398):50-9.

10. Chen W, Wu C, Jung C, Chen L, Niu C, Lai P. Combined anterior and posterior surgeries in the treatment of spinal tuberculosis spondylitis. Clin Orthop Relat Res. 2002; (398):50-9.

11. Clohisy JC, Akbarnia BA, Bucholz RD, Burkus JK, Backer RJ. Neurologic recovery associated with anterior decompression of

spine fractures at the thoracolumbar junction (T12-L1). Spine. 1992 Aug; 17(8 Suppl): S325-30.

12. Compere EL, Jerome JT. the treatment of tuberculosis of the spine in young children. Ann Surg. 1935 Aug;102(2):286-96 PMID: 17856622 [PubMed]

13. Denis F. Spinal instability as defined by the three-column spine concept in acute spinal trauma. Clin Orthop. 1984 Oct;(189): 65-76.

14. Denis F. The three-column spine and its significance in the classification of acute thoracolumbar spinal injuries. Spine. 1983 Nov-Dec;8(8): 817-31.

15. Dunn, H. K.: Anterior stabilization of thoracolumbar injuries. Clin. Orthop., 189: 116-124, 1984.

16. Esses, S. I.; Botsford, D. J.; and Kostuik, J. P.: Evaluation of surgical treatment for burst fractures. Spine, 15: 667-673, 1990.

17. Fehlings MG, Tator CH. An evidence-based review of decompression surgery in acute spinal cord injury: rationale,

indications, and timing based on experimental and clinical studies. J Neurosurg (Spine 1) 91: 1-11, 1999

18. Finkelstein JA, Chapman JR, Mirza S. Anterior cortical allograft in thoracolumbar fractures. J Spinal Disorders, 1999, 12(5), 424-9

19. G.D.Sundararaj, S. Behera, V. Ravi, K. Venkatesh, V. M. Cherian, V.Lee role of posterior stabilisation in the management of tuberculosis of the dorsal and lumbar spine jbjs br. vol. 85-b, no. 1, january 2003

20. Gertzbein SD. Scoliosis Research Society. Multicenter spine fracture study. Spine. 1992 May; 17(5): 528-40

21. Govender S. The outcome of allografts and anterior instrumental in spinal tuberculosis. Clin Orthop Relat Res. 2002; (398): 60-6.

22. Govender S. The outcome of allografts and anterior instrumental in spinal tuberculosis. Clin Orthop Relat Res. 2002; (398): 60-6.

23. Griffiths DL. The treatment of spinal tuberculosis. In: McKibbin B, editor. Recent advances in orthopaedics. Edimburgh: Churchill Livinstone; 1979

24. Griffiths DL. The treatment of spinal tuberculosis. In: McKibbin B, editor. Recent advances in orthopaedics. Edimburgh: Churchill Livinstone; 1979. p. 1-17.

25. Haas, N.; Blauth, M.; and Tscherne, H.: Anterior plating in thoracolumbar spine injuries. Indication, technique, and results. Spine, 16 (3S): S100-S111, 1991

26. Hodgson AR, Stock FE, Frog HSY, Ong GB: Anterior spinal fusion: The operative approach and pathological findings in 412 patients with Pott's disease of the spine. Br J Surg 1960;48:172-178.

27. J Bohlman HH, Anderson PA. Anterior decompression and arthrodesis of the cervical spine: long-term motor improvement. Part I--Improvement in incomplete traumatic quadriparesis. J Bone Joint Surg Am. 1992 Jun; 74(5): 671-82.

28. J. S. Mehta, S. Y. Bhojraj Tuberculosis of the thoracic spin a classification based on the selection of surgical strategies vol. 83-b, no. 6, august 2001sability Rehabilitation Journal 75 Vol. 15 No. 1 2004 From Hinduja Hospital, Mahim Mumbai, India

29. Katoh S, el Masry WS, Jaffray D, McCall IW, Eisenstein SM, Pringle RG, Pullucino V,Ikata T. Neurological outcome in conservatively treated patients with incomplete closed traumatic cervical spinal cord injury. Spine 1996 (20) 2345-51

30. Kemp HBS, Jackson JW, Jeremiah JD, Cook J. Anterior fusion of the spine for infective lesions in adults. J Bone Joint Surg [Br] 1973; 55-B:715-34.

31. Kiyoshi kaneda, hiroshi taneichi, kuniyoshi abumi, tomoyuki hashimoto, shigenobu satoh, and masanori fujiya anterior decompression and stabilization with the kaneda Device for Thoracolumbar Burst Fractures Associated with Neurological Deficits* J. Bone Joint Surg. Am., Jan 1997; 79: 69 - 83.

32. Klöckner C, Valencia R. Sagittal alignment after anterior debridement and fusion with or without additional posterior instrumentation in the treatment of pyogenic and tuberculous spondylodiscitis. Spine. 2003; 28:1036-42.

33. Klöckner C, Valencia R. Sagittal alignment after anterior debridement and fusion with or without additional posterior

instrumentation in the treatment of pyogenic and tuberculous spondylodiscitis. Spine. 2003; 28:1036-42.

34. Li yang Dai , Lei- Jang, Wei Wang, yimin Single stage anterior autogenous bone grafting and instrumentation in the surgical management of spinal tuberculosis SPINE vol 30 pp2342-2349 2005

35. M. M. Prabhakar*, Dhaval R. Modi, Bhavin Jadav management of mass scale dorso-lumbar injuries for early rehabilitation 2001.

36. Mark of Mcdonnel, Steven, Glassman, John, Diwar, Rolando Pono, John R Johnson, Louvisville Kentonly, Perioperative complications of anterior procedures of spine. JBCS June 1996, Vol.78-A, P839-847.

37. McAfee, P. C.; Bohlman, H. H.; and Yuan, H. A.: Anterior decompression of traumatic thoracolumbar fractures with incomplete neurological deficit using a retroperitoneal approach. J. Bone and Joint Surg., 67-A: 89-104, Jan. 1985.

38. McCormack T, Karaikovic E, Gaines RW. The load sharing classification of spine fractures. Spine 1994 Aug 1; 19(15): 1741-4

39. McLain RF, Sparling E, Benson DR. Early failure of short-segment pedicle instrumentation for thoracolumbar fractures. A preliminary report. J Bone Joint Surg Am. 1993 Feb; 75(2): 162-

40. Moon M, Moon Y, Moon J, Kim S, Sun D. Conservative treatment of tuberculosis of the lumbar and lumbo sacral spine. Clin Orthop Relat Res. 2002; (398):40- 9.

41. Moon MS, Ha KY, Sun DH, et al. Pott's paraplegia: 67 cases. Clin Orthop 1996;323:122-8.

42. MRC. A ten-year assessment of a controlled trial comparing debridement and anterior spinal fusion in the management of tuberculosis of the spine in patients on standard chemotherapy in Hong Kong. J Bone Joint Surg [Br] 1982;64-B:393-8.

43. Nao hisa miyakoshi , EIJI Abe, yoichi , michio , mitsuho ,kozo Anterior decompression with single segmental spinal interboby fusion for lumbarburst fracture SPINE vol 24 pp 67-73, 1999

44. Oga M, Arizono T, Takashita M, Sugioka Y. Evaluation of the risk of instrumentation as a foreign body in spinal tuberculosis: clinical and biological study. Spine 1993;18:1890-4.

45. Özdemir HM, Us AK, Ögun T. The role of anterior spinal instrumentation and allograft fibula for treatment of pott disease. Spine. 2003; 28:474-9.

46. Özdemir HM, Us AK, Ögun T. The role of anterior spinal instrumentation and allograft fibula for treatment of pott disease. Spine. 2003; 28:474-9.

47. P Kostuik Anterior fixation for burst fractures of the thoracic and lumbar spine with or without neurological involvement. Spine, Mar 1988; 13(3): 286-93.

