A *Dissertation on*

FUNCTIONAL OUTCOME OF DORSOLUMBAR SPINE FRACTURE WITH NEUROLOGICAL DEFICIT AFTER SURGICAL MANAGEMENT

Dissertation submitted in

Partial fulfilment of the regulations required for the award of

M.S. DEGREE in

ORTHOPAEDIC SURGERY

THE TAMILNADU DR.M.G.R.MEDICAL UNIVERSITY

COIMBATORE-TAMILNADU

APRIL 2020

CERTIFICATE - I

This is to certify that this dissertation titled **FUNCTIONAL OUTCOME OF DORSOLUMBAR SPINE FRACTURE WITH NEUROLOGICAL DEFICIT AFTER SURGICAL MANAGEMENT** is a bonafied record of work done by **Dr.P.Raghu,** during the period of his post graduate study from May 2017 to September 2019 under guidance and supervision in the INSTITUTE OF ORTHOPAEDICS AND TRAUMATOLOGY, Coimbatore Medical College and Hospital, Coimbtore-641018, in partial fulfillment of the requirement for **M.S.ORTHOPAEDIC SURGERY** degree examination of The Tamilnadu Dr. M.G.R. Medical University to be held in April 2020.

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CERTIFICATE – II

This is to certify that this dissertation work titled **FUNCTIONAL OUTCOME OF DORSOLUMBAR SPINE FRACTURE WITH NEUROLOGICAL DEFICIT AFTER SURGICAL MANAGEMENT** of the candidate **Dr.P.Raghu** with Registration Number 221712257 for the award of **MASTER OF SURGERY** in the branch of **ORTHOPAEDICS**. I personally verified the urkund.com website for the purpose of plagiarism Check. I found that the uploaded thesis file contains from introduction to conclusion 78 pages and result shows 3% percentage of plagiarism in the dissertation.

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CERTIFICATE OF APPROVAL

To
Dr.Raghu P
Post Graduate,
Department of Orthopaedics,
Coimbatore Medical College & Hospital
Coimbatore -18.

Dear **Dr.Raghu P**

The Institutional Ethics Committee of Coimbatore Medical College, reviewed and discussed your application for approval of the proposal entitled **"Functional outcome of Doorsolumbar Spine Fracture with Neurological Deficit after Surgical Management."**No.079/2017.

The following members of Ethics Committee were present in the meeting held on 25.11.2017.conducted at MM - II Seminar Hall, Coimbatore Medical College Hospital Coimbatore-18.

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15	Mr.V.A.Shahul Hameed, +2	Lay-Person

We approve the Proposal to be conducted in its presented form.

Sd/Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

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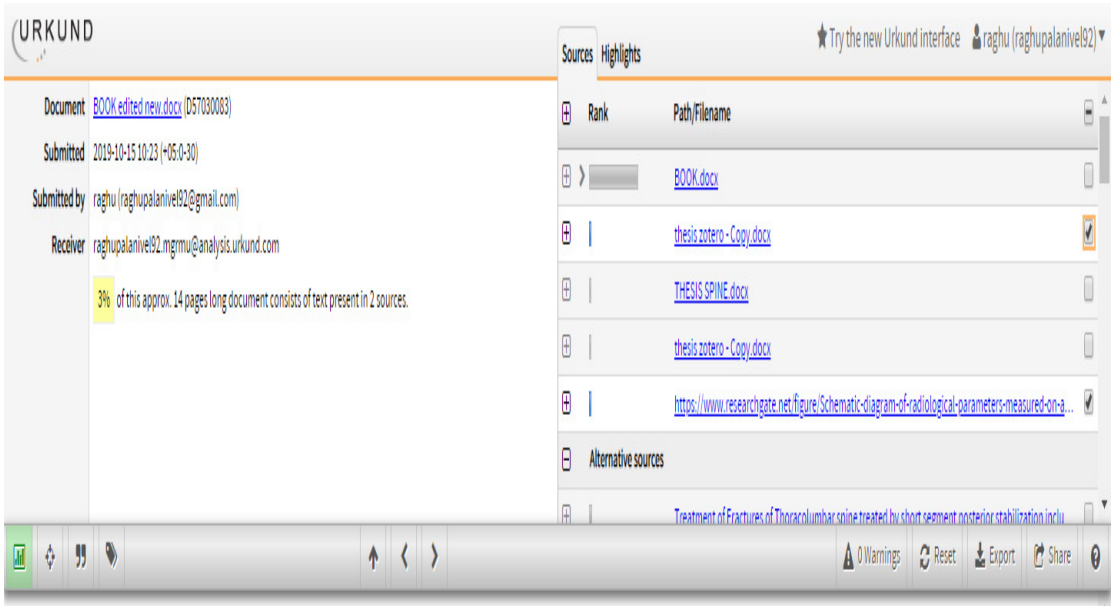

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FUNCTIONAL OUTCOME OF DORSOLUMBAR SPINE FRACTURE WITH NEUROLOGICAL DEFICIT AFTER SURGICAL MANAGEMENT

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functional outcome of dorsolumbar spine fracture with neurological injury after surgical management

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COIMBATORE-TAMILNADU APRIL 2020

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in partial fulfillment of the requirement for M.S.ORTHOPAEDIC SURGERY degree examination of The Tamilnadu Dr.

DECLARATION

I declare that the dissertation entitled **"FUNCTIONAL OUTCOME OF DORSOLUMBAR SPINE FRACTURE WITH NEUROLOGICAL DEFICIT AFTER SURGICAL MANAGEMENT"** submitted by me for the degree of M.S is the record work carried out by me during the period of **May 2017 to September 2019** under the guidance of **Prof..S.Vetrivel Chezian, M.S.Ortho.,D.Ortho.,FRCS, PhD,** Director, Institute of Orthopaedics and Traumatology, Coimbatore Medical College& Hospital, Coimbatore. This dissertation is submitted to The Tamilnadu Dr.M.G.R. Medical University, Coimbatore, in partial fulfillment of the University regulations for the award of degree of M.S.ORTHOPAEDICS examination to be held in April 2020.

Place: Coimbatore **Signature of the Candidate**

Date:

(Dr.P.Raghu)

Signature of the Guide

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I sincerely thank **Dr.S.Marimuthu, Dr.M.S.Mugundhan, Dr.P.Balamurugan, Dr.R.Vivekanandhan, Dr.M. Ravi Kumar, Dr.S.Arun Kumar**, Assistant Professors of this institute for their valuable suggestions and help during this study.

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I am grateful to all my post graduate colleagues for helping in this study. Last but not least, my sincere thanks to all our patients, without whom this study would not have been possible.

Dr.P.Raghu.

CONTENTS

INTRODUCTION

Vertebral fractures are common problem in orthopaedics nowadays and associated with severe morbidity if left untreated. Among the total trauma patients, spinal fractures accounts for 6% approximately and out of these patients 2.6% are associated with neurological deficit in the form of motor, sensory deficiency, bladder and bowel dysfunction depends on the level of injury. Cervical spine is the most common site of fracture and the second most common is thoracolumbar spine. Thoracolumbar injuries distributed bimodally and males less than 30 years and geriatric populations are most commonly involved. Road traffic accident and fall from height are the common mode of injury. The common complications after these injury include kyphosis, scoliosis, deep vein thrombosis, bed sores, respiratory tract infections etc. So prevention of these complications are more important than treating the fractures.

The treatment goal is to restore maximum possible function, early rehabilitation and to prevent further deformity. So surgical stabilization is performed to achieve these goals. Posterior stabilization is the most common method used in thoracolumbar region because it is safer and most surgeons are familiar in this approach.

In this study, the patients with thoracolumbar spine fracture with neurological injury were stabilized and decompressed with or without posterolateral fusion using either long or short segment posterior stabilization.

AIM AND OBJECTIVE

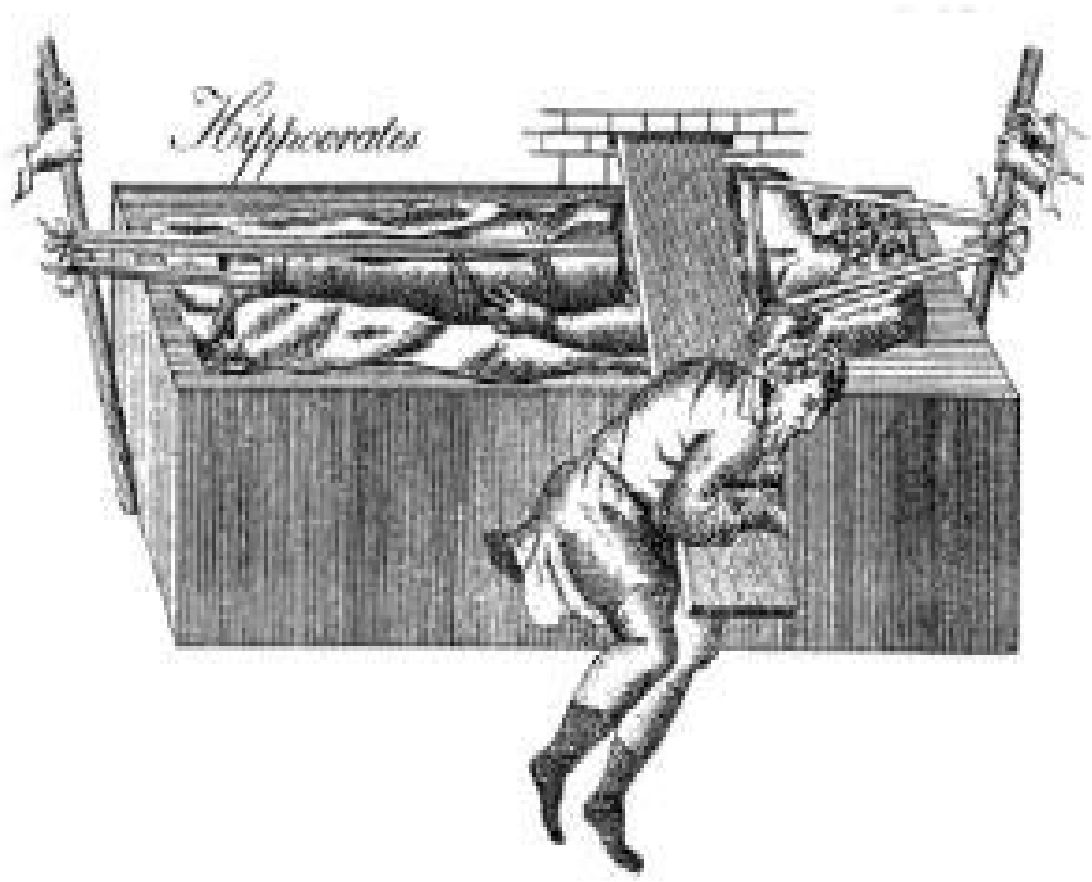
To study the functional outcome of dorsolumbar spine fracture with neurological injury after surgical management with stabilization, decompression and fusion.

To facilitate early rehabilitation and thus preventing further complications.

HISTORY AND REVIEW OF LITERATURE

In 1550 BC. Spinal fractures are managed at first and Edwin smith surgical papyrus is the written proof for this.

Hippocrates treated the patients without neurological deficit by conservative management with traction and manual reduction and advised bed rest in supine position.



Hippocratic vertebral fracture reduction table.

Oribasius fracture reduction table

Laminectomy was first suggested by Paul of aegina, in 7th century. And it was first documented by MacEven in 1886.

Malgaigne in 1847 and Bholer in 1932 recommended Indirect reduction by traction, hyperlordosis, immobilization by using plaster jacket followed by muscle exercise intensively.

First spinal instrumentation was done by HadraGalueston in 1891 for cervical spine injury using wire.

In 1991 Hibbs introduced the concept of fusion without spinal instrumentation for stabilizing the spinal deformity.

In 1909, Fritz Lang used rigid celluloid rods with wires and silk for posterior stabilization.

In 1940, King used extensive internal fixation for thoracolumbar spine fracture by pedicle screws.

In 1960s, first successful instrumentation was done by Harrington. It was a gold standard technique for many years and other techniques were compared and analysed with this technique.

Roy Camille and colleague used pedicle screws in 1963 and later it was modified by Louis and Maresca.

After 1970, improvement in imaging techniques, advancement in implant and anaesthetic techniques, operative techniques were performed.

In 1994, Dick et al. performed a study of biomechanics of pedicle screw fixation.

Stefen et al studied 617 patients with vertebral fractures treated them with pedicle screws in 1996 and the conclusion of the study was 27.4% complication rate overall.

Ache et al. studied the complications of transpedicular screw fixation for vertebral fractures in 163 cases in 1994. They found 3 patients had dural leak, 17 patients had improper screw placement, 34 patients had loosening of screws, screws and rods were disconnected in 3 patients, 9 patients had screw breakage, 3 patients had rod breakage and 3 patients were suffered from pulmonary embolism.

In 2010, Yong Ji et al. studied posterior stabilization with short segment fixation using pedicle screws at fractured vertebra. And they found, this method is safer and helps to kyphosis correction, fracture reduction and over distraction of discs are avoided.

RELEVANT ANATOMY

The spinal column is divided into individual units called as vertebra. Understanding the anatomy of vertebral column, spinal cord and structures around it is more important to evaluate the spinal trauma.

The anatomy of vertebral column can be divided into two.

A) Spinal column

B) Spinal cord

1). Spinal Column:

It consists of,

1) Anterior elements: vertebral bodies and intervertebral discs.

2) Posterior elements:spinous process, transverse process, pedicles, lamina and 2 articular processes superior and inferior.

3) Interconnecting ligaments.

A). Vertebral Bodies And Intervertebral Discs:

Spinal column is made of 33 vertebrae

Cervical:7

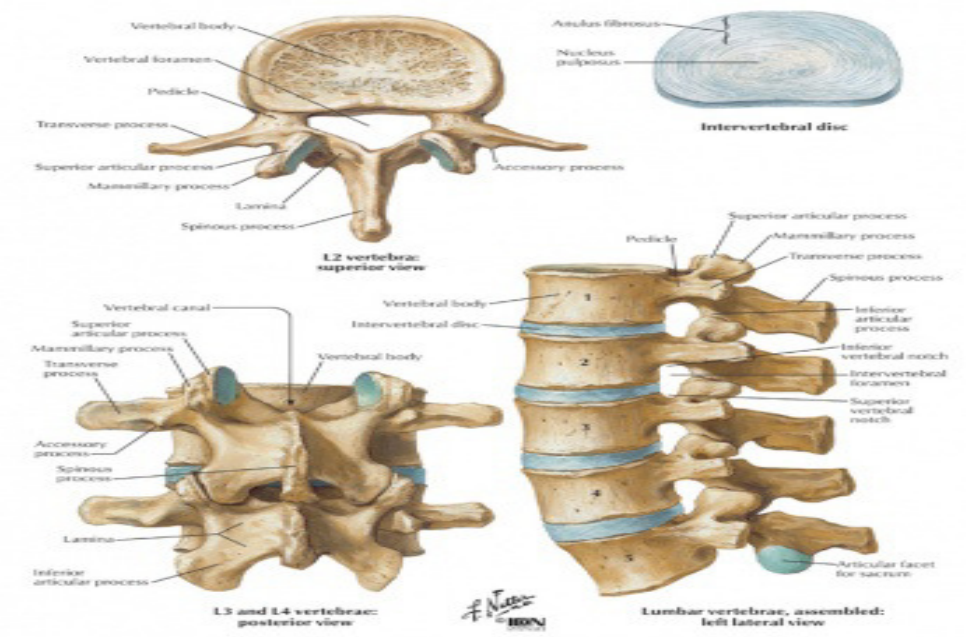
Thoracic: 12

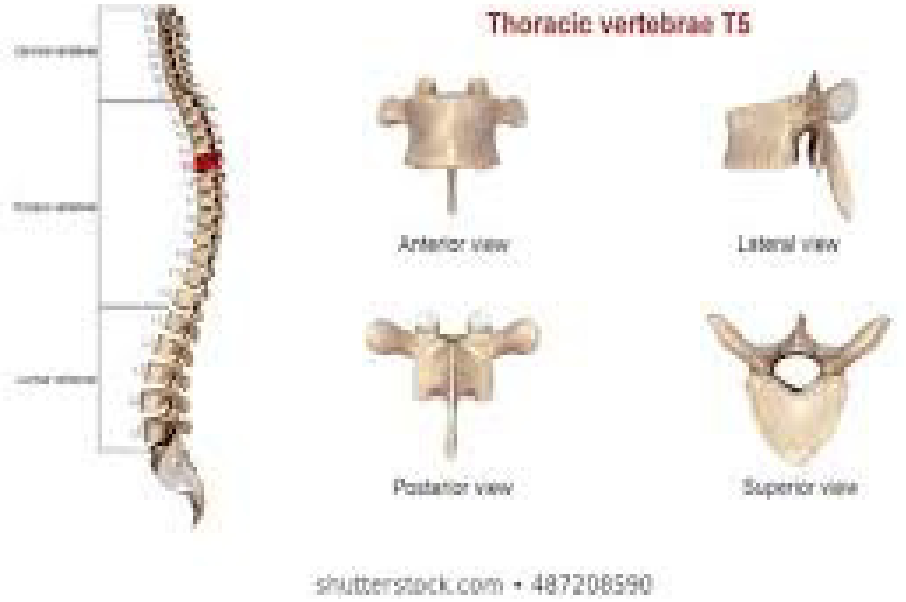
Lumbar:5

Sacral:5

Coccyx:4

Intervertebral disc fill the space between the adjoining. Along with these above mentioned structures anterior longitudinal ligament and posterior longitudinal ligament provides additional stability to the spinal column and these structures forms the Denis anterior and middle columns.


