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ANALYSIS OF POSTERIOR DECOMPRESSION AND SHORT SEGMENT POSTERIOR STABILIZATION FOR DORSOLUMBAR SPINE FRACTURES BY PEDICLE SCREWS AND RODS SYSTEM

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ABSTRACT

INTRODUCTION:

The spinal traumas are common and leading problem in orthopedic practice. Thoraco-lumbar fractures are serious injuries of concern, if left untreated may result in marked morbidity and disability to the patient. Thoracolumbar segment is second most commonly involved segment in the spinal cord following spinal injuries followed by cervical segment. It constitutes 40 to 60% of all spinal injuries. In this study, we stabilize the fractures of the unstable thoracolumbar spine with or without decompression and pedicle screw & rods and fusion with bone grafts.

PATIENTS AND METHODS :

Patients of this prospective study comprises of 24 cases of dorsolumbar spinal injuries treated with short segment posterior stabilization with or without decompression in our institution

RESULTS:

All the 24 patients were operated for their spinal injury by posterior short segment stabilization by pedicle screws and rods system. 10 patients underwent posterior decompression by means of laminectomy, hemilaminectomy and 14 patients underwent indirect posterior decompression by means of ligamentotaxis, all underwent posterior stabilization and spinal fusion with cancellous grafts

Out of the 24 patients twenty patients showed neurological recovery to various Frankel grades. All patients had post-operative pain relief and no evidence of radiating pain. All patients showed good anatomical reduction and maintainence of the reduction in the post operative follow-up period. Results are categerised with categories such as 1.Post operative pain relief 2. Anatomical reduction and maintainence 3. Superficial and deep infections 4. Implant failure 5. Post-op neurological status 6. Locomotion 7. Bowel and bladder rehabilitation with scores of Good [11 to 13] Fair [7 to 10] Poor [0 to 6]. In our study out of 24 cases good result in about 19 cases, fair result in 4 cases and poor result in 1 case.

Conclusion:

In our series of twenty four cases followed up for a period of three months to sixteen months, ten cases underwent direct decompression and posterior stabilization and fourteen cases underwent indirect decompression and posterior stabilization. Posterior stabilization is done by means of short segment pedicle screws and rods system. Among them no patient showed neurological complication per-operatively.

KEYWORDS : Posterior stabilization, dorsolumbar fractures, pedicle screws

INTRODUCTION:

The spinal traumas are common and leading problem in orthopedic practice[1]. Thoraco-lumbar fractures are serious injuries of concern, if left untreated may result in marked morbidity and disability to the patient. The fractures to spine are reported to be around 6% approximately of the trauma patients, of which around 2.6% of the patients sustains spinal cord or nerve root level neurological injury. Such fractures are commonly associated with motor and sensory disturbance, bladder and bowel disturbances, erectile dysfunction, deformities like kyphosis, scoliosis as result of neurological injury. The patients are also prone for bed sores and pulmonary infections.

Thoracolumbar segment is second most commonly involved segment in the spinal cord following spinal injuries followed by cervical segment. It constitutes 40 to 60% of all spinal injuries. The trauma of thoracolumbar segment is high in thoracolumbar junction to the extent up to 65% between T12 to L2.[2] Only 20% of the fractures at thoracolumbar level are associated with neurological injury.

Patients and methods :

Patients of this prospective study comprises of 24 cases of dorsolumbar spinal injuries treated with short segment posterior stabilization over a period between feb-2008 to april-2009 treated in our institution.

Selection of patients:

The patients who gave informed consent and who were fit for prolonged general anaesthesia were selected for surgery. The preoperative kyphosis angle is less than 40 degrees in our series.

Exclusion criteria:

1) Skin infections
2) Tumours with pathological fracture 3)Severe wedge compression with dislocation of vertebra

Ethics approval:

The study was approved by our institutional review board. 24 Patients [21 male and 3 female] of average age36 years were included in the study were followed up over a mean period of 30 months. A detailed history was obtained for evaluating the mode of trauma,frankel's scoring , sensory level and to check for any spinal deformity. They were clinically and radiologically evaluated for ensuring the thoracolumbar fracture. Plain X - ray in antero-posterior and lateral views were obtained and the instability of the spine was confirmed using White and Punjabi criteria of spinal instability. Fracture classified accordindg to AO classification.

Laboratory investigations were carried out before surgery. MRI/CT scan was conducted to evaluate the relationships and instability of the spine, and bone fragments inside the spial canal. 80% of fractures are between T11 to L2. Surgical procedure was performed in prone position, through posterior approach to spine.

THE SURGICAL PROCEDURE:

All the 24 patients were operated for their spinal injury by posterior short segment stabilization by pedicle screws and rods system.Among the 24 patients 10 patients underwent posterior decompression by means of laminectomy, hemilaminectomy and 14 patients underwent indirect posterior decompression by means of ligamentotaxis, all underwent posterior stabilization and spinal fusion with cancellous grafts.