48. Pott P. The chirurgical works of Percivall Pott, FRS, surgeon to St. Bartholomew's Hospital, a new edition, with his last corrections. Clin Orthop Relat Res. 2002; (398): 4-10.

49. R. Parthasarathy, K. Sriram, T. Santha, R. Prabhakar, P. R. Somasundaram, S. Sivasubramanian Short-course chemotherapy for tuberculosis of the spine a comparison between ambulant treatment and radical surgery – ten-year report J Bone Joint Surg [Br] 1999;81-B:464-71.

50. Rajasekaran S, Soundarapandian S. Progression of kyphosis in tuberculous spine treated by anterior arthrodesis. J Bone Joint Surg [Am] 1989;71-A:1314-23.

51. Sai Kiran NA, Vaishya S, Kale SS, Sharma BS, Mahapatra AK Surgical results in patients with tuberculosis of the spine and severe lower-extremity motor deficits: a retrospective study of 48 patients trademark of Elsevier B.V. ScienceDirect® is a registered PMID: 17436920 [PubMed - indexed for MEDLINE

52. Stephens, G. C.; Devito, D. P.; and McNamara, M. J.: Segmental fixation of lumbar burst fractures with Cotrel-Dubousset instrumentation. J. Spinal Disord., 5: 344-348, 1992.

53. Teoman Benli & Ahmet Alanay, Serdar Akalin, Mahunt bis, Gune Alaroghi, Bulene ates and Grbil sydin. Comparison of anterior instrument system and the result of minimum 5 year follow up in the treatment of tuberculosis spondylosis, Journalof Orthopaedics, Turkey, May 2005, P252-262.

54. TULI Tuberculosis of skeletal system, 3RD edition

55. Transfeldt EE, White D, Bradford DS, Roche B. Delayed anterior decompression in patients with spinal cord and cauda equina injuries of the thoracolumbar spine. Spine. 1990 Sep; 15(9): 953-7. Tuli SM. Tuberculosis of skeletal system. 2nd edition.

56. Weinstein JN, Collalto P, Lehmann TR. Thoracolumbar "burst" fractures treated conservatively: a long-term follow-up. Spine. 1988 Jan; 13(1): 33-8.

57. Wood KB, Butterman G, Garvey T, Sichreist F, Jhanjee F, Mehbod A, Kane R. Operative Vs Nonoperative Treatment of Thoracolumbar Burst Fractures Without Neurological deficit spine vol34 345-351

58. Yilmaz C, Selek HY, Gurkan I, et al. Anterior instrumentation for the treatment of spinal tuberculosis. J Bone Joint Surg Am 1999;81:1261–7.

59. yogesh pithwa*, ganesh chauhan**,sanjay dhar***, prashant weling**** tb spine : role of instrumentation Journal of Bone and Joint Surgery - British Volume, Vol 87-B, Issue SUPP_III, 241.

CASE I:

Sekar, 38/M had burst Fracture treatment. After surgery with cage his neurology improved from Frankel Grade D to Grade E. His kyphotic angle is corrected from 40^{o} to 20^{o} and he has gone for new job.

CASE II:

Jeyaram 65/M, had burst fracture D12. After surgery, his pre-op neurology of frankel grade a remained the screw. His kyphotic angle is cemented from 20 to 11^{o}. He leads a wheelchair life.

CASE III:

Tamilselvi 30/F had caries spine D12L1. Her neurology improved from frauled grade D to grade E. Her kyphotic angle is connected from 45^{o} to 15^{o}. She is able to do household works.

CASE IV:

Muniyan 45/M had D10 D11 caries gpine. His pre-op neurology of Franked grade B remained the same. His kyphotic angle is

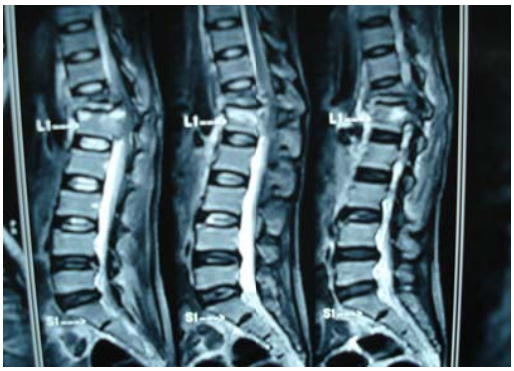
connected from 30^{o} to 10^{o}. He has been rehabilitated with walker and weight relieving callipers.

CASE V:

Kumar 38/M, had D5D6D7 caries spine. His pre-op neurology of franted grade A improved to grade E postoperatively. His kyphotic angle is connected from 40 to 20^{o}. He is employed in new