Vertebral body
Vertebral foramen
Pedicle
Transverse process
Superior articular process
Mammillary process
Lamina
Spinous process
Accessory process
L2 vertebra: superior view
Annulus fibrosus
Nucleus pulposus
Intervertebral disc
Vertebral canal
Superior articular process
Mammillary process
Transverse process
Accessory process
Spinous process
Lamina
Inferior articular process
Vertebral body
L3 and L4 vertebrae: posterior view
Pedicle
Superior articular process
Mammillary process
Transverse process
Spinous process
Vertebral body
Intervertebral disc
Inferior articular process
Inferior vertebral notch
Intervertebral foramen
Superior vertebral notch
Articular facet for sacrum
Lumbar vertebrae, assembled: left lateral view


Thoracic vertebrae T5
Anterior view
Lateral view
Posterior view
Superior view
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B). Posterior Elements:

Posterior elements consists of spinous process, transverse process, pedicles, lamina and 2 articular processes superior and inferior. These bony parts are interconnected by supporting ligaments like intertransverse ligament, supraspinous and infraspinous, facet capsules and ligamentumflavum. These structures forms the Denis posterior column.

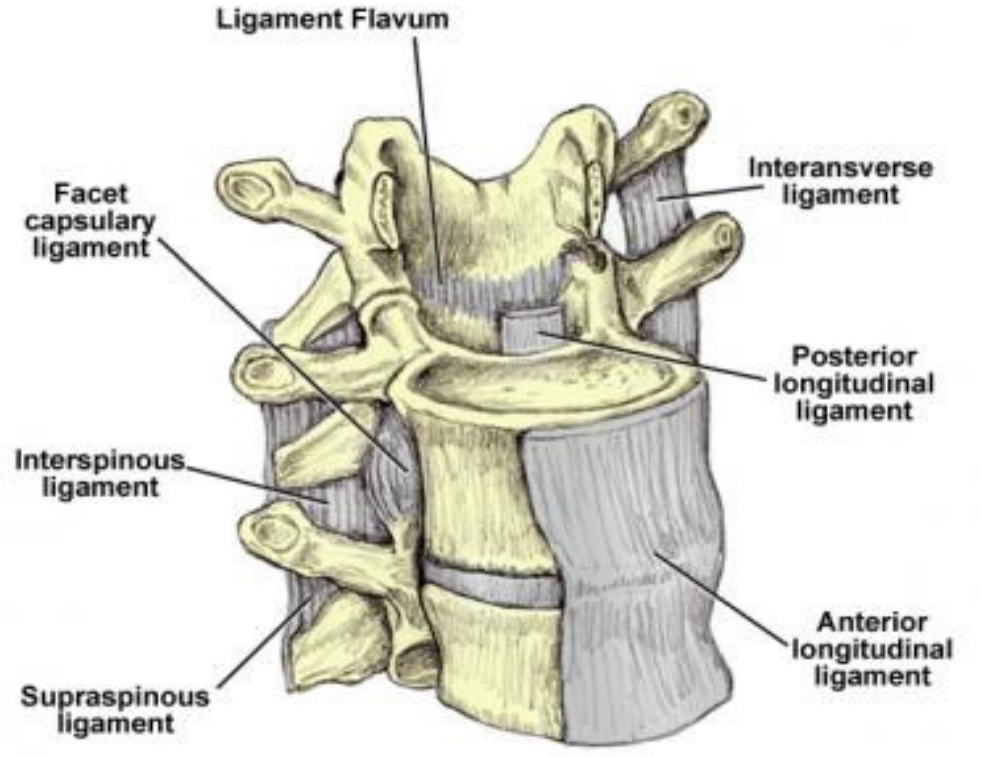
C). Ligaments:

Ligaments of spinal column are uniaxial in nature. The functions of the ligaments are carrying loads in the direction of itsfibres. They are resistant in tensile forces and fails in compression.

Spinal ligaments are classified into

1) Continuous and

2) Segmental.



- **Continuous ligaments:**

  1)Anterior longitudinal ligament,

  2) Posterior longitudinal ligament,

  3) Supraspinous ligament.

- **Segmental ligaments:**

  1)Ligamentumflavum,

  2)Interspinous ligament,

  3) Intertransverse ligament.

1). **Anterior Longitudinal Ligament**:

The anterior longitudinal ligament starts from the base of the occiput in its anterior aspect andattachment of the ligament is to the anterior surface of the vertebral bodies. It is thicker in the thoracolumbar region. And the intervertebral discs are not attached to this ligament.

2). **Posterior Longitudinal Ligament**:

Posterior longitudinal ligament originates from the base of the occiput in its posterior aspect and its attachment is to the posterior surface of the all vertebral bodies. It is thicker in the thoracic region like anterior longitudinal ligament but in lumbar region it is thinner when compared to the anterior longitudinal ligament.

3). IntertransverseLigament:

These cordlike rounded structure connects the transverse processes inthe thoracicregion. They are also attached to the deeper layer of paraspinal muscles.

4). SupraspinousLigaments:

It attaches the Ligamentumnuchae and the sacrum. It is broader and thicker in the lumbar spine region.

5). LigamentumFlavum:

Ligamentumflavum is called as yellow ligament because of its high amount of elastin content. Its location is between the interlaminararea. Due to their high elastin content, these arecalled as "**yellow ligaments'**. It originates from theanteroinferior part of the upper lamina and attached to the posterosuperior part of the lower lamina. These are more prominent in the thoracic spine region.

6). Interspinous Ligaments:

Two adjacent spinous processes are connected by interspinousligament . It is thickened and broadened in the lumbar region and it is elongated and narrower in thoracic spine region.

D) Pedicles:

The strongest and most important part of a vertebra is pedicle. It transmit the load between the body and neural arch. The integrity of the pedicle is important for proper screw selection and screw placement. It has two parts outer cortex and inner medulla.

Zindrick et al, SingleTc et al, Krag et al, Rama Devi et al studied about the pedicle morphology and those results are helpful in pedicle screw placement and screw selection.

Anatomical relation of pedicle screws:

Pedicles are surrounded by vital structures. So knowledge about these relationship is important during pedicle screw placement.

Side	Related structure
Anteriorly	L3,L4 levels: common iliac vessels. Sacral spine region: Sacral artery.
Superiorly and laterally	Nerve root of upper vertebral level lies closely. Sacral region: Great vessels and its branches.
Medial	Nerve root, Dural sac, Epidural space.
Caudally	Exiting nerve root of same level.

E).Facet Joints:

Facet joint is formed by superior and inferior articular facets.It is a synovial joint.

F). Laminae:

They are plate like bony part lie medial and posterior to the pedicle. Lamina of both sides combined to form spinous process in the median plane.

G). Spinous Process:

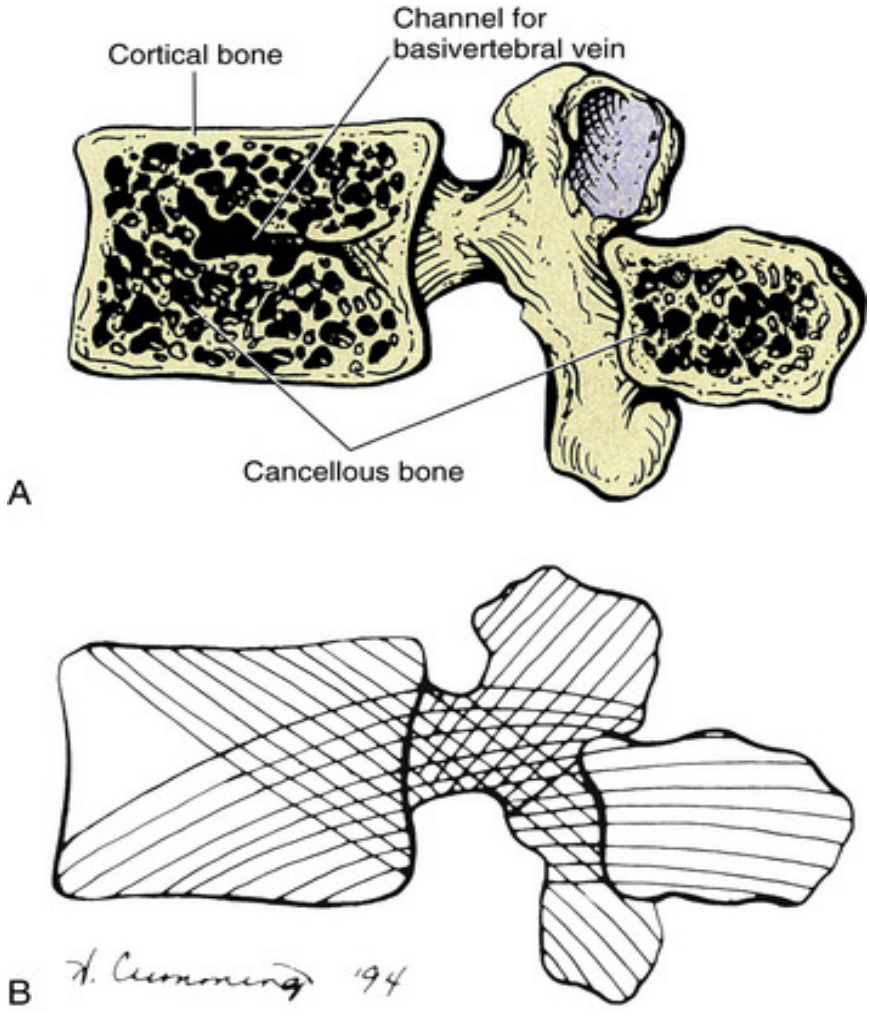
It is formed by fusion of right and left lamina in the median plane. It gives attachment to the muscles and ligaments which is involved in the spinal stability.

H). Transverse Processes:

It is a lateral structure projected from the junction of lamina and pedicle on either side. In thoracic region it articulates with ribs.

I). Trabecular Pattern Of The Vertebrae:

In coronal section they are oriented vertical and horizontally. In sagittal plane they are oriented obliquely. The superior trabeculae arise from superior end plate and extended posteriorly, while the inferior trabeculae starts from inferior end plate.

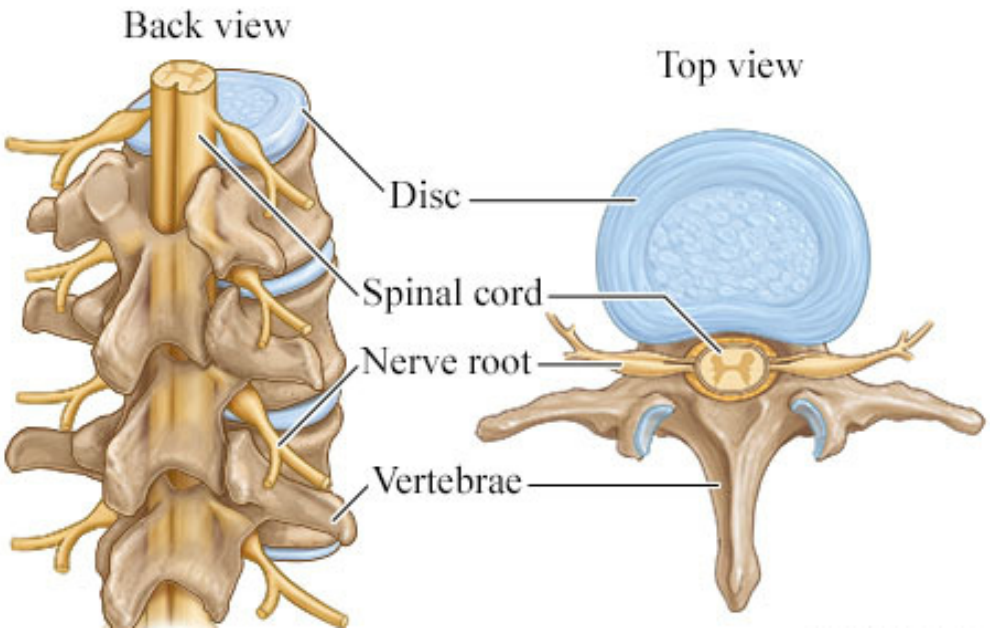


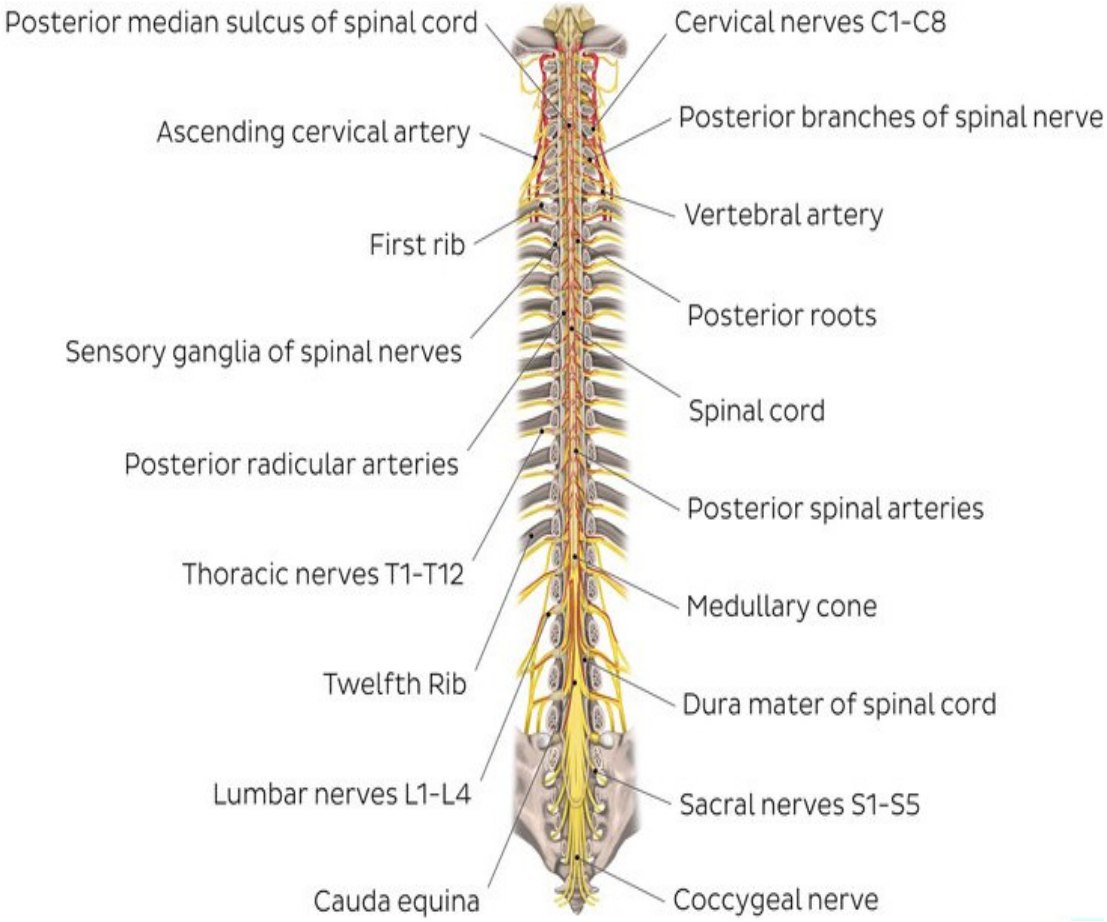
J) Spinal muscles:

- Sacrospinalis- longissimus,spinalis,iliocostalis.
- Multifidis,
- Rectus abdominus.