CASE - III

PRE OP



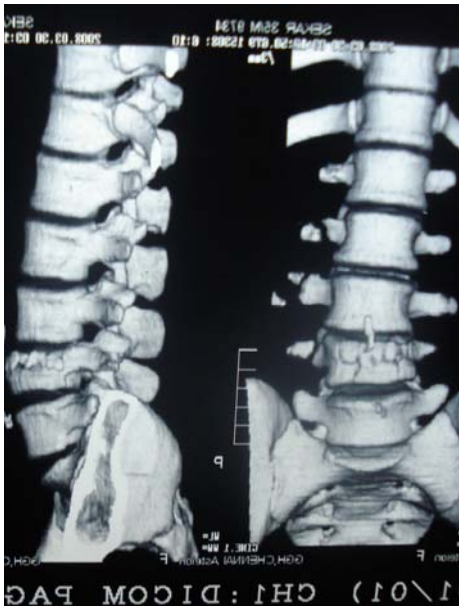
POST OP

CASE - III

FOLLOW UP

CASE - I

PRE OP



CASE - I

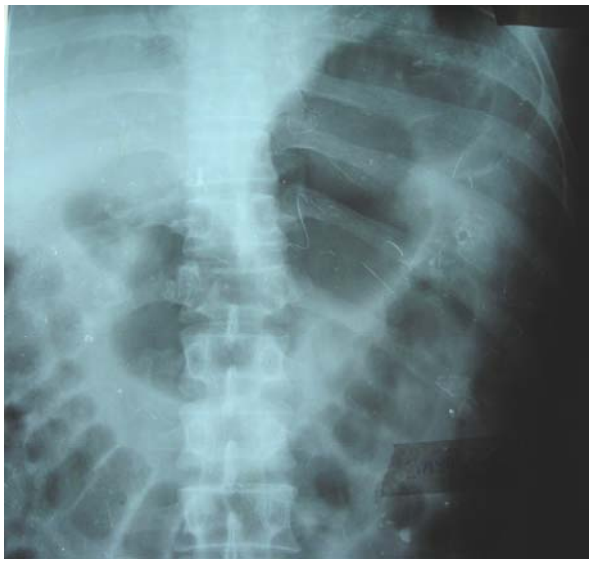
POST OP

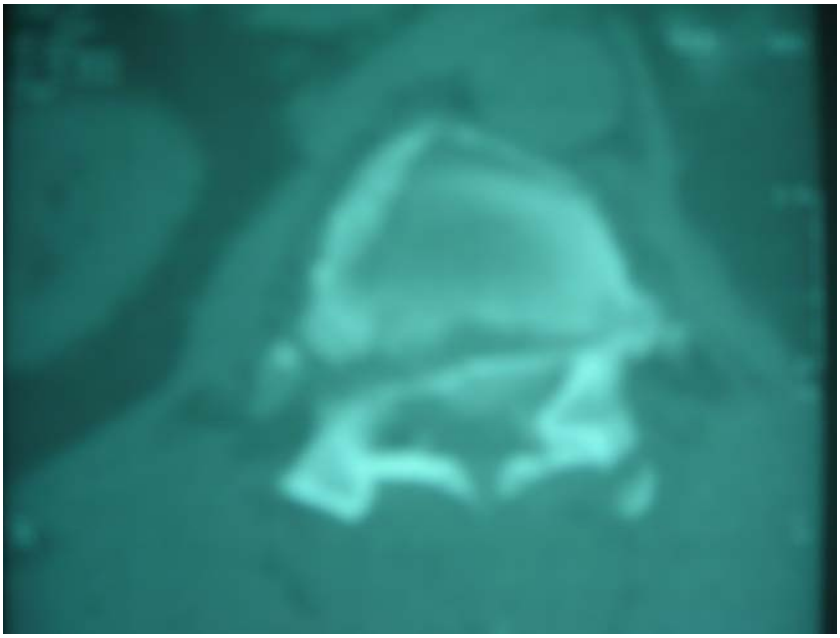
CASE - I

FOLLOW UP

CASE - II

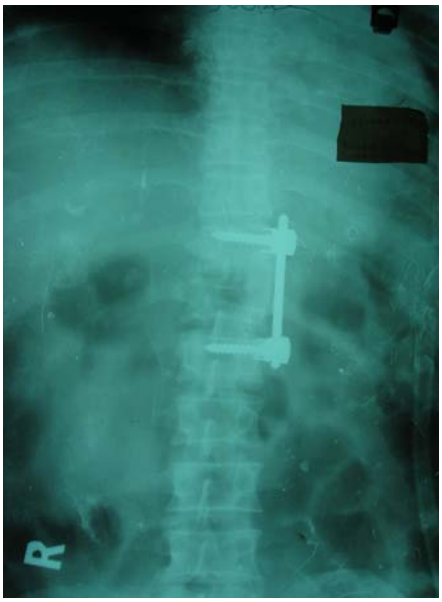
PRE OP





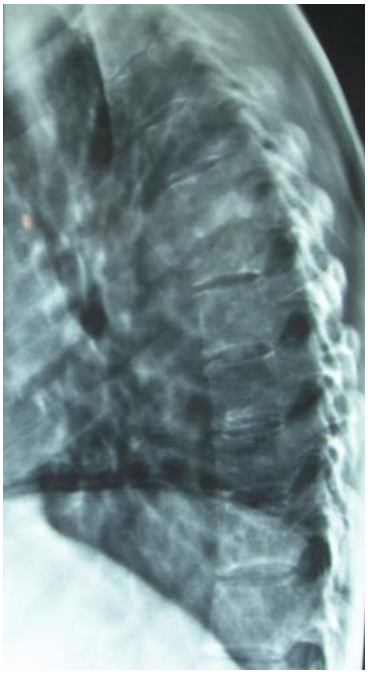
CASE - II

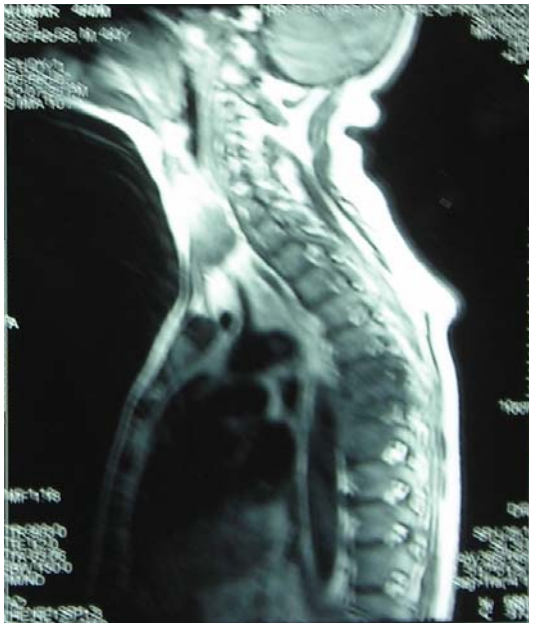
POST OP



CASE - V

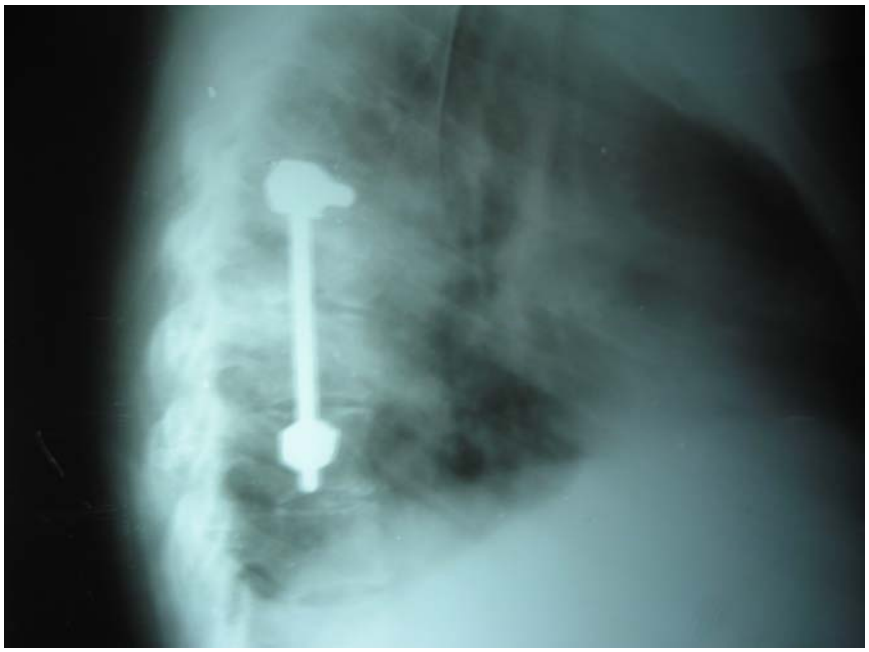
PRE OP





CASE - V

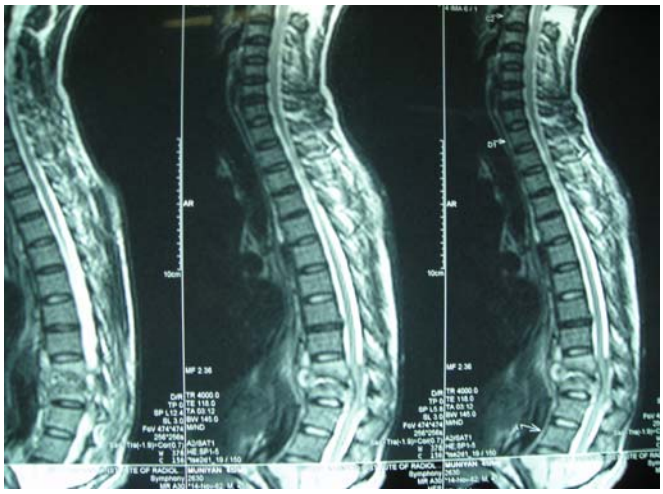
POST OP



CASE - V
FOLLOW UP

CASE - IV

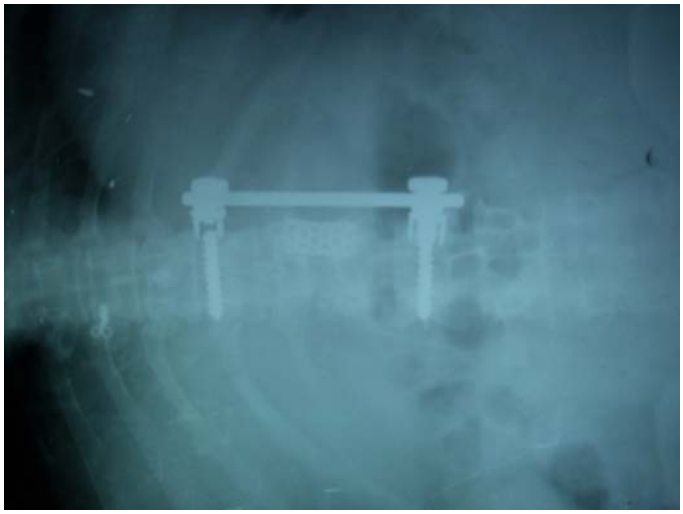
PRE OP



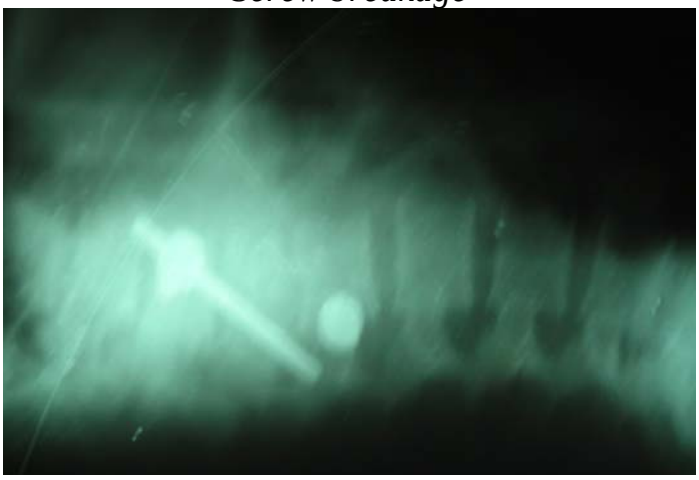
CASE - IV

POST OP

COMPLICATION



Screw breakage

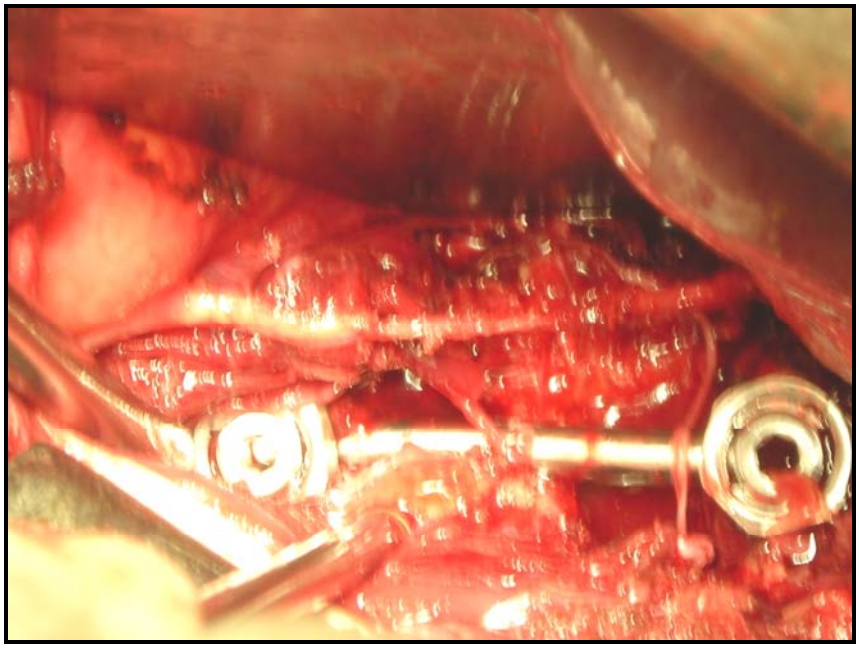


Rod Pull out from screw

Pseudoarthrosis with recurrence of Kyphosis

POSITIONING OF THE PATIENT

PEROP PICTURE WITH ROD AND SCREWS INSITU



DENIS CLASSIFICATION OF DORSO LUMBAR BURST FRACTURE

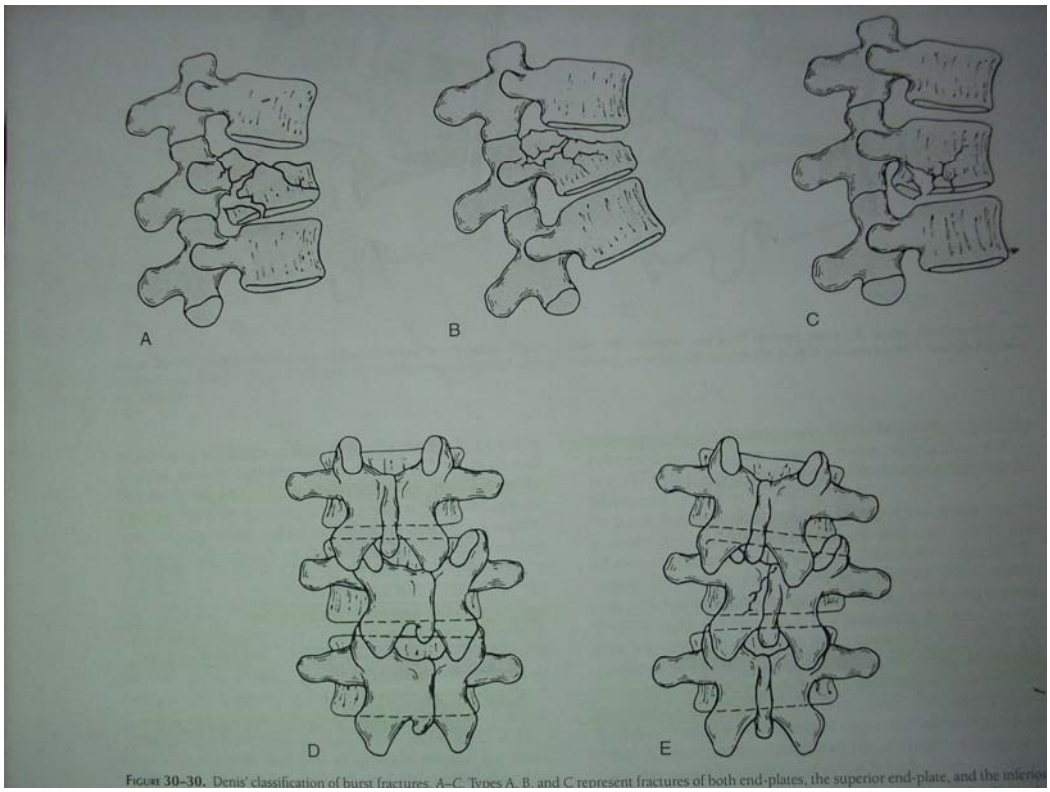
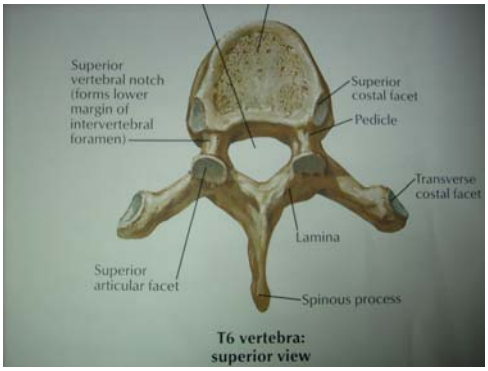
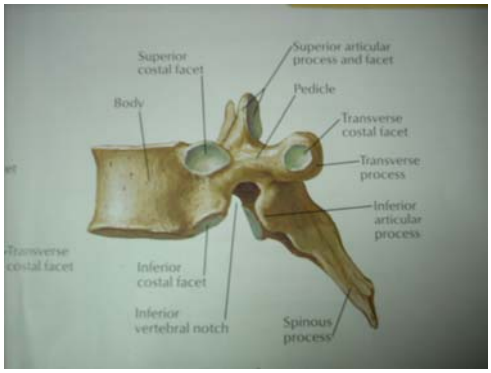