2) Spinal Cord:

Spinal cord arises from medulla oblongata a part of brain stem. It is surrounded by meninges ,epidural fat, cerebrospinal fluid. It ends at L1L2 disc space in adults. The end of the spinal cord is called as conusmedullaris. Below this level caudaequina occupies the spinal canal.




Posterior median sulcus of spinal cord
Ascending cervical artery
First rib
Sensory ganglia of spinal nerves
Posterior radicular arteries
Thoracic nerves T1-T12
Twelfth Rib
Lumbar nerves L1-L4
Cauda equina
Cervical nerves C1-C8
Posterior branches of spinal nerve
Vertebral artery
Posterior roots
Spinal cord
Posterior spinal arteries
Medullary cone
Dura mater of spinal cord
Sacral nerves S1-S5
Coccygeal nerve

BIOMECHANICS AND PATHOPHYSIOLOGY

Spinal motion can be divided into 6 components by using three dimensional coordinate system. These includes,

Three types of translation:

Anteroposterior translation in sagittal plane,

Mediolateral translation in frontal plane,

Craniocaudal translation in longitudinal plane.

Three types of angulation:

Flexion extension in sagittal plane,

Lateral flexion in frontal plane,

Rotation in craniocaudal axis.

Translation motions are restricted in thorocolumbar region, particularly mediolateral or anteroposterior translation. Consequently, physiological spinal motions are achieved mainly by angulations. When compared to lumbar spine stiffness is higher in the thoracic spine in the sagittal plane. This causes restriction of lateral flexion extension. Rotatory movements of thoracic spine is greater in the craniocaudal axis.

Compressive load of thoracolumbar junction is 400 Newton due to the body weight above that level.

Haher and coworkers studied about thoracolumbar junction's load carrying capacity. When the anterior column is disrupted, the thoracolumbar junction's load carrying capacity decreased by 30%. If both anterior and middle column is involved the capacity is reduced by 70%. 65% of load carrying capacity can be decreased by ablating the posterior column. This helps to evaluate the spinal instability accurately.

Biomechanics Of Pedicle Screws:

Biomechanics of pedicle screw fixation is based on three concepts.

1) Pull out strength is determined by outer diameter and fatigue strength is determined by inner diameter of pedicle screw.

2) During pedicle screw insertion, dorsal cortex should not be damaged and the length of the screw should be adequate, it should converge on both side.

3) Augumentationof fixation can be done in case of revision surgery or severe osteoporosis.

Pathophysiology:

The forces involved in spinal injury include flexion, extension, axial loading, axial rotation and shear. The combination of above forces results in spinal injury. Compressive forces or pure axial loads cause fractures of end plate, burst fracture and anterior wedge compression fracture. Extension-type of injuries cause tensile forces in anterior spine and tensile or compressive forces in the posterior elements. Axial load with mild extension is the major mechanism causing burst fractures, with pedicles wideningand the retropulsion of fragments.

Spinal StabilityAnd Instability:

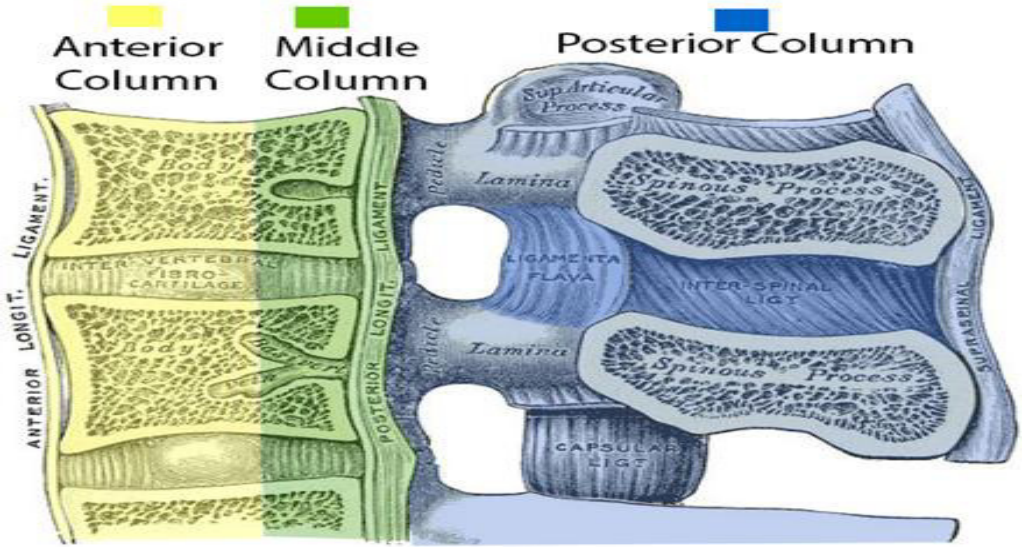
White And Punjabi:

By posterior longitudinal ligament, they divided spinal column into anterior and posterior column.

To achieve spinal stability one column should be completely intact and at least an element of other column alsoshould be intact

Denis three column concept:

COLUMN	STRUCTURES
Anterior column	anterior half of the vertebral body, anterior longitudinal ligament, anterior part of annulus fibrosis.
Middle column	posterior half the of vertebral body, posterior longitudinal ligament, posterior part of annulus fibrosis.
Posterior column	interspinous ligament, ligamentumflavum, facet joint capsule, neural arch.



To achieve spinal stability at least 2 column should be stable.

Factors Providing Spinal Stability:

Active stabilization	–	deep muscles of back
Passive stabilization	–	anatomy of vertebral body and the facetjoints.
Hydrodynamic stability	–	provided by nucleus pulposus.
Dynamic stabilization	–	joint capsule, viscoelastic ligaments, annulus fibrosus.

Instability:

It has two types:

Neurological,

Mechanical.

***Neurological instability*:**

Inability to provide protection to the neural elements like spinal cord, Cauda equine andnerve roots.

Mechanical instability:

Unable to withstand the physiologic needs, without producing any deformity, pain or nerve compression.

MATERIALS AND METHODS

This study included the patients treated in government Coimbatore medical college for dorsolumbar spine fracture with neurological deficit. These patients were managed with posterior stabilization, decompression with or without fusion and the functional outcome was evaluated.

Period of study: JANUARY 2018 –DECEMBER 2018

Inclusion criteria:

1. Age group 18 to 70 years of either sexes.

2. Fractures duration less than 14 days after haemo dynamic stabilization.

3. Dorsolumbar spine fracture-Confirmed by clinical examination, x rays and if required CT scan.

4. Patients who give informed consent and willing for follow up.

Exclusion criteria:

1. Patients less than 18 years of age.

2. Patients unfit for surgery.

3. Pregnancy.

4. Associated comorbid conditions history of suffering from Myocardial Infarction(MI) less than 1year, psychiatric illness, head injury.

5. Associated major visceral injury.

Patient evaluation:

Patients admitted in emergency department were thoroughly examined regarding patient details, detailed history of mode of injury, any associated comorbid conditions, previous history of any surgery and also ruled out associate head injury, chest injury and abdominal injury.

After detailed general examination, patients who fulfilled the inclusion criteria were evaluated for neurological status and radiological examination.

Neurological Examination:

- By using Glasgow coma scale level of conscious was evaluated.
- Motor power, sensory examination, reflexes were elicited and ASIA impairment scale was used for this neurological examination.

Radiological examination:

Plain x-ray was taken initially in patients with suspected spinal injury. These includes anteroposterior and lateral view of spine.

Anteroposterior view:

Interpedicular distance widening,

Coronal plane irregularities.

Lateral view:

Compression of vertebral body,

Interspinous distance,

Degree of kyphosis by using cobb's method,

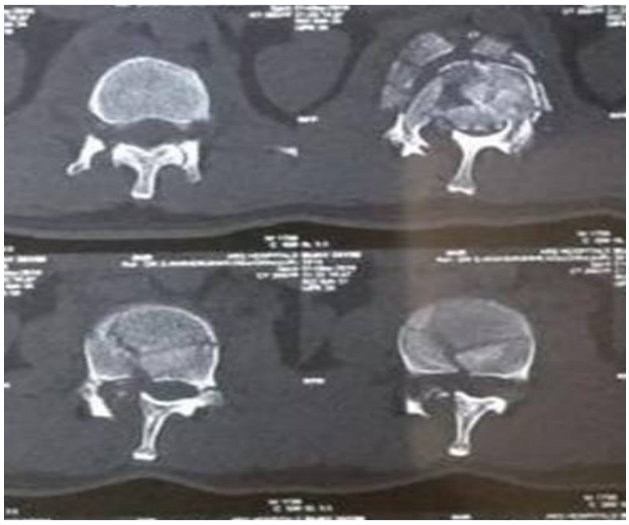
Posterior vertebral angle

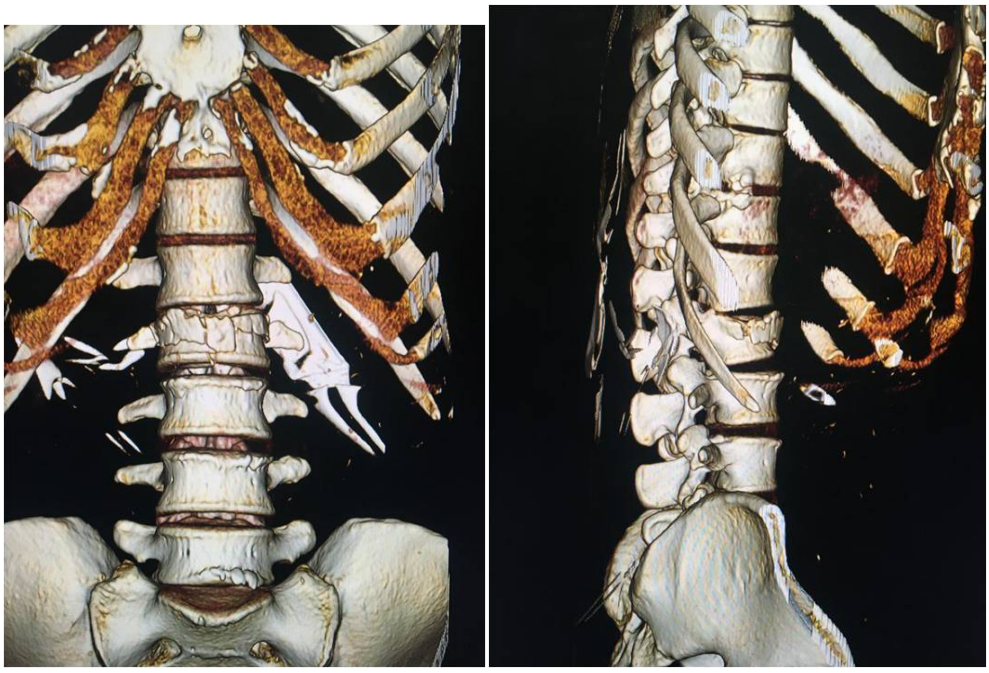
Retropulsion of bony fragments

Subluxation.

Computed Tomography:

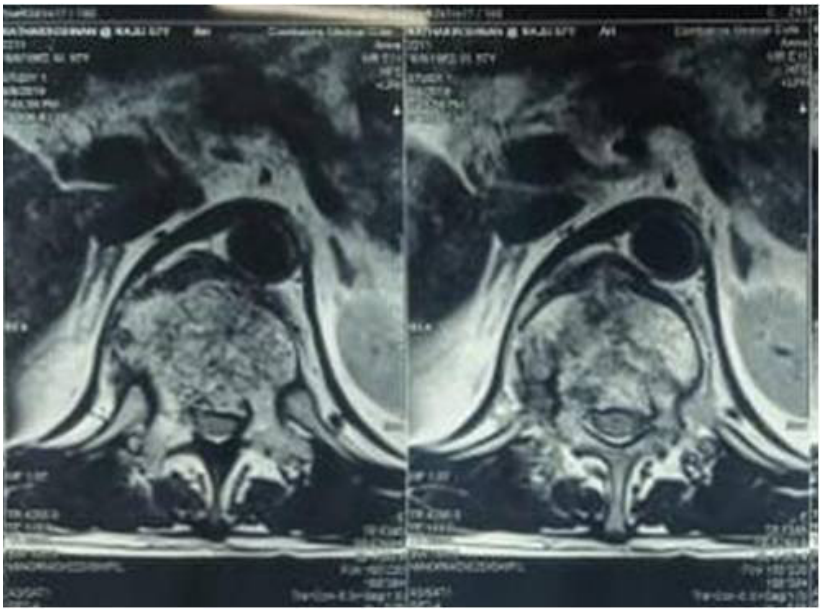
CT scan was taken for all patients before surgery to identify the comminution of fracture, intactness of pedicles etc.





Magnetic Resonance Imaging:

In our study MRI was taken for all the patients. It is useful to assess the cord edema, cord compression, disc herniation, ligament injury etc. It is a useful tool to assess the integrity of posterior ligamentous complex and assessing the spinal stability.



Classification:

Holdsworth classification:

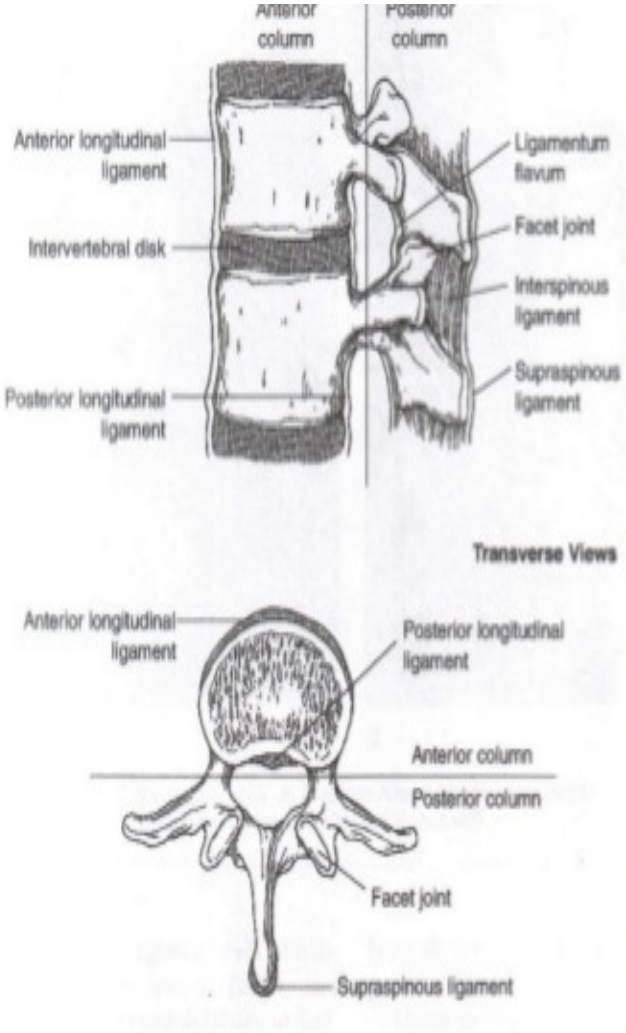
He classified the spine into two column:

1) anterior weight-bearing column,
2) posterior tension-bearing column.