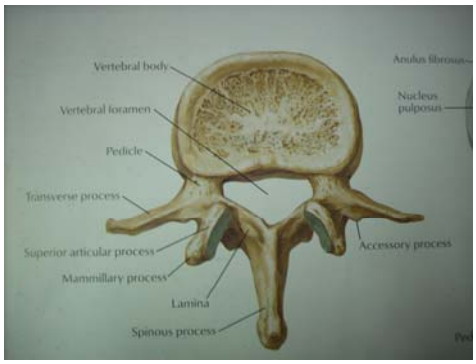
FIGURE 30–30. Denis' classification of burst fractures. A–C. Types A, B, and C represent fractures of both end-plates, the superior end-plate, and the inferior

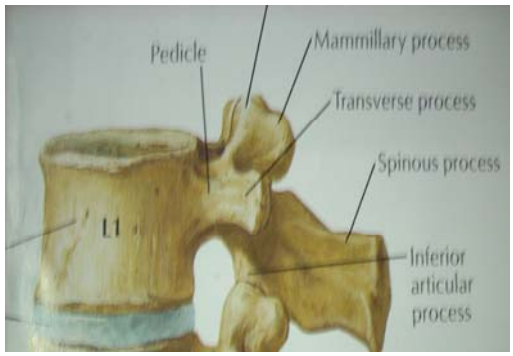
TYPICAL DORSAL VERTEBRA



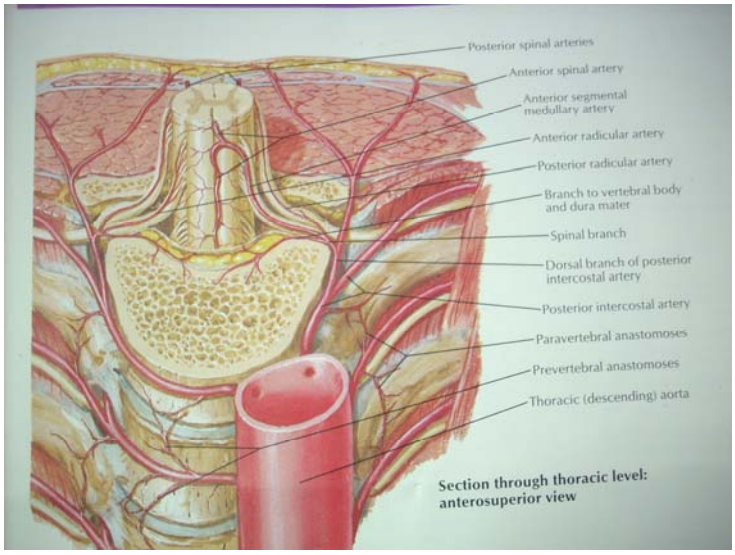


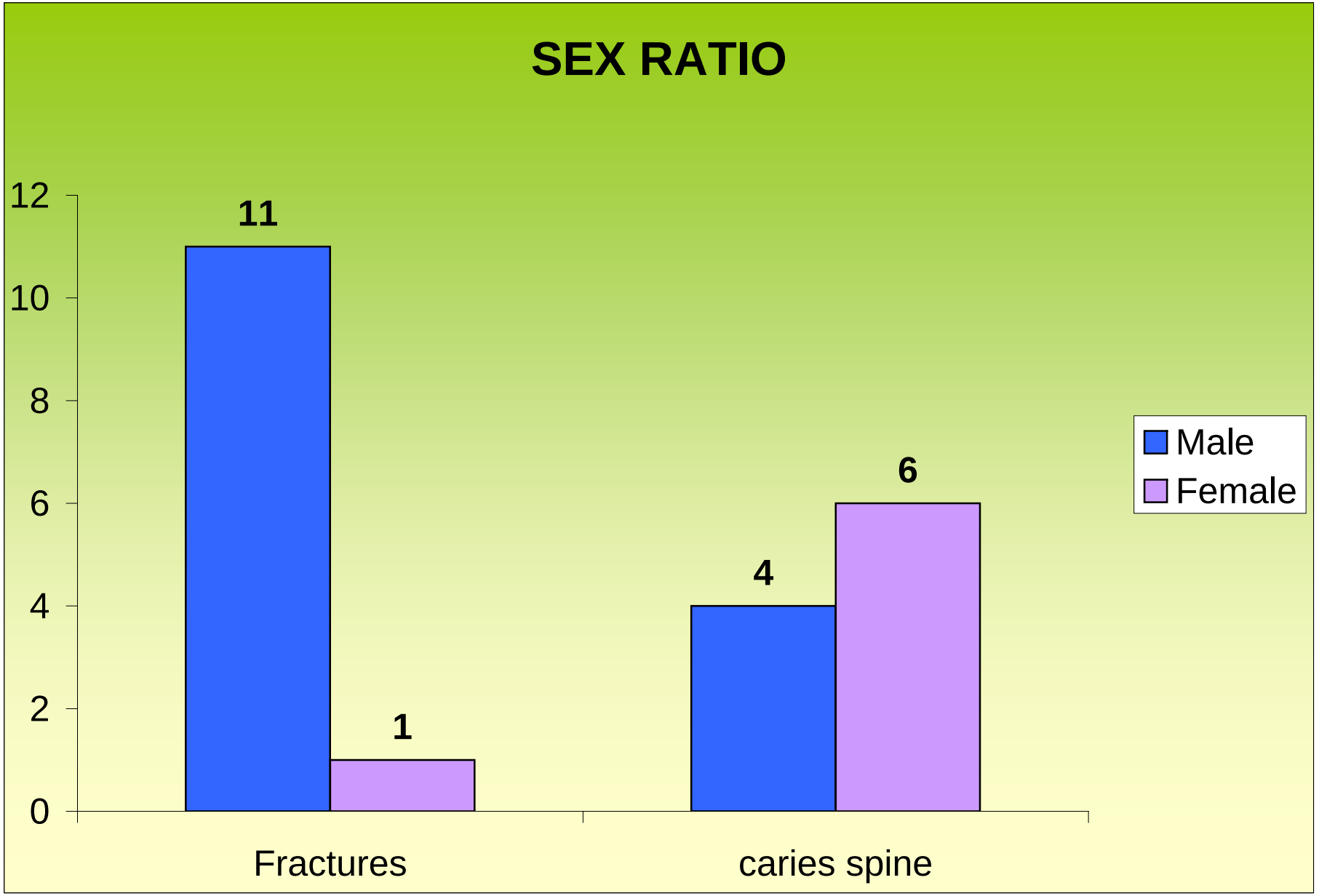
TYPICAL LUMBAR VERTEBRA

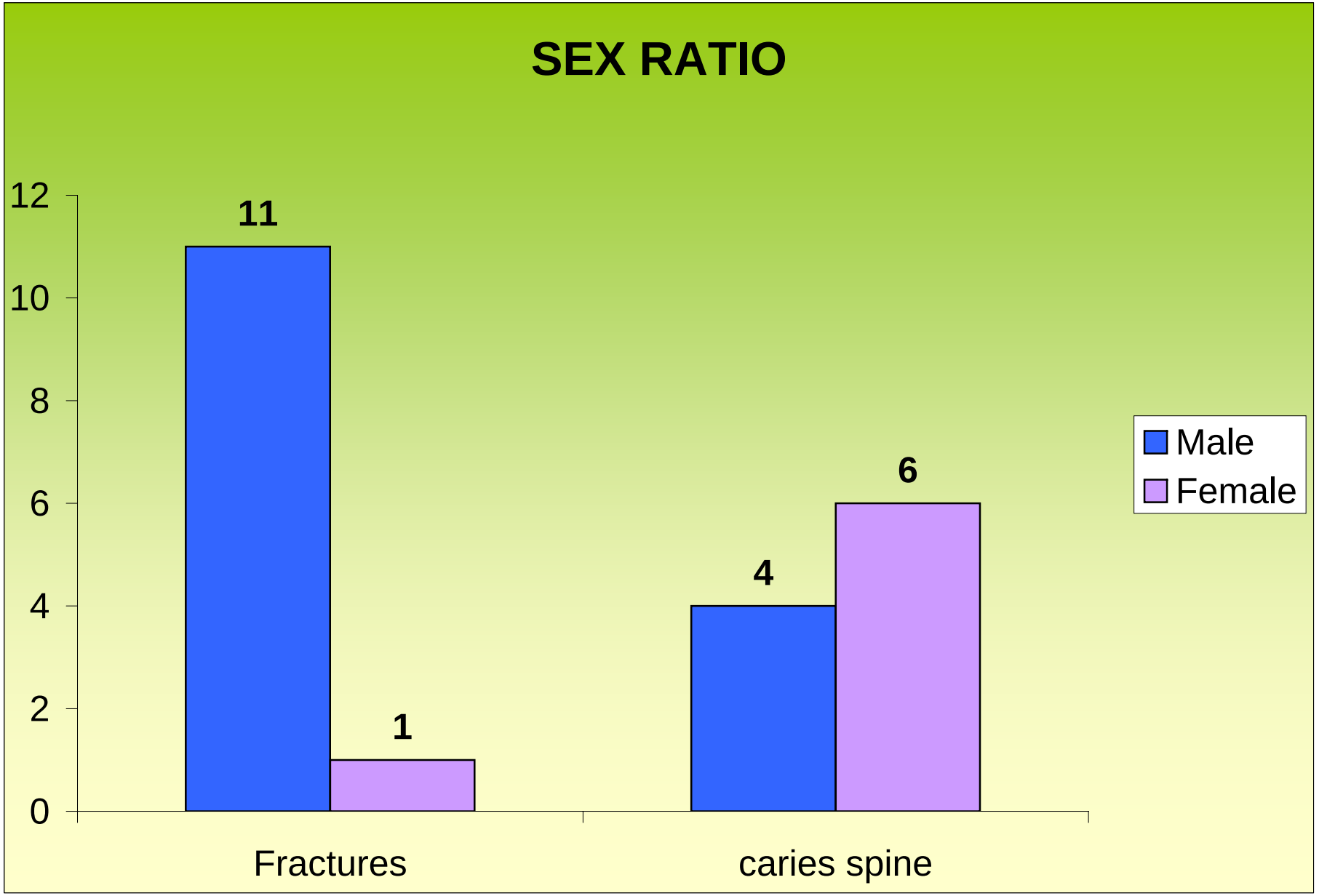


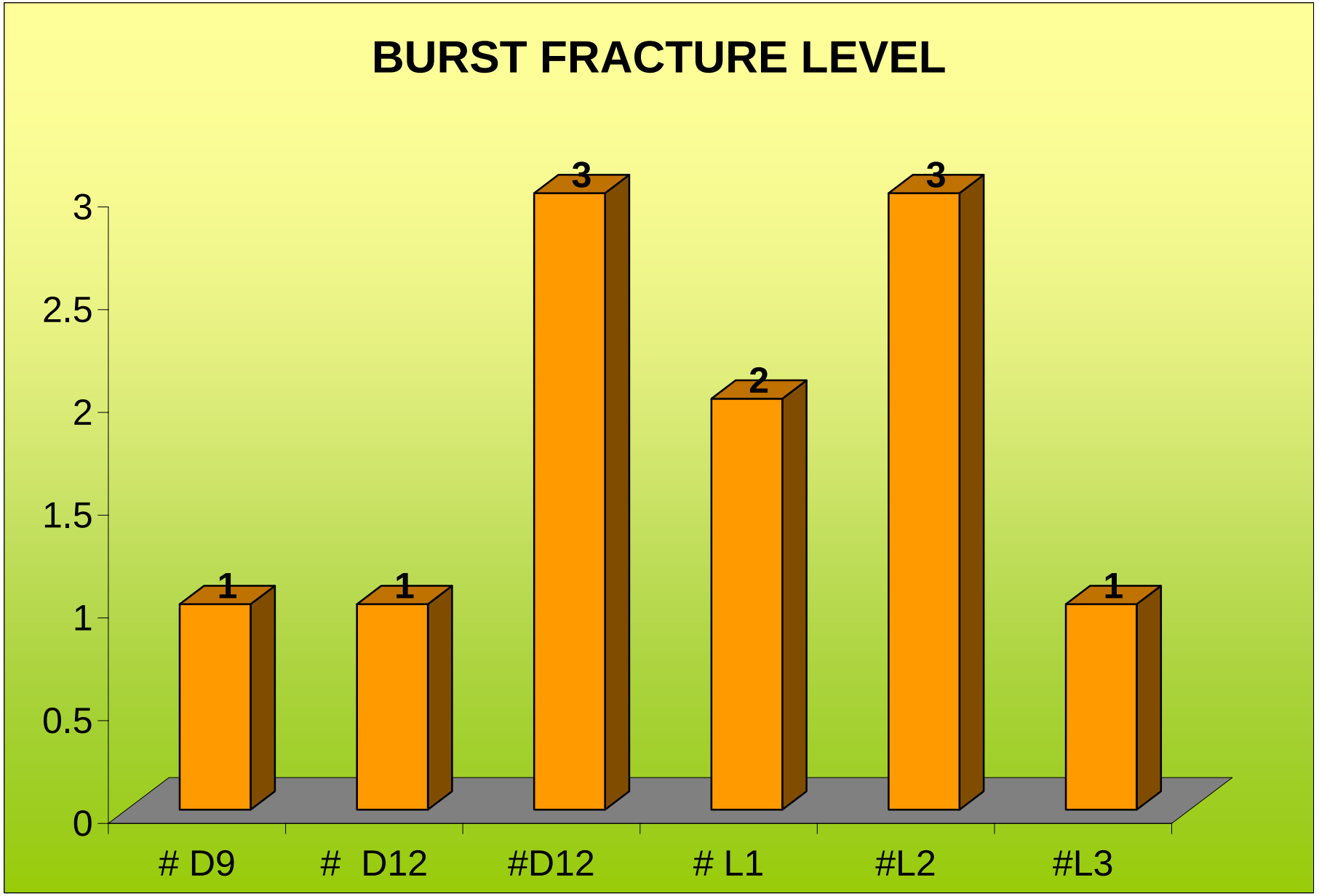


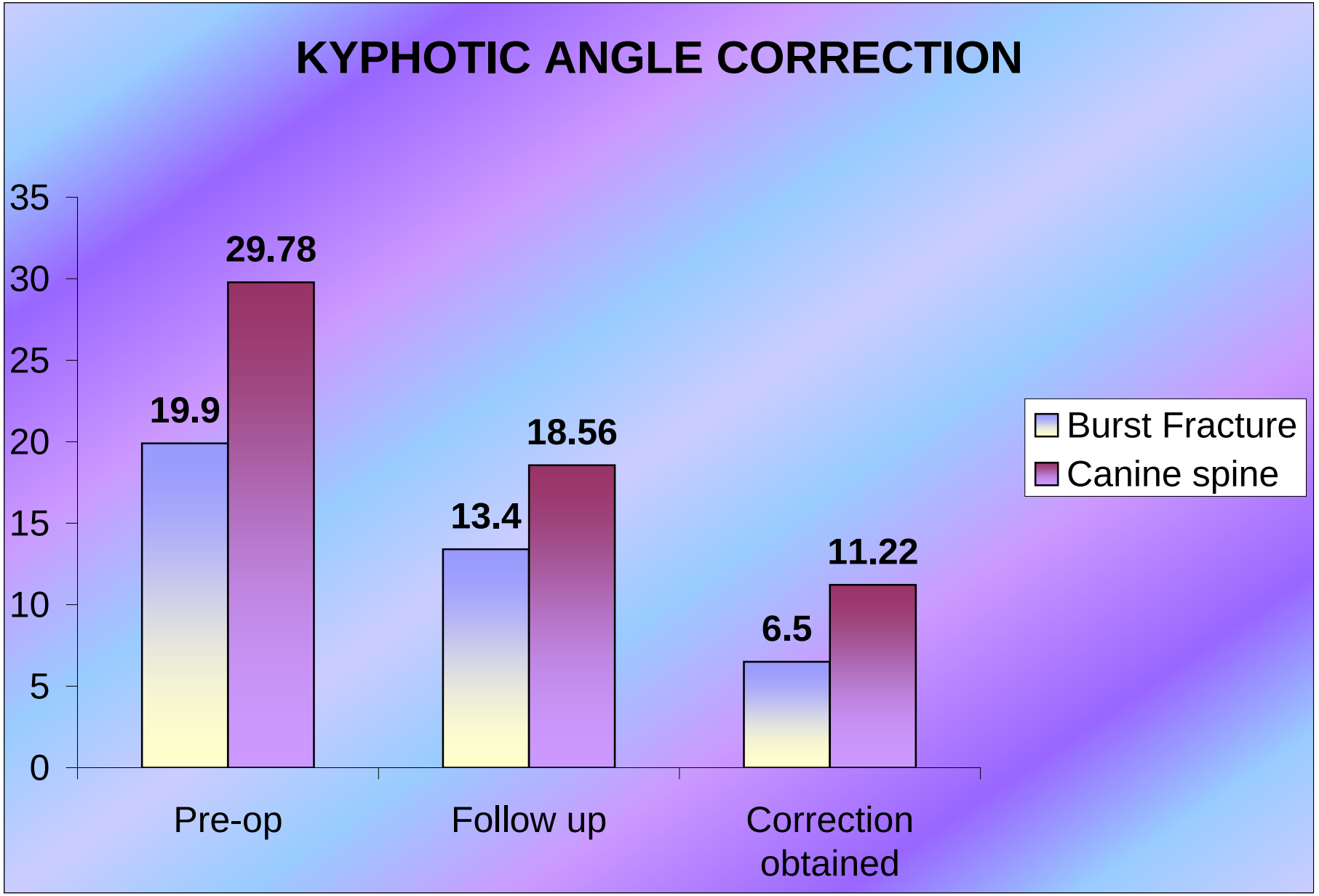
VASCULAR SUPPLY OF SPINAL CORD



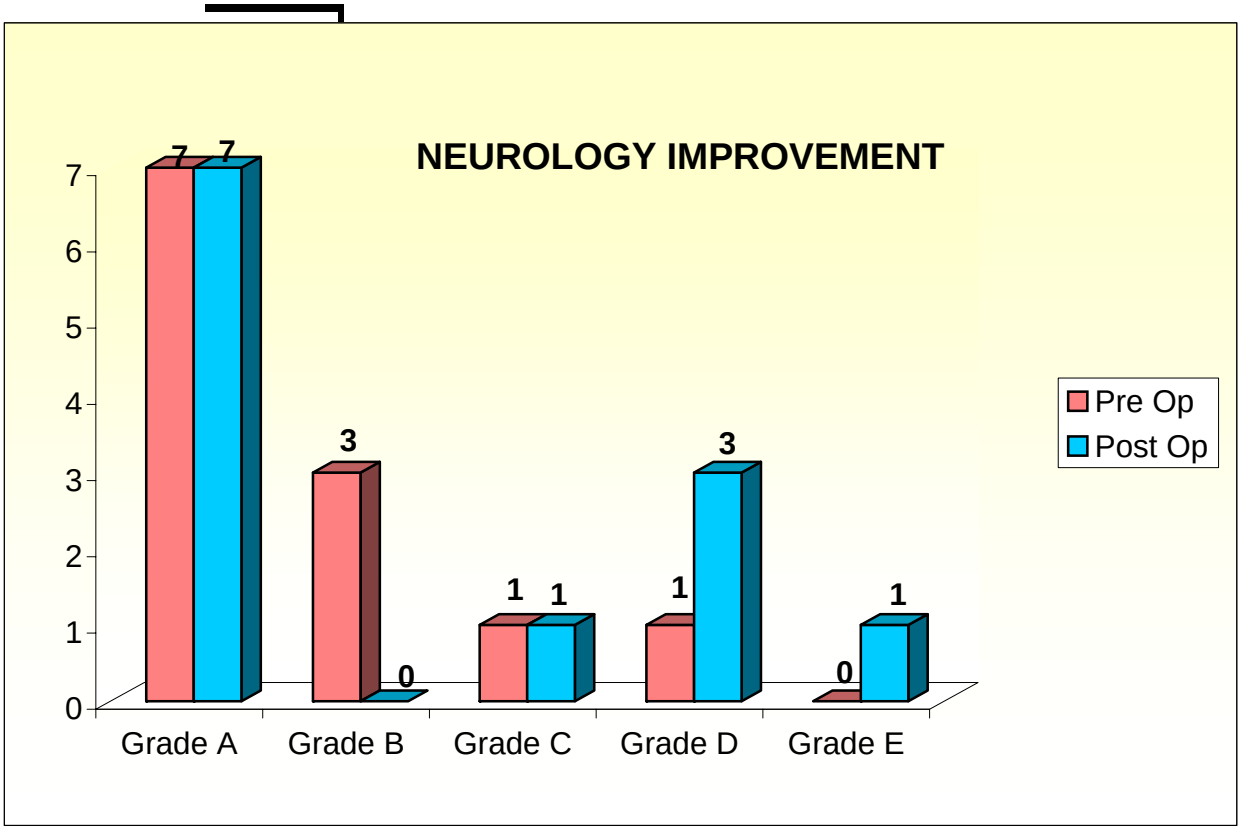

SEX RATIO
12
10
8
6
4
2
0
11
1
4
6
Male
Female
Fractures
caries spine


SEX RATIO
12
10
8
6
4
2
0
11
1
4
6
Male
Female
Fractures
caries spine

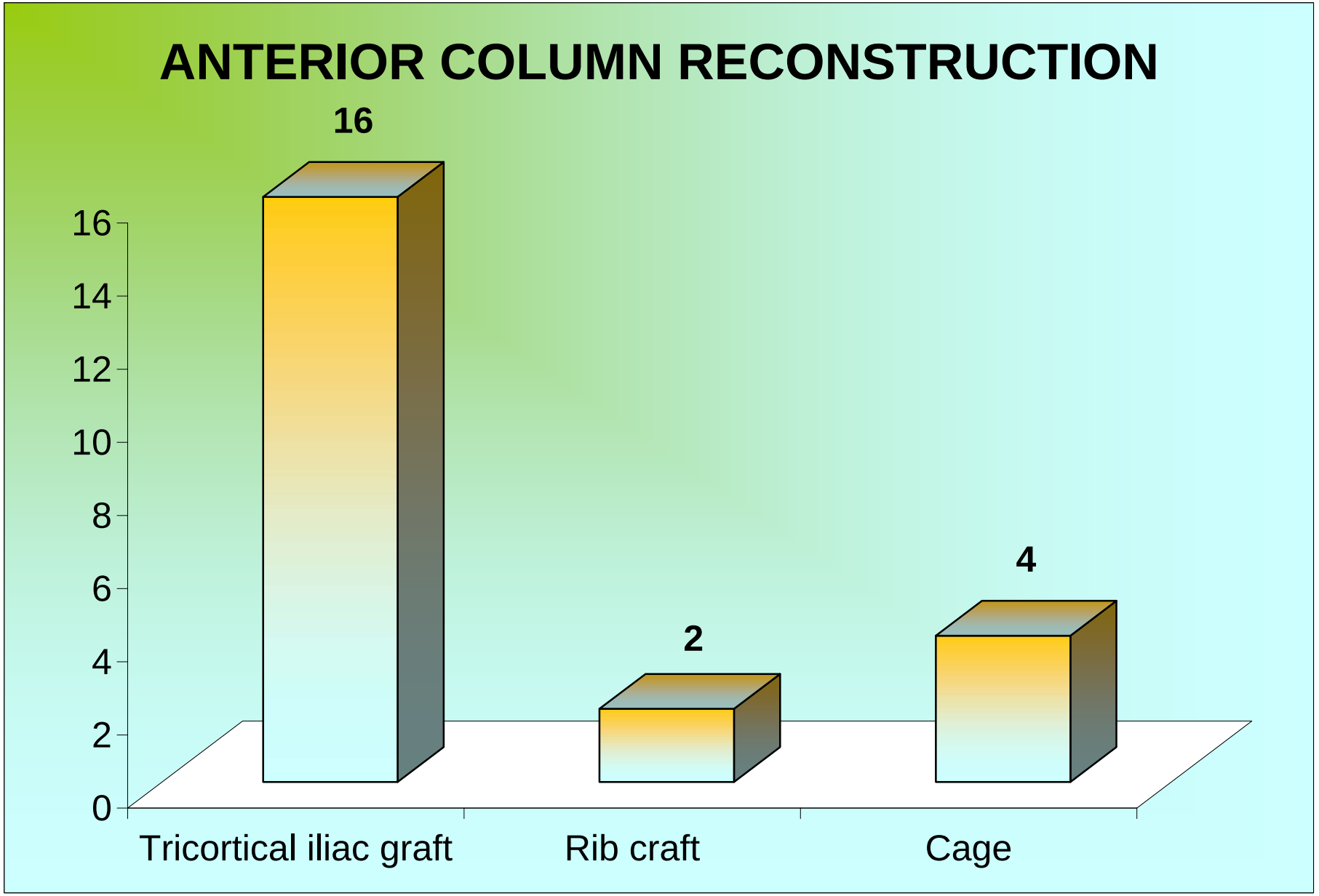

BURST FRACTURE LEVEL
3
2.5
2
1.5
1
0.5
0
1
1
3
2
3
1
D9
D12
#D12
L1
#L2
#L3


KYPHOTIC ANGLE CORRECTION
35
30
25
20
15
10
5
0
29.78
19.9
18.56
13.4
11.22
6.5
Pre-op
Follow up
Correction obtained
Burst Fracture
Canine spine

grades	Pre Op	Post Op
Grade A	7	7
Grade B	3	0
Grade C	1	1
Grade D	1	3
Grade E	0	1



Op
st Op


ANTERIOR COLUMN RECONSTRUCTION
16
16
14
12
10
8
6
4
2
0
2
4
Tricortical iliac graft
Rib craft
Cage

DOS	SL	NAME	AGE	MODE OI	DIAGNOSIS	DURATION	IMPLANT	SEG	NEUROLOGY (Frankel grade)		
									Preop	postop	Follow up
5/5/07	1.Ramesh		28/m	Fall fr.tree	Burst # L1	14 d	t.i.graft	1	A	A	A
7/5/07	2.Bairavan		18/m	Fall fr.tree	Burst # D12	25 d	t.i.graft	1	B	B	C
18/6/07	3.Subramani		30/m	Fall fr ht.	Burst # L2	37 d	Cage	1	A	A	A
3/8/07	4.Mani		38/m	Fall fr.tree	Burst # L2	16 d	t.i. graft	1	C	C	E
28/8/07	5.Marimuthu		55/m	Fall fr.tree	# dislocationD8,9	22 d	t.i.graft	1	A	A	A
24/9/07	6.Jagan		23/m	RTA	Burst # D11,12	20 d	t.i. graft	1	A	A	A.
15/10/07	7.Jeyaram		65/m	RTA	Burst # D 12	5 d	t.i graft	1	A	A	A
18/12/07	8.Thapupandiyan		25/m	Fall fr ht.	Burst # L2	20 d	t.i. graft	1	B	B	D.
20/12/07	9.Nagammal		27/f	RTA	Burst # D12	23 d	cage	1	A	A	A