Holdsworth 1963

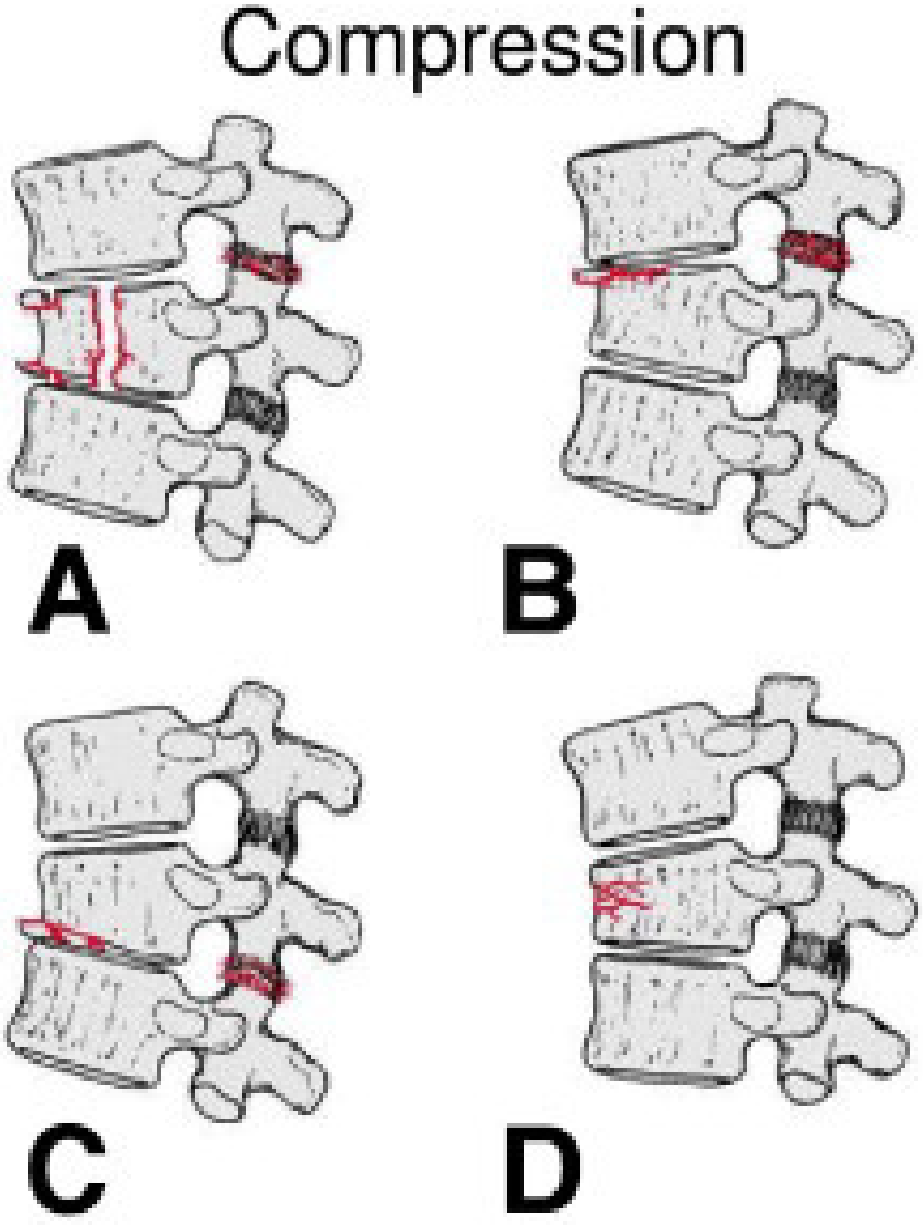
2 column theory

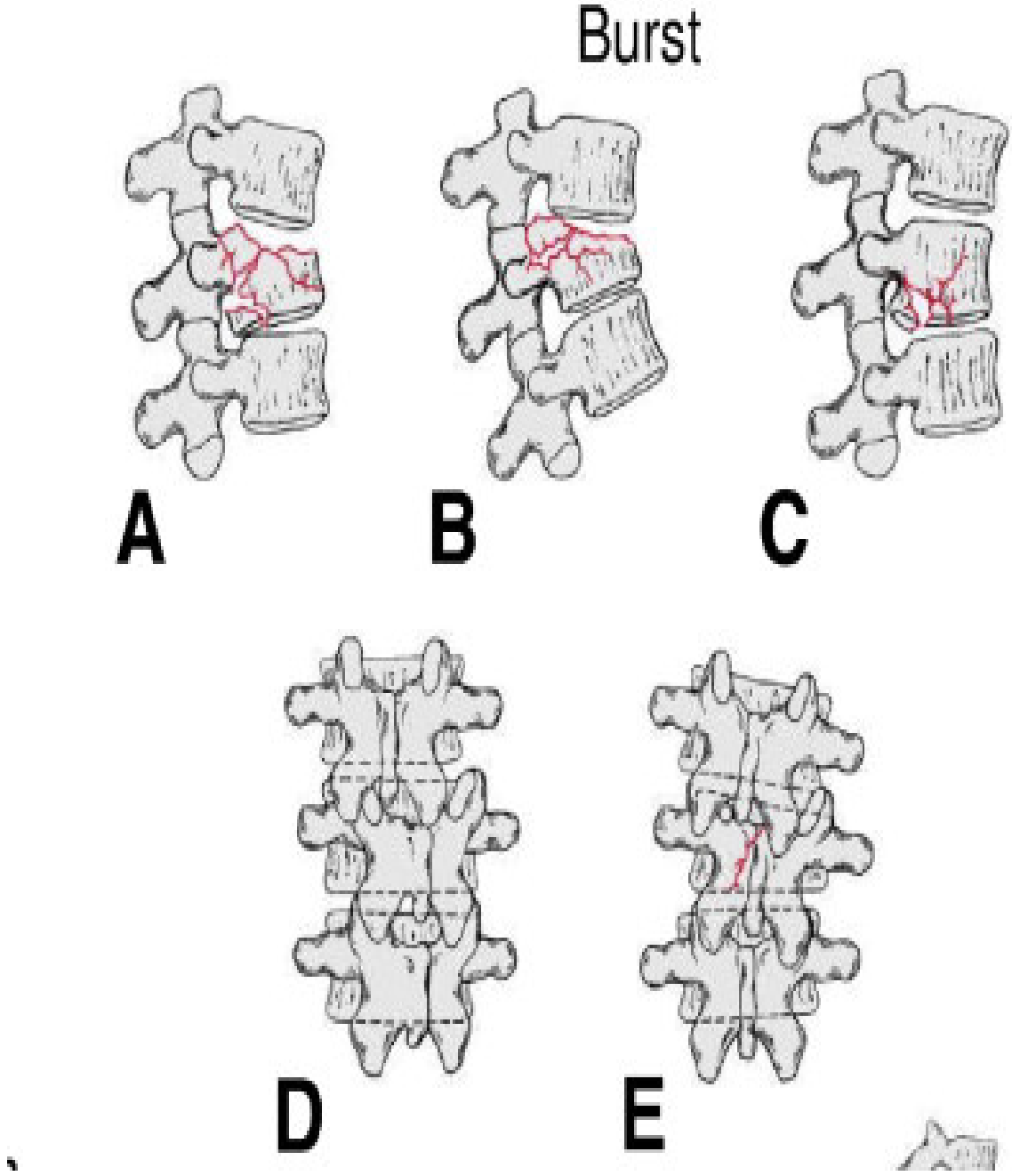
Post. ligaments

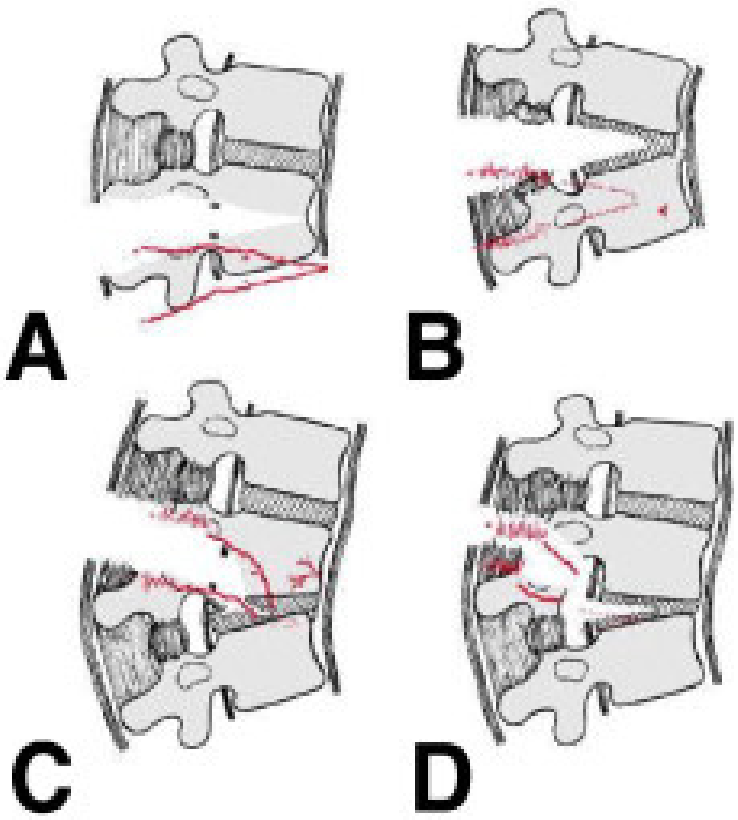


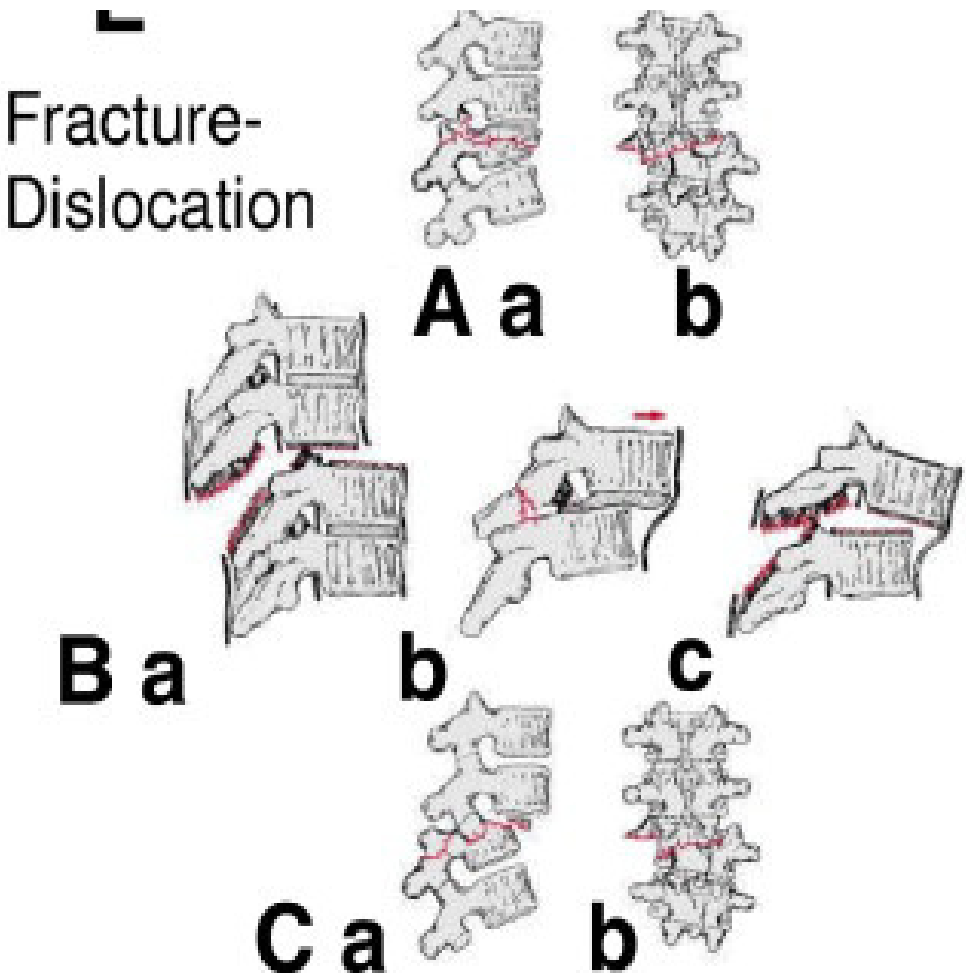
Denis Classification:

He divided thorocolumbar injuries into 4 principle categories. These includes compression fracture, burst fracture, chance fracture and fracture dislocation.

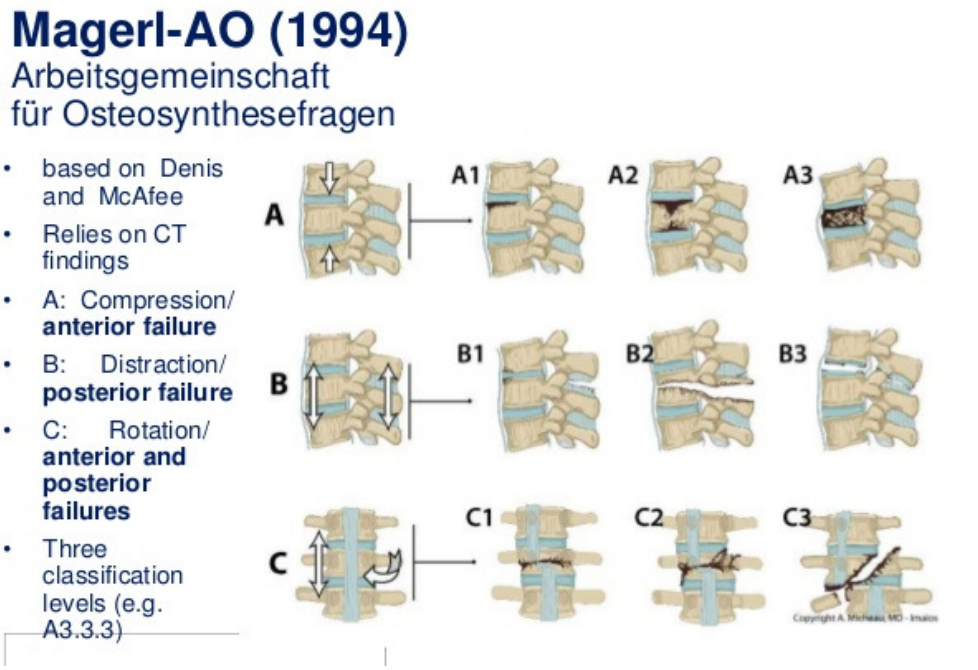



Burst
A
B
C
D
E


Flexion-Distraction
A
B
C
D


Fracture-
Dislocation
A a
b
B a
b
c
C a
b

Magerl System(AO):



TLICS SCORE:

Thoracolumbar Injury Classification and Severity Score	
	POINTS
FRACTURE MECHANISM	
Compression fracture	1
Burst fracture	1
Translation/rotation	3
Distraction	4
NEUROLOGIC INVOLVEMENT	
Intact	0
Nerve root	2
Cord, conus medullaris, incomplete	3
Cord, conus medullaris, complete	2
Cauda equina	3
POSTERIOR LIGAMENTOUS COMPLEX INTEGRITY	
Intact	0
Injury suspected/indeterminate	2
Injured	3

Score of ≤ 3: nonoperative treatment; score of ≥ 5: operative treatment; score of 4: either nonoperative or operative treatment, depending on qualifiers such as comorbid medical conditions and other injuries.
From Vaccaro AR, Zeiller SC, Hulbert RJ, et al: The thoracolumbar injury severity score: a proposed treatment algorithm, J Spinal Disord Tech 18:209, 2005.

PROFORMA

Name: Age/Sex: Case no:

D.O.A: D.O.S: D.O.D:

Phone No:

Occupation:

Presenting complaints:

Fracture characteristics:

Mechanism of injury: RTA/sports injury/fall from height:

Site of fracture: Dorsal spine/ Lumbar spine

Type of fracture: Burst fracture/ wedge compression fracture/other types

Fracture classification: Mcafee / Denis classification

Associated with neurological deficit:

Associated vascular injury:

Initial treatment: Steroid/Brace immobilisation

Associated injuries:

Head injury/chest injury/abdominal and pelvic injury/other fracture

Associated co-morbid conditions, if any:

General examination:

Local examination: Spine:

Inspection:

Palpation :

Neurological examination:

Power :

Tone:

Reflex:

Sensation:

Bowel and bladder habits:

Bulbocavernous reflex:

Anal wink:

Perinal sensation:

Frankel grading:

Operative details:

Duration between trauma & surgery: Anaesthesia:

Duration of surgery: Position:

Fixation method:

Approach: Anterior/ Posterior

Post-operative management:

Radiographic evaluation:

X ray:

CT:

MRI:

At the time of discharge:

Power : Reflex :

Tone: Sensation:

Bowel and bladder habits:

Wound healing: Duration of hospital stay:

Complications:

Superficial surgical site infection:

Deep Infection:

Urinary tract infection:

Meningitis:

Neurological complication:

Pressure sore:

Screw impingement:

Screw failure/breakage

Follow up

	2 weeks	**6 weeks**	**3 months**	**6 months**
DATE				
SLRT				
CLINICAL STATUS: WOUND: POWER: TONE: SENSATION: REFLEX:				
RADIOLOGICAL EVALUATION				
FUNCTIONAL ASSESSMENT SYSTEM				
ADVICE				
PROFESSOR SIGNATURE				

Surgical Techniques:

Implants:

We used 5.5mm or 6.5mm titanium pedicle screws and titanium rod for surgical stabilization of spinal column.

Patient positioning:

Anaesthesia: general anaesthesia.

Position: prone.