12/2/08	10.Selvaraj		25/m	Fall fr.tree	Burst # L1	13 d	t.i. graft	1	A	A	A

5/4/08	11.Sekar	35/m	Fall fr ht.	Burst # L4	4 d	t.i.graft with cage	1	D	D	E
5/9/07	12.Durairajan	42/m	Fall fr. Ht.	Burst # L3	18 d	t.i. graft	1	C	C	D

KYPHOSIS ANGLE			CANAL COMPROMISE	FAILURE OF IMPLANT	PAIN SCALE	WORK SCALE	RECENT FOLLOW UP	S.No
PREOP	POSTOP	FOLLOW UP						
30	15	15	55	---	1	5	23/9/08	1.
40.	15	15	55	---	1	5	13/9/08	2.
25	8	10	60	---	2	5	12/8/08	3.
20	5	5	40	---	1	3	31/8/08	4.
45	30	30	20	---	1	5	12/9/08	5.
33	15	15	50	---	2	5	14/9/08	6.
20	11	11	70	---	2	5	5/10/08	7.
35.	10	10	40	---	1	4	28/8/08	8.
40	20	20	45	---	1	5	13/9/08	9.
20	10	10	50	---	2	5	28/9/08	10.
40	20	20	40	---	1	3	11/9/08	11.
40	20	20	50	--	2	2	22/9/08	12.

	SL	NAME	AGE	MODE OI	DIAGNOSIS	DURATION	IMPLANT	SEG	NEUROLOGY (Frankel grade)		
DOS									Preop	postop	Follow up
24/12/06	1.Rajeswari		40/f		D12 L1 caries	8m	Cage	1	C	C	E