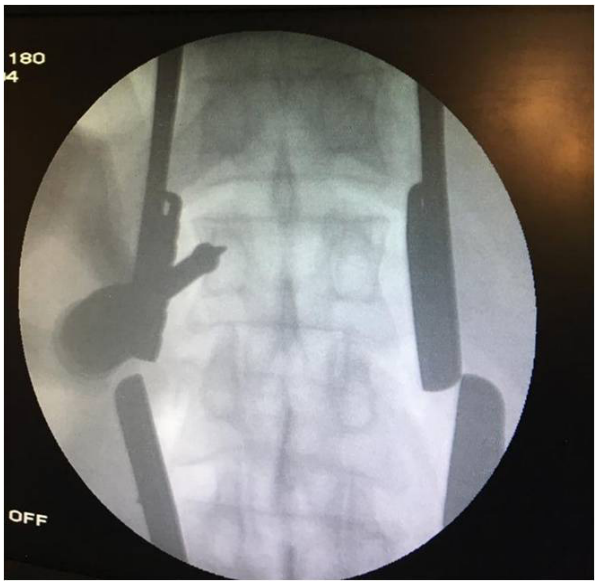
Surgical techniques:

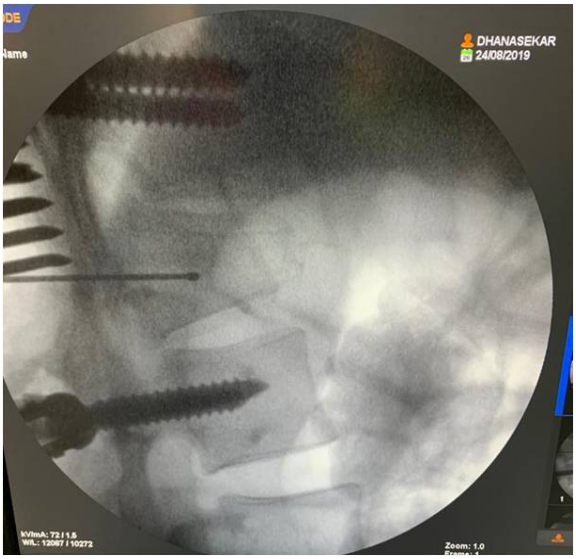
Approach: we used only posterior approach in our study.

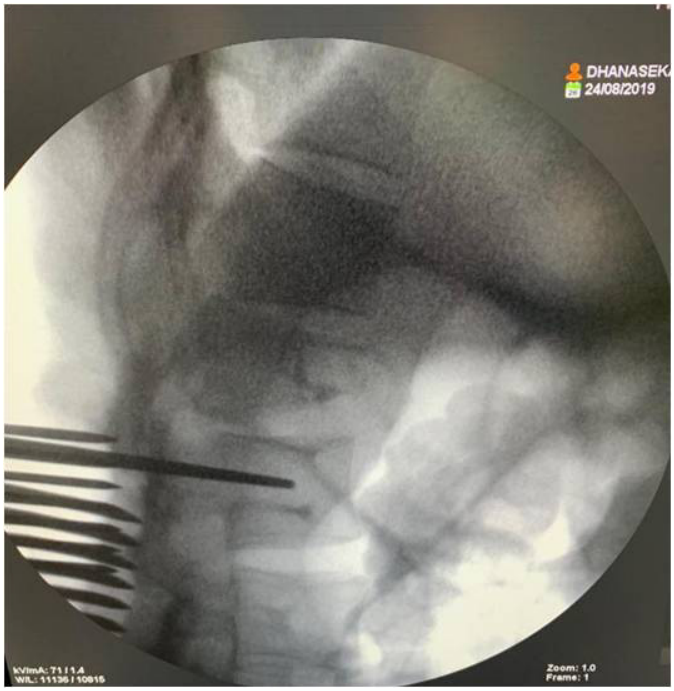
We used adrenaline for skin infilteration to control bleeding. Intersection technique was used for pedicle entry.

Skin incision and exposure:

Pedicle entry and probing:







Fixation with screws and rods:

Post operative protocol and follow up:

Post operatively IV antibiotics were given for 5 days. And then oral antibiotics started and continued till suture removal.

Physiotherapy started from first post operative day.

Drain removed after 48 hours.

Sutures removed on 12th postoperative day.

Advised to wear brace for 3 months postoperatively.

Radiological and neurological status were recorded postoperatively and then followed up every month for 6 months.

Clinical evaluation was done by using Frankel scale and Denis pain scale and rolandmorris scale at the end of the 6^{th} month.

FRANKEL	NEUROLOGICAL DEFICIT
A	Full sensitive and motor palsy below injury level
B	Full motor palsy, but some residual sensitivity present
C	Presence of sensitivity with residual motor function, not useful for the patient
D	Presence of sensitivity and motor function, but below normal levels
E	No neurological change

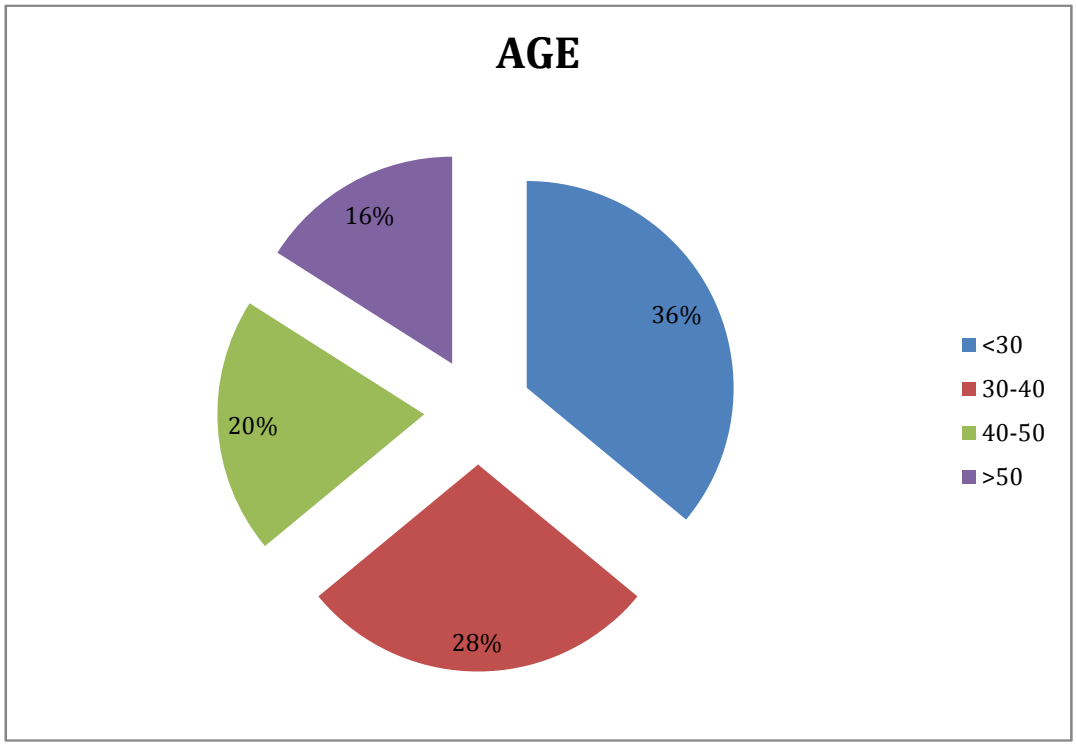
Table 2. *Denis' functional pain scale.*

SCORE	PAIN SCALE CRITERIA
1	No pain
2	Minimum pain, without use of medication
3	Moderate pain, with occasional use of medication
4	Moderate to severe pain, with constant use of medication
5	Severe pain, with chronic use of medication

RESULTS

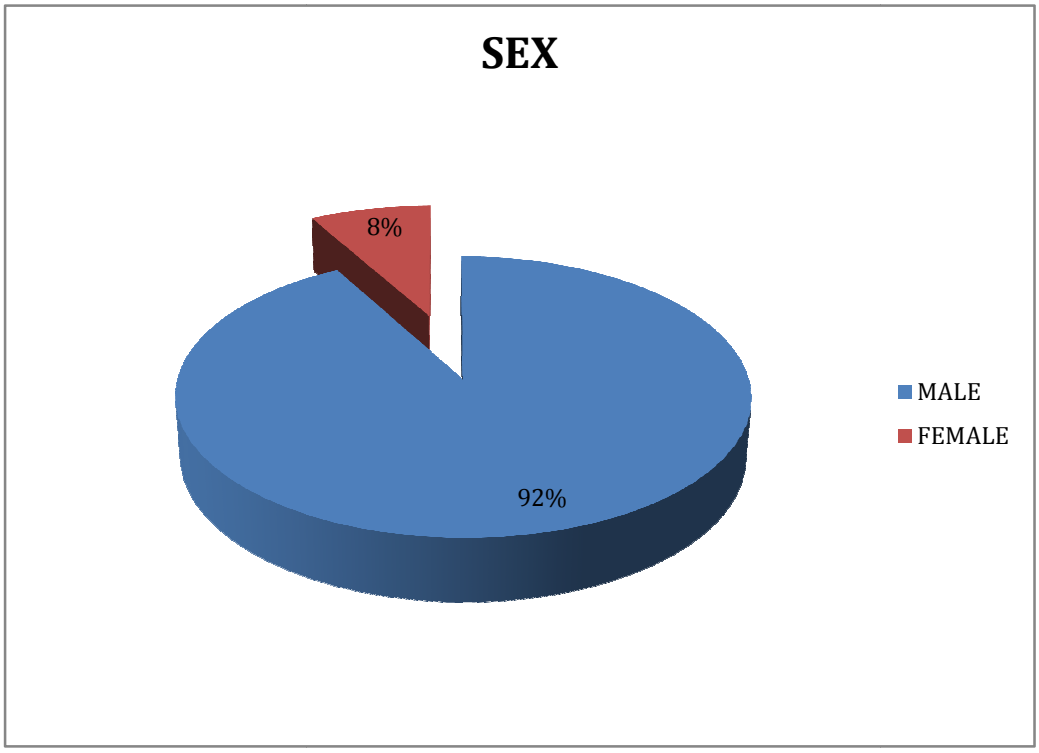
Age distribution:

Age in years	No of cases	Percentage
<30	9	36
30-40	7	28
40-50	5	20
>50	4	16



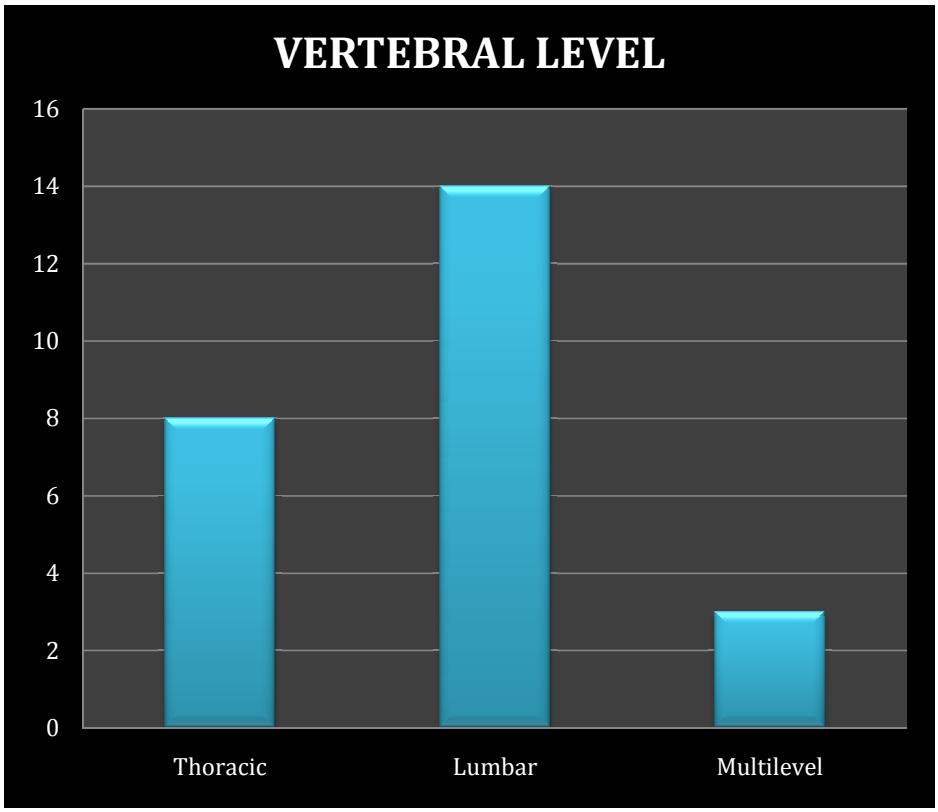
Sex distribution:

Sex	No of cases	Percentage
Males	23	92
Females	2	8



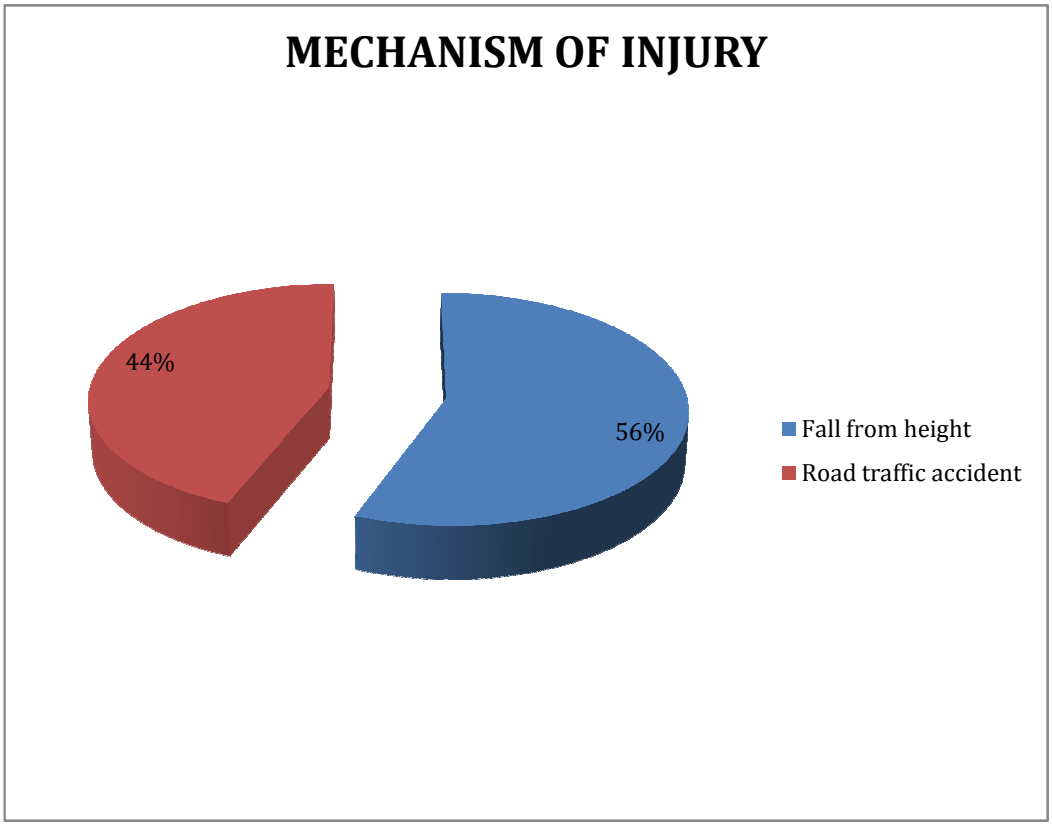
Level of vertebra involved:

Vertebra level	No of cases	Percentage
Thoracic	8	32
Lumbar	14	56
multilevel	3	12



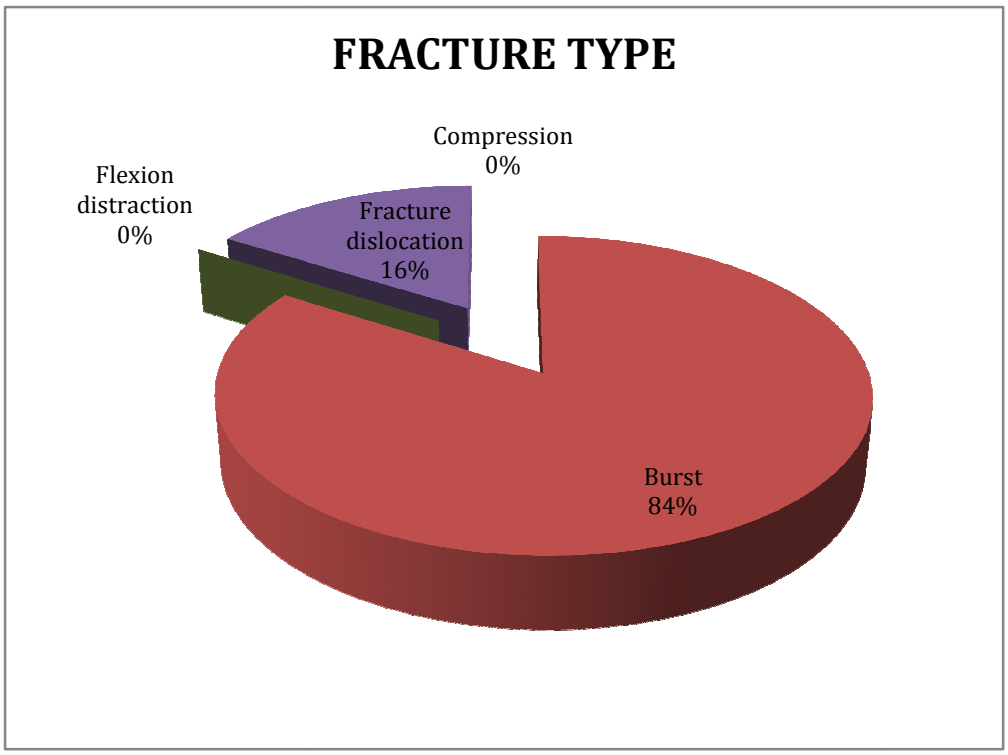
Mechanism of injury:

Mechanism of injury	No of cases	Percentage
Fall from height	14	56
Road traffic accident	11	44



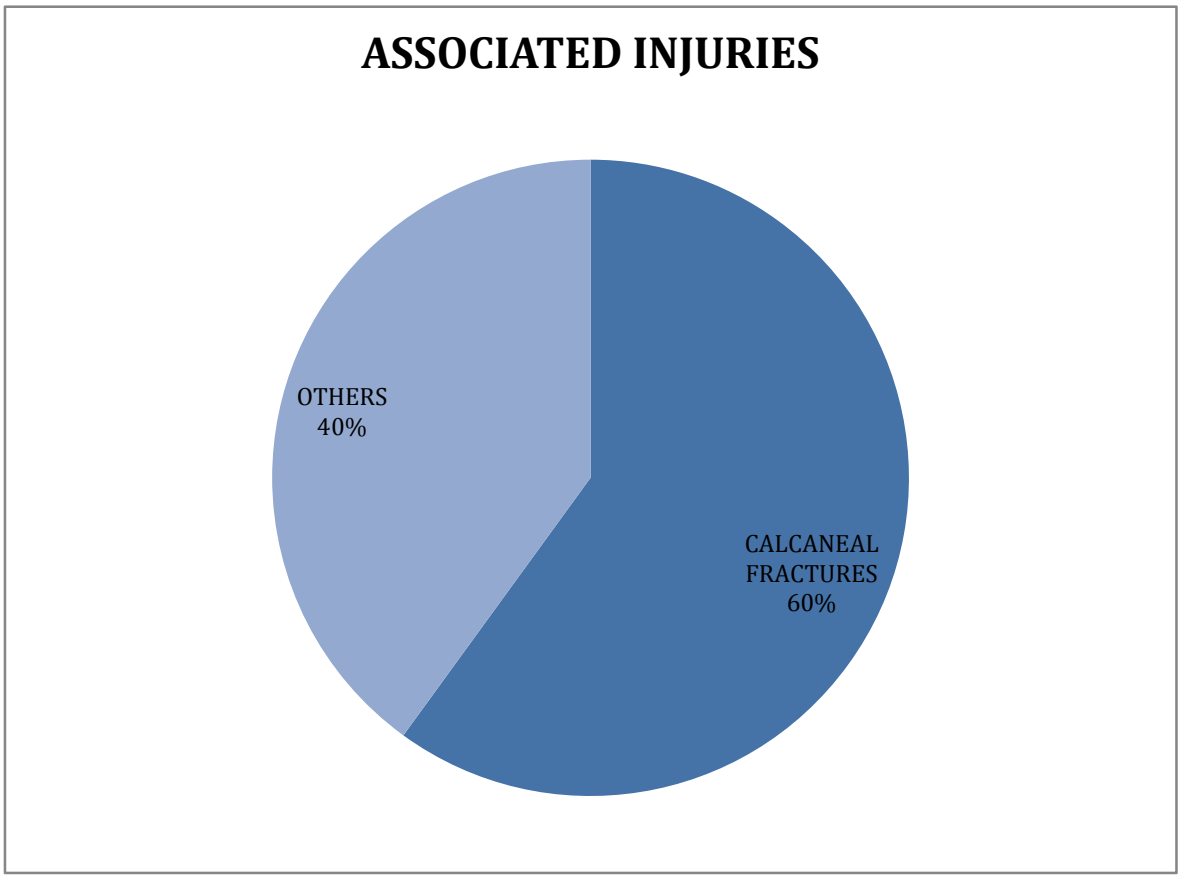
Type of fracture:

Fracture type	No of cases	Percentage
Compression	0	0
Burst	21	84
Flexion distraction	0	0
Fracture dislocation	4	16



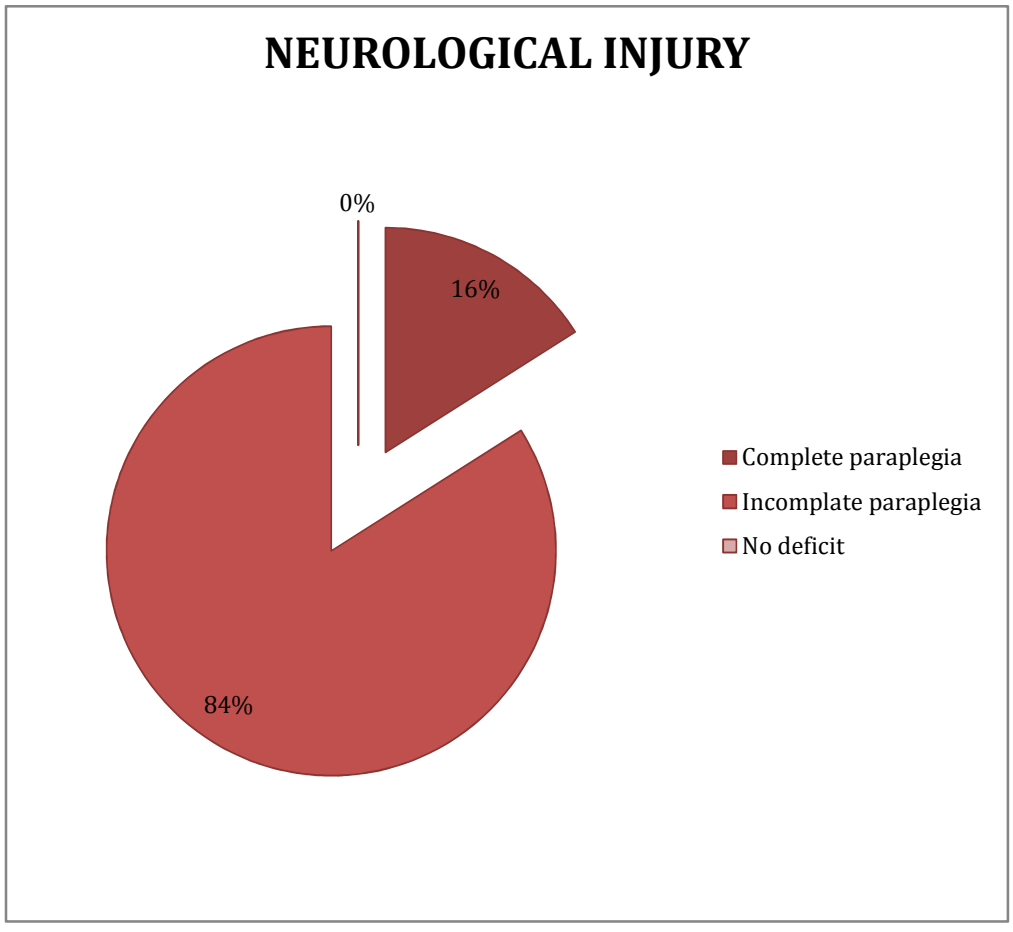
Associated injuries:

Associated injuries	No of cases	Percentage
Calcaneal fracture	6	24
Others	4	16



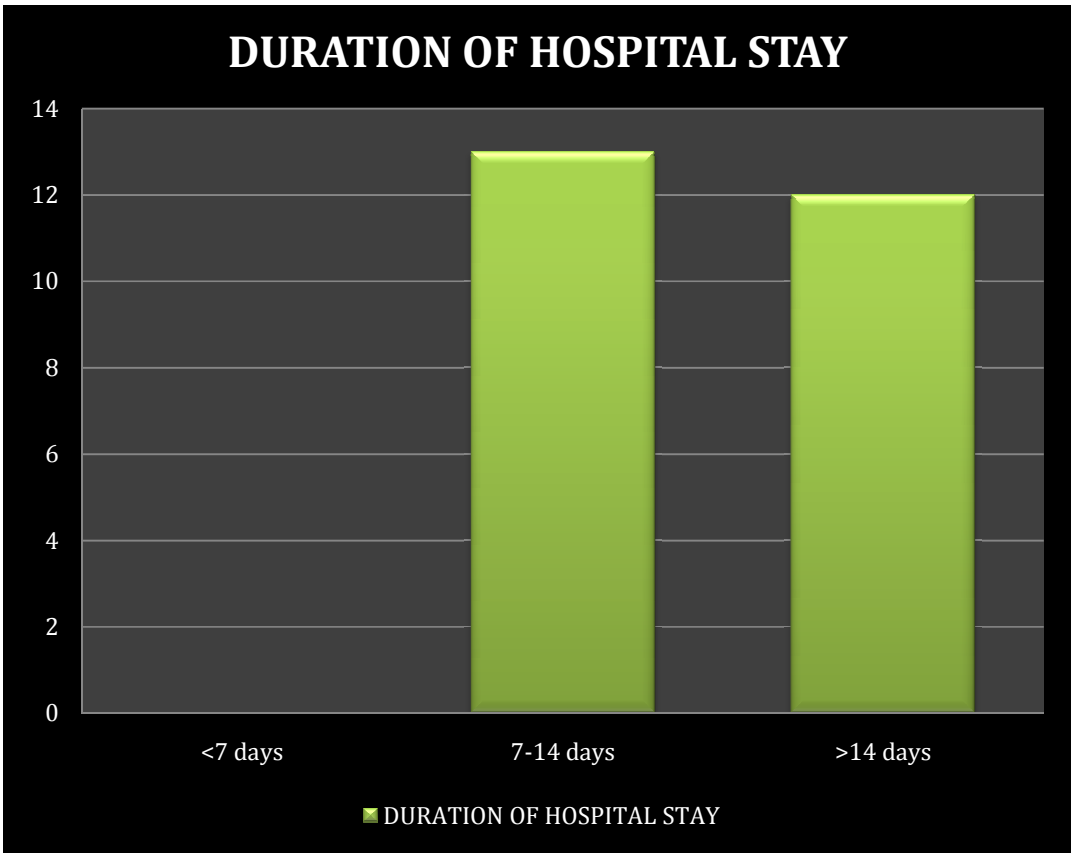
Neurological injury:

Neurological injury	No of cases	Percentage
Complete paraplegia	4	16
Incomplete paraplegia	21	84
No deficit	0	0



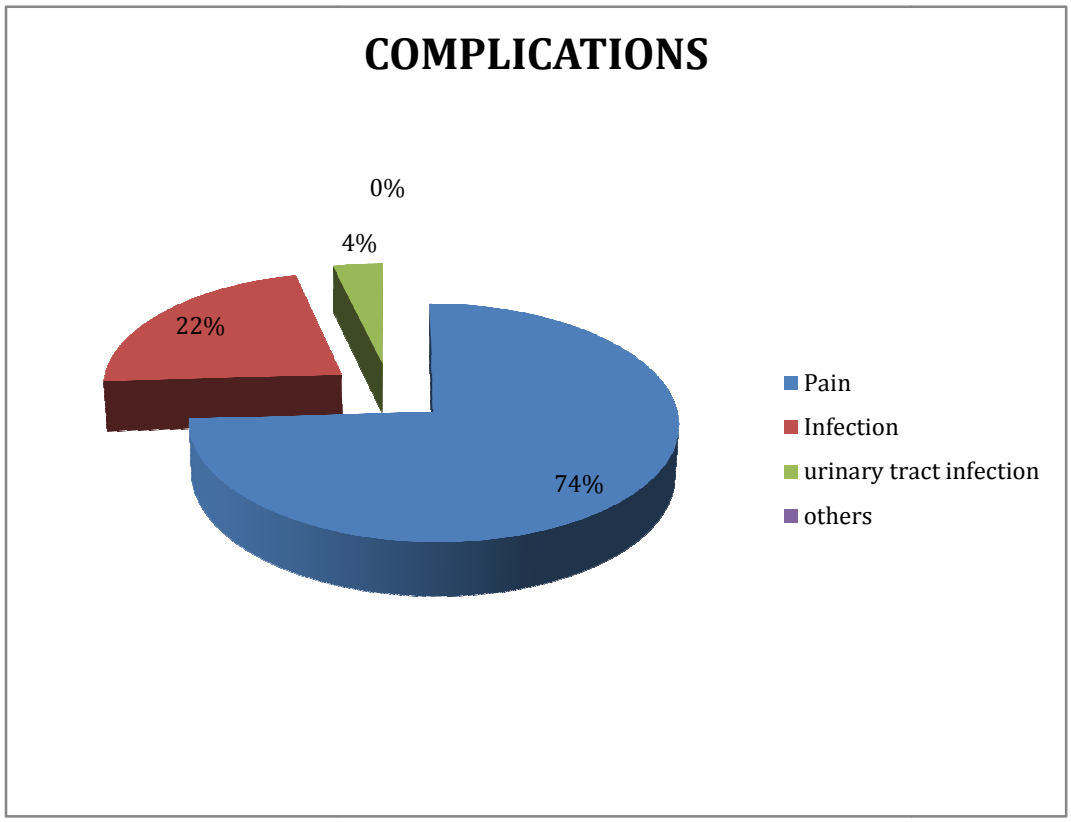
Duration of hospital stay:

Duration	No of cases	Percentage
<7days	0	0
7-14 days	13	52
>14 days	12	48



Postoperative complications:

Complication	No of cases	Percentage
Pain	20	80
Wound infection	6	24
Bed sore	0	0
Screw failure	0	0
Meningitis	0	0
Urinary tract infection	1	4



Functional score:

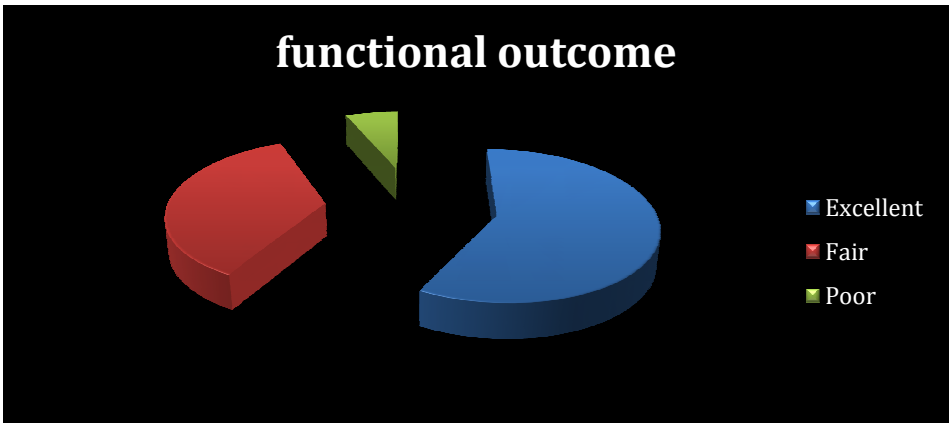
We used Denis pain scale, Frankel grading and Roland morris scale for postoperative functional outcome.

Denis pain scale:

Score	No of cases (At 6 months)	Percentage
1	4	16
2	6	24
3	11	44
4	4	16
5	0	0

Roland morris scale:

Score	No of cases (At 6 months)	percentage
<8 (excellent)	13	52
8-18 (fair)	8	32
>16 (poor)	4	16



DISCUSSION

Early management of vertebral fracture with neurological injury is important to prevent permanent disability. Spinal injuries are common problem nowadays. So treatment of these injuries are important to prevent long term disability and early rehabilitation. Thoracolumbar junction is a common site for vertebral fracture and the incidence is around 60% of total spinal injuries because of its high mobility.

Vertebral fracture may cause spinal cord injury or nerve root damage. Patient without associated neurological deficit and stable injuries can be treated conservatively. Unstable fracture, associated with spinal canal compromise and neurological deficit needs operative intervention.

The causesof burst fracture vary depending on the age. In youngpatients, it occurs commonly due to high energy traumalike road traffic accident and fall from height. In elderly patients it occurs commonly dueto trivial fall. Associated osteoporosis contributes a major role in these population.

In patients with spinal canal narrowing decompression should be done along with fracture stabilization. In our study we used TLICS score for selecting the patient for surgery. Posterior stabilization is commonly

used because of its safety and surgeons familiarity. In our study posterior stabilization was performed for all the patients.

Spine fractures are associated with Spinal column disruption and affects the functions of the nerve. So thepurpose of the treatment is bring back the normalanatomy, remove the spinal cord or nerve root compression and thus promoting the early recovery of nerve function. Patients without neurological deficit and minimal canal narrowing can be effectively treated by conservative management. Unstable fractures and also associated with neurological deficits operative treatment should be considered.

The main indication for operative treatment in a burst fractures is to decompress the spinal cord and nerve root. Both clinical and experimental studies showed neurological recovery will takes place after decompression of spinal cord and nerve roots.We can do either direct decompression by removing the bone fragments in the spinal canal or indirect decompression by restoring the alignment of the spinal column. Posterior stabilization of spine indirectly reduces the fracture and realign the sagittal contour of spine. The ligamentotaxis principle is used in this method of fixation.

Commonly operative treatment is indicated if the canal compromise is more than 50%, loss of vertebral height more than 50%, kyphotic angle more than 20-30 degrees and associated neurological deficit.

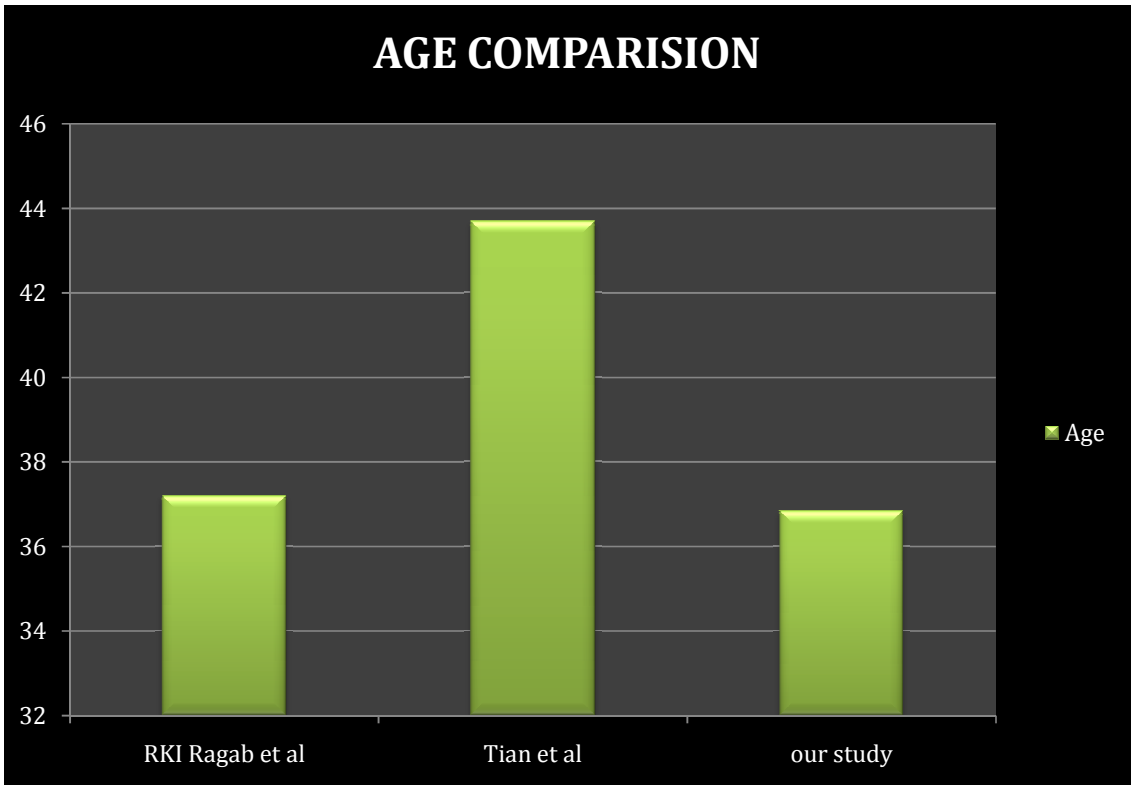
Still there is debate exists in the exact treatment modality of treatment and timing of surgical intervention– Whether to useAnterior instrumentation- Anterior decompression and fusion,Posterior instrumentation- Posterior decompression and fusion or

Combined Early or late operative intervention is helpful.

We compared our study with Tian et al (Aug 2011), RKI Rahab et al (2009) and Farrokhi et al (2010).

In our study, average age at fixation is 36.84. According to Tian et al. the average age at fixation was 43.7 and according to RKI Ragab et al it was 37.2.

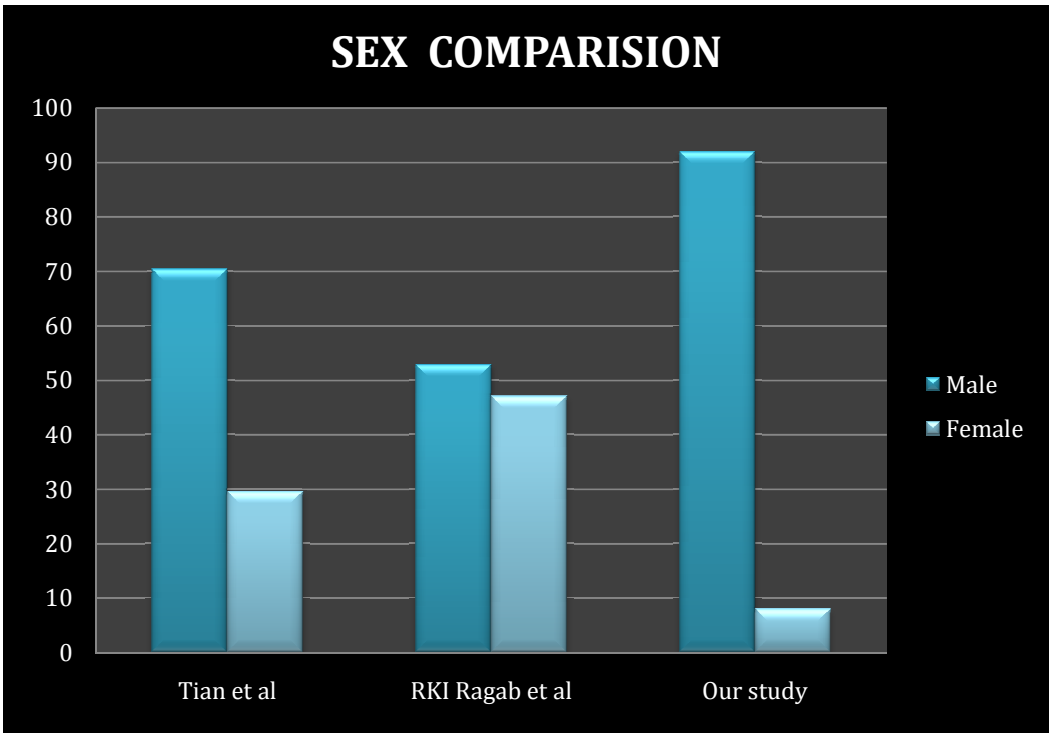
Study	Average age
RKI Ragab et al ,2009	37.2
Tian et al, Aug 2011	43.7
Our study	36.84



Males are commonly involved in our study. Out of 25 patients, 23 patients were male (92%) and only 2 patients were female. Tian et al. found 70.4% cases were male and according to RKI Ragab et al it was 52.9.

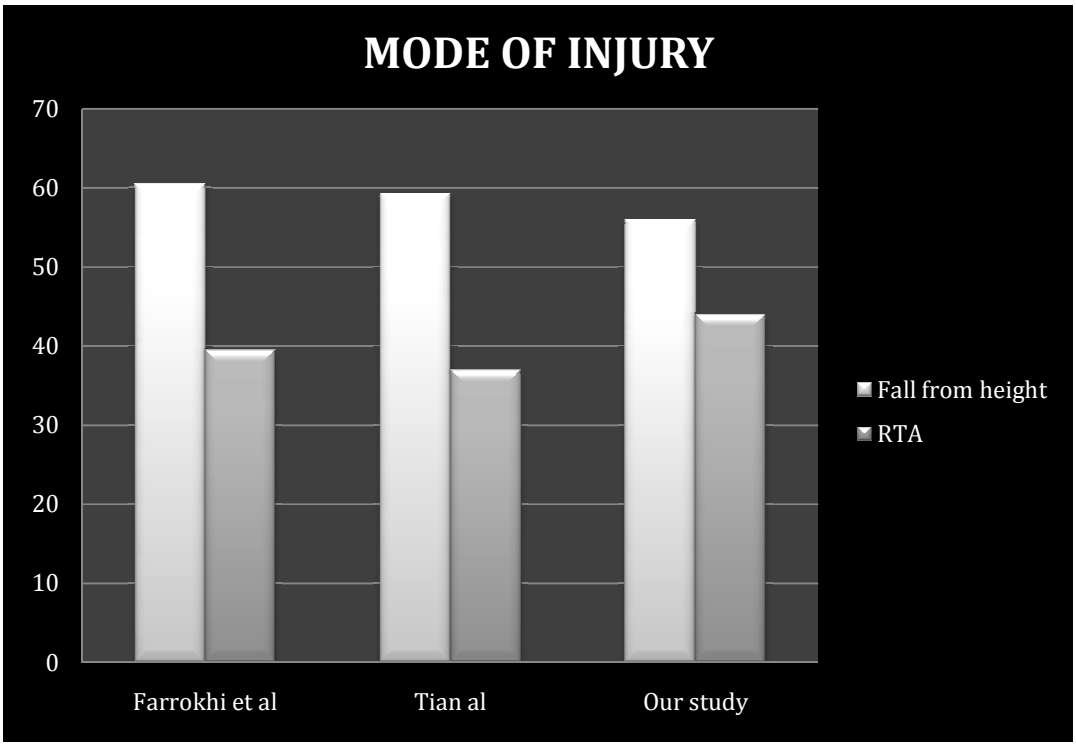
Study	Male	Female
Tian et al, Aug 2011	70.4	29.6
RKI Ragab et al,2009	52.9	47.1
Our study	92	8

T



The common mode of injury is fall from height (56%) in our study. According to Tian et al 59.3% was due to fall from height. It was 60.5% according to Farrokhi et al.

Study	Fall from height	RTA
Farrokhi et al, 2010	60.5	39.5
Tian et al, Aug 2011	59.3	37
Our study	56	44



In our study, 84% of patients were suffered from burst fracture and the remaining 16% were diagnosed to be fracture dislocation type of injury. Post operatively neurological status was improved in all of the incomplete paraplegia patients, but it was not in the case of complete paraplegia.

The recovery rate is compared between complete and incomplete paraplegia patients. There is significant difference in the post operative neurological recovery between the two groups ($p<0.001$). In our study, no patients were recovered from preoperative neurological status, who had complete paraplegia.

And also there is significant difference in neurological injury and the type of fracture ($p<0.001$). All patients with fracture dislocation type of injury were associated with complete paraplegia. But the patients who had burst fractures were associated with incomplete paraplegia.

The outcome of dorsal and lumbar vertebrae are compared. There is no significant difference ($p=0.12$) in the final outcome between these two groups.

Dashti et al Short-segment pedicle screw fixation allows for spinal stabilization while simultaneously preserving as many motion segments as possible. SH Lee et al andTezeren G Kuru I says, When

short-segment fixation was compared to long-segment fixation, the radiographic parameters were more favorable in the latter but the clinical outcome was the same for both methods.

ILLUSTRATIVE CASES:

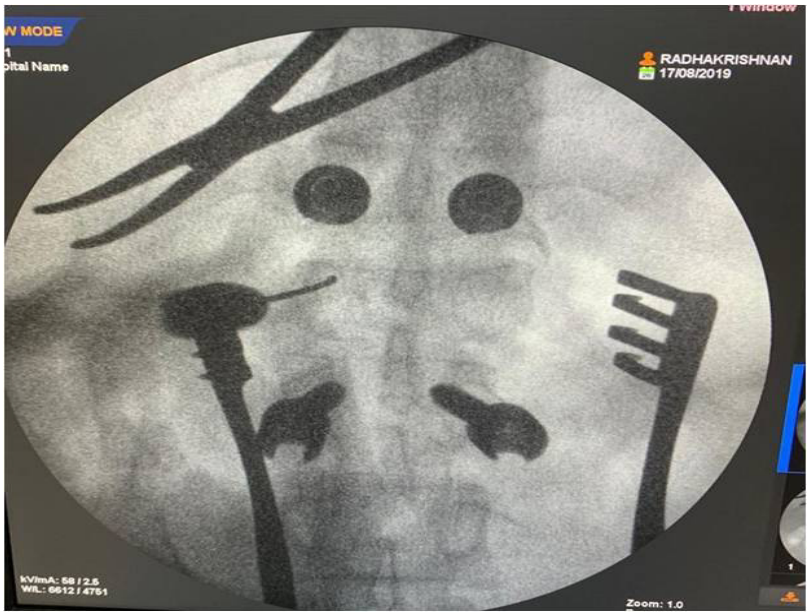
CASE:1

Preop x ray:

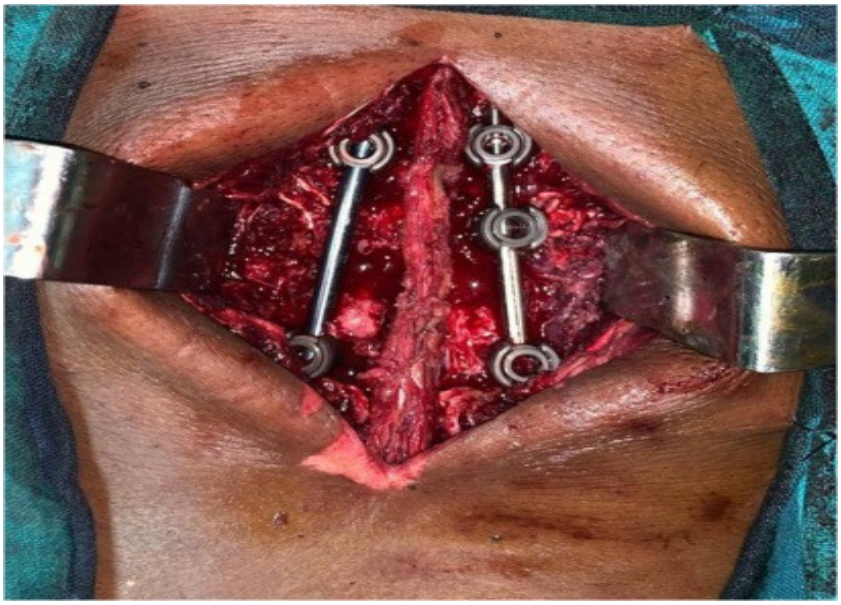
CT:

MRI:

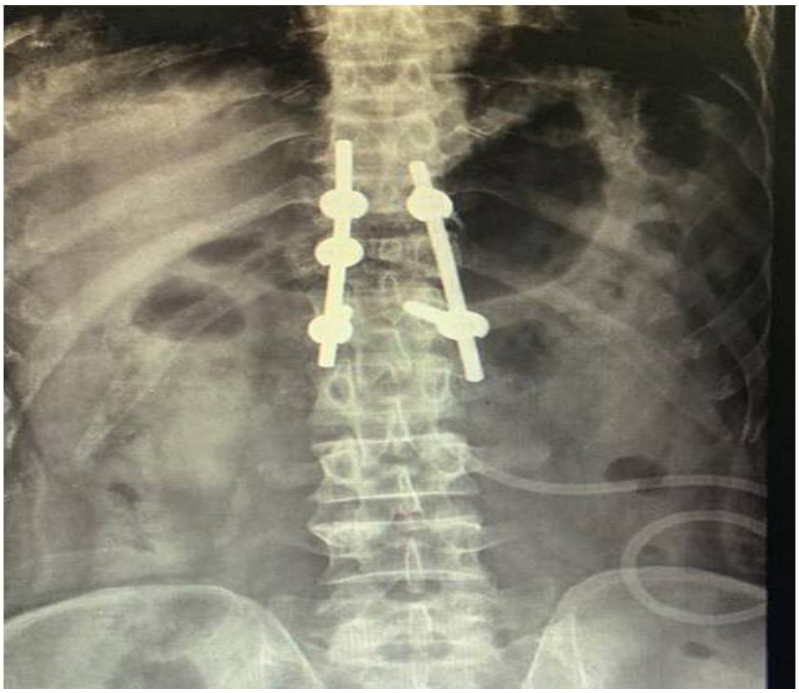
CARM PICTURE



INTRAOP CP:



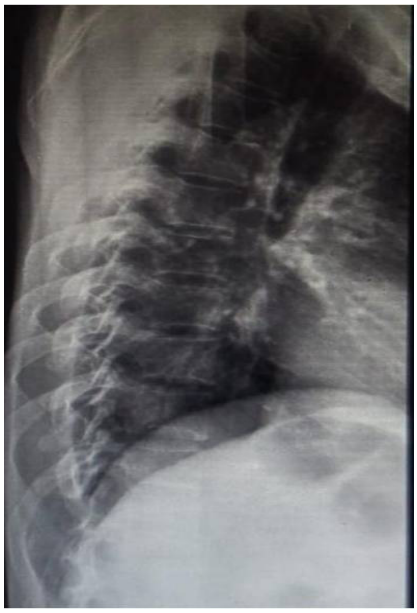
POSTOP XRAY:



FOLLOW UP:

CASE 2:

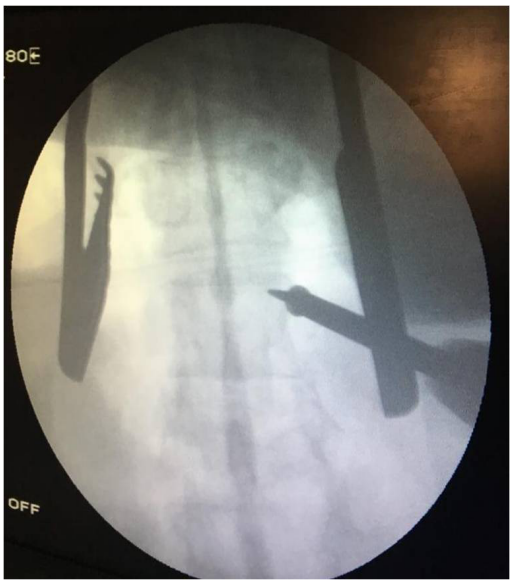
PREOP X RAY:



CT:

MRI:

CARM PICTURE:



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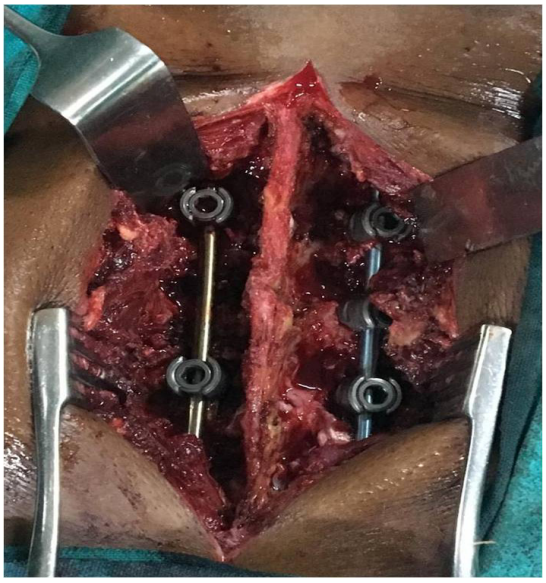


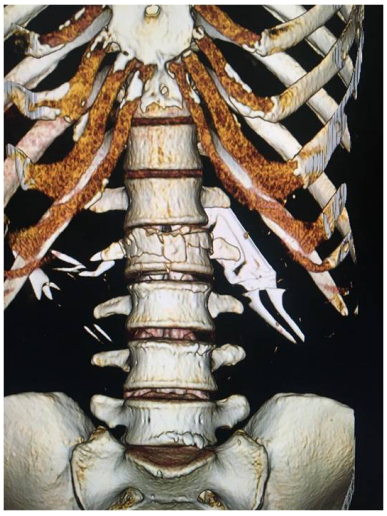
POST OP XRAY:

FOLLOW UP:

CASE 3:

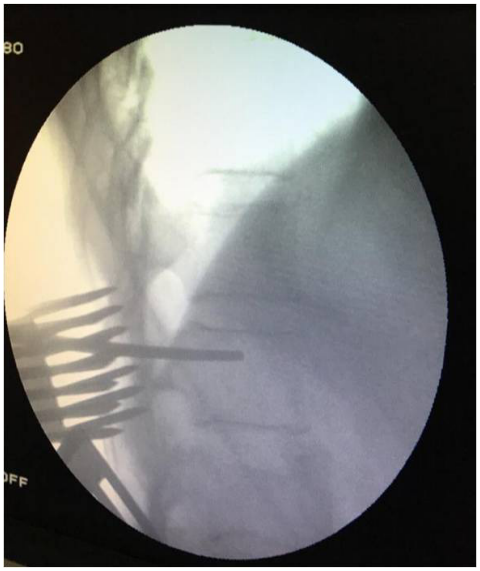
PREOP X RAY:

CT:



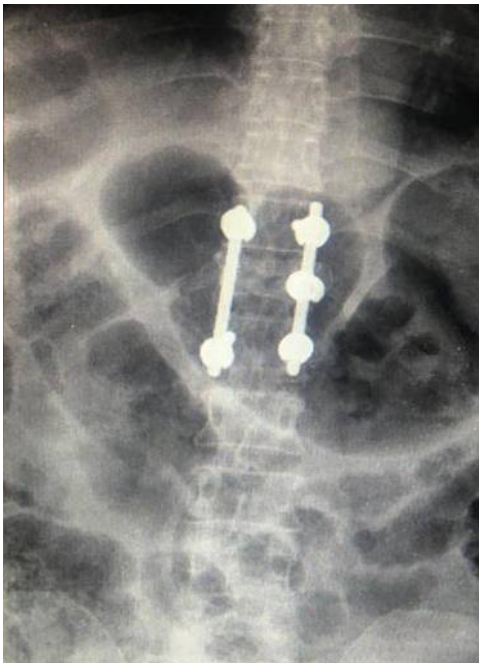
MRI:

CARM PICTURE:



INTRAOP CP:

POSTOP X RAY:

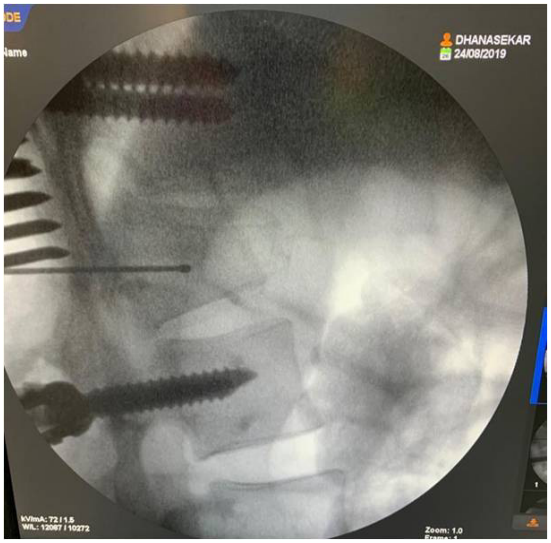


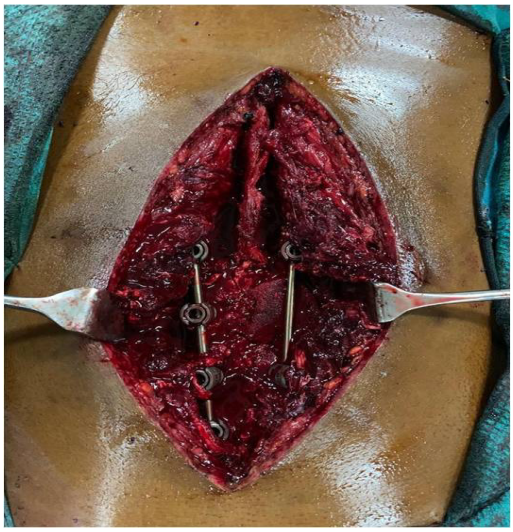
FOLLOW UP:

PREOP X RAY:

CT: MRI:

CARM PICTURE: **INTRAOP CP:**





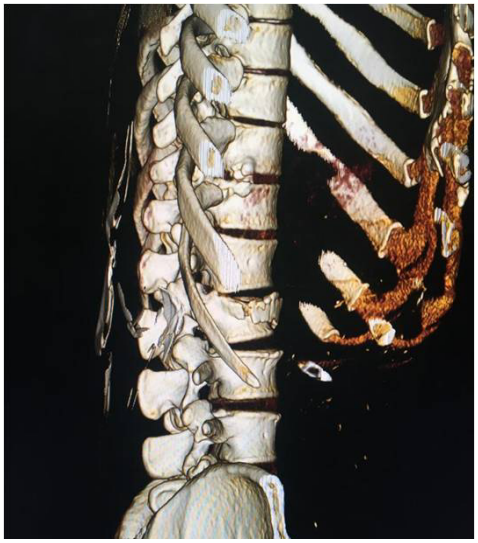
POST OP X RAY:

FOLLOW UP:

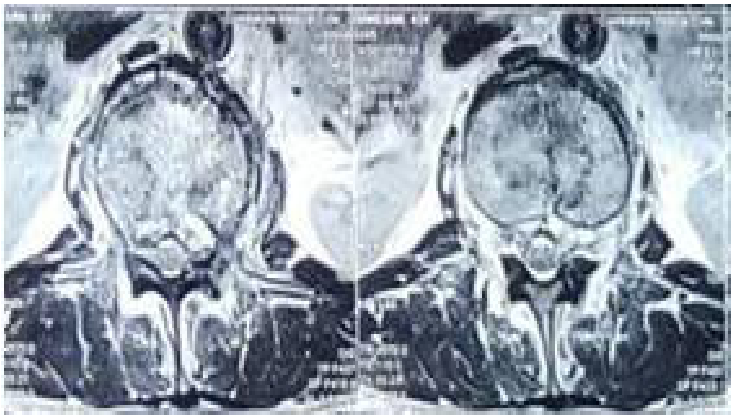
CASE 5:

PREOP X RAY:

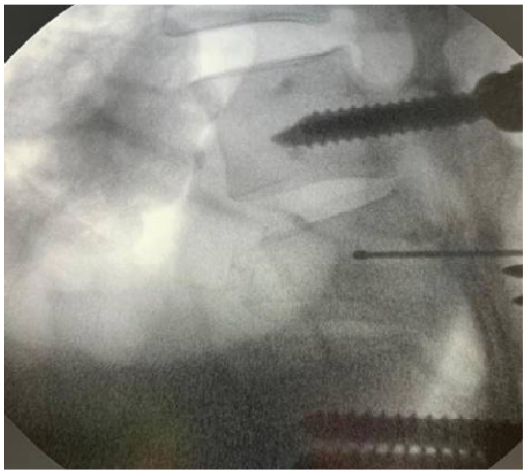
CT:



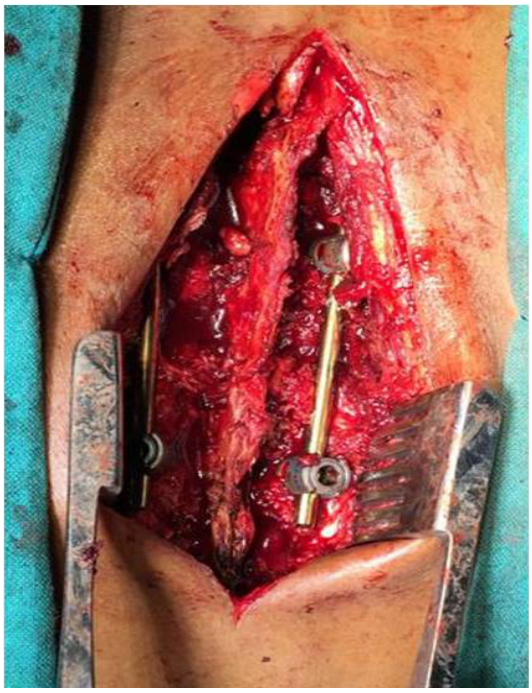
MRI:



CARM PICTURE:



INTRA OP CP:



POST OP XRAY:

CONCLUSION

From our study,

Vertebral fractures are commonly encountered in the thoracolumbar junction. In our series it was found to be sixty percent.

Fall from height and road traffic accidents are the two most common mode of injury. Earlier in our country, the common cause of paraplegia was due to tuberculosis. Today in the modern era it is mostly due to road traffic accident and fall from height. So we need to reduce this type of injury, since this type of injury affects the activities of daily living.

It's better to evaluate whether the paraplegia is complete or incomplete. Patient with incomplete paraplegia, the chance of neurological recovery is high. But in complete paraplegia the prognosis is very poor.

Regarding the surgical options, patient needs decompression and stabilization. For multiple level fracture with complete paraplegia along with posterior stabilization, fusion is indicated to improve stability.

If the pedicle is intact in fractured vertebra, adding a screw in this vertebra will provide stability.

In our series, with sample size if twenty five patients, we did only posterior stabilization.

Decompression to improve neurological recovery and stabilization to early rehabilitation to prevent complications like bed sores, respiratory tract infections etc.

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MASTER CHART

S. NO	NAME	AGE	SEX	IPNO	MODEOF INJURY	FRACTURE LEVEL	NEUROLOGY COMPLETE /INCOMPLETE PARAPLEGIA	ASSOCIATED INJRY	RESULTS
1	RAJU	54	M	58151	FALL FROM HEIGHT	D12	INCOMPLETE	NO	GOOD
2	MAYAKRISHNAN	39	M	43274	FALL FROM HEIGHT	L2	INCOMPLETE	YES	GOOD
3	BIJAY	38	M	45317	FALL FROM HEIGHT	D12&L1	COMPLETE	NO	POOR
4	ANTONY INNACHIMUTHU	48	M	40070	RTA	D12	INCOMPLETE	NO	GOOD
5	DHANASEKAR	38	M	62165	RTA	D12	INCOMPLETE	YES	FAIR
6	GANESAN	45	M	29965	FALL FROM HEIGHT	L2	INCOMPLETE	YES	GOOD
7	RAJAN	48	M	53338	RTA	L1	INCOMPLETE	NO	GOOD
8	SIVASAKTHI	16	M	213432	RTA	L2	INCOMPLETE	NO	GOOD
9	PRAKASH	24	M	673178	RTA	L2	INCOMPLETE	YES	GOOD
10	MADHU	25	M	452843	RTA	L1	INCOMPLETE	YES	FAIR
11	GIRI	22	M	752956	RTA	L2	INCOMPLETE	NO	FAIR
12	SOUNDARAJAN	46	M	452674	FALL FROM HEIGHT	L1	INCOMPLETE	NO	FAIR
13	SENTHIL KUMAR	32	M	762567	FALL FROM HEIGHT	L1	INCOMPLETE	NO	GOOD
14	SUBRAMANI	45	M	462767	FALL FROM HEIGHT	L1	INCOMPLETE	NO	GOOD
15	SARAVANAKUMAR	23	M	33241	FALL FROM HEIGHT	D8	INCOMPLETE	NO	FAIR

16	SUMATHY	38	F	39876	FALL FROM HEIGHT	D11	INCOMPLETE	NO	GOOD
17	VELUSAMY	30	M	33336	RTA	D11	INCOMPLETE	YES	FAIR
18	MANIKANDAN	20	M	43734	RTA	D7&D8	COMPLETE	YES	POOR
19	PETER	38	M	52754	FALL FROM HEIGHT	L1	INCOMPLETE	NO	GOOD
20	SIVASAMY	23	M	12147	RTA	L2	INCOMPLETE	YES	GOOD
21	KALEESWARI	22	F	16219	RTA	D12	INCOMPLETE	NO	GOOD
22	RAMASAMY	63	M	14971	FALL FROM HEIGHT	L1	INCOMPLETE	NO	FAIR
23	NATARAJAN	60	M	173916	FALL FROM HEIGHT	D12&L1	COMPLETE	YES	POOR
24	RAMASAMY	65	M	14971	FALL FROM HEIGHT	L1	INCOMPLETE	YES	FAIR
25	ANANDHA KUMAR	28	M	185847	RTA	D12	COMPLETE	NO	POOR