7/3/07	2.Kumar		38/m		D6,7 caries	3m	t.i graft	1	A	A	E.
21/3/07	3.Kondamma		49/f	Fall	D4 caries	35 d	Rib graft	1	B	B	B
1/8/07	4.Srinivasan		22/m		L1L2 caries	6m	t.i. graft	2	D	D	E.
9/8/07	5.Rekha		16/f		D3,4,5 caries	3m	Rib graft	1	D	D	E
5/1/08	6.Muniyan		45/m		D1O,11 caries	3 m	t.i.graft	1	B	B	B
13/1/08	7.narmadha		10/f		D3,4 caries	6m	Cage	1	C	C	D.
2/4/08	8.Tamilselvi		30/f		D12 L1 caries	4 m	t.i.graft	1	D	D	E
7/4/08	9.Udhaya sundar		18/m		D8,9 Caries	2m	t.i.graft	1	C	C	D
10/5/08	10.Ammu		27/f		D12,L1 caries	2m d	t.i.graft	1	C	C	D.

KYPHOSIS ANGLE			CANAL COMPROMISE	FAILURE OF IMPLANT	PAIN SCALE	WORK SCALE	RECENT FOLLOW UP	S.No
PREOP	POSTOP	FOLLOW UP						
30	8	8	45	PRESENT	1	3	29/9/08	1.
40	20	20	20	---	1	2	16/9/08	2.
35	20	20	40	---	2	5	9/9/08	3.
35	20	20	30	---	1	3	25/9/08	4.
30	10	10	40	---	1	3	2/9/08	5.
30	10	10	20	---	1	5	5/10/08	6.
45	30	30	20	---	1	3	15/9/08	7.
45	15	15	20	---	1	3	20/9/08	8.
25	10	10	20	---	2	3	16/9/08	9.
20	5	5	15	--	1	3	3/8/08	10.