The pedicles were identified by Roy Camille method . Using AP C-arm imaging the pedicles were located and marked. A ridge exists on the top of the transverse process, the superior facet and the pars inter-articularis. The point of convergence of these three ridges represent a “window” of entry into the intramedullary canal of the pedicle. In previously non-operated spines, the mamillary process if preserved serves as a marker directly over this “window”. Once this point was identified, enough cortical bone was removed using a rongeur or the sharp trocar with stopper to expose the underlying cancellous bone. Using a pedicle probe the intramedullary canal of the pedicle was

entered Once entry has begun, the probe was advanced by manually guiding it down the intramedullary canal of the pedicle into the vertebral body. Once the probe was withdrawn a tap of appropriate size was used to cut threads into the walls of the pedicle. After the tap was removed, the sounding probe was inserted into the hole to "feel" for the threaded grooves and the bottom of the hole thus confirming that the tapped hole was entirely within the confines of the pedicle and the vertebral body. The pedicle was made ready to accept a screw. The screw was carefully tightened into the hole using the pedicle screw was carefully tightened into the hole using the pedicle screw inserter [3].

THE SCREW PLACEMENT IN LOWER THORACIC SPINE AND LUMBAR SPINE:

At D12 with its 12th rib attachment the transverse process is very small. Directly beneath the mamillary body is the approach to the pedicle of D12. D11 is similar to D12 except that the entire transverse process must be removed before the probe can be inserted into the pedicle and the vertebral body.

In lumbar spine,the point where the three line converge, the ridge on the pars interarticularis, the ridge on the superior articular facet and the ridge on the transverse process. This point is called the force nucleus that overlies the pedicle.

THE FUSION SITE PREPARATION:

The vertebra beneath the full length of the posterior instrumentation system was fused. The fusion site was usually prepared prior to instrumentation thereby providing more working space for bone preparation. After all soft tissues were removed from the surface of the fusion bed, decorticate the transverse process, facets joint and other bone fusion surface. The articular surface of the facet joint were removed from the cartilage. The cancellous bone graft which was taken from the iliac crest were packed into the facets and in between the transverse process for postero-lateral fusion.

The standard short segment, posterior lumbar assembly used four pedicle screws. The pedicle screws are placed using the technique detailed above. Care is taken to ensure that all the slots of the screw were aligned. The rod was contoured if required and placed into the universal top loading connection post of the screws. The straight or curved rod pushers may be used if required to facilitate correct seating.

Prior to closure, the spinal, lateral and foraminal canals, were reinspected to ensure that no grafts is impinging on the nerve roots. Wound closure requires special attention in that all dead space must be obliterated. This was achieved by sewing the paraspinal muscle mats down to the opposite with a heavy non-absorbable suture with suction drain.

THE IMMEDIATE POST-OPERATIVE PERIOD:

The patient was nursed in water bed. Prophylactic antibiotics were continued upto five days. Appropriate analgesics were given. Drain removed at the end of 48 hours. Sutures were removed on 12th postoperative day. When an orthosis is used to protect the spine during healing of a fracture, it must be worn for to 12 weeks.

Periodic follow-ups of the patients are done and during the visits the following are noted,

1. The nature of the wound
2. Neurological status
3. Periodic x-rays showing the position of the implants and any complication
4. Bladder and Bowel rehabilitation
5. Locomotion of the patient

In successive reviews, the patients were made to do the following exercises with the aim of strengthening the back extensors and lower extremities, improving posture and reducing pain within the tolerable limits of individual patients :-

1) Supine lying over rolled up towel to facilitate thoracic extension
2) Erect sitting on a chair with no back rest, chin retraction, scapular retraction and abdominal muscles contraction.
3) Trunk mobility in sitting by hands on shoulder, gentle rotation in both directions, and lateral flexion on either side.
4) Standing wall push-ups.
5) Briding in supine with knees bent and feet flat on the couch, lifting the pelvis and back off the couch.
6) Hip extension in prone.
7) Stepping up and down a high step, alternate legs.
8) Prone trunk extension.

ANALYSIS OF RESULTS:

All patient were called for follow up at three months interval . x rays were taken to asses the maintenance of reduction , spinal fusion, implant loosening. Two patients were lost followup.

The immediate postoperative x rays showed a good placing of the screws.

In our study no patient had loosening of screws , pullout of screws , screw breakage or implat failure due to mechanical causes. The implants in all patients were holding in good position for a follow up period of one and half years.

FRANKEL SCORE ANALYSIS:

PREOPERATIVE	POSTOPERATIVE	TOTAL				
	A	B	C	D	E	
A-9	2	1	2	1	3	9
B-1					1	1
C-12				2	10	12
D-1					1	1
E-1					1	1

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S.no	Complication	No of cases
1	Pressure sore	1
2	Urinary tract infection	2
3	Pneumonitis	1
4	Superficial infection	2
5	Deep infection	Nil
6	Screw cut out/rod breakage	Nil

THE RESULTS:

Out of the 24 patients twenty patients showed neurological recovery to various Frankel grades. All patients had post-operative pain relief and no evidence of radiating pain. All patients showed good anatomical reduction and maintainence of the reduction in the post operative follow-up period. one patient had superficial infection and treated with parenteral antibiotics.

The result is categarised as good,fair and poor by taking the following criteria:

1. Post operative pain relief [No pain-2,pain-1,severe pain-0]
2. Anatomical reduction and maintainence [Kyphosis corrected-1,not corrected-0]
3. Superficial and deep infections [No infection-2,superficial infection-1,deep infection-o]
4. Implant failure [No breakage-2,partial breakage/pull out-1,complete pull out-0]
5. Post-op neurological status [E -2,D,C-1,B,A-0]
6. Locomotion [Unaided walking-2, assisted walking-1,wheel chair-0]
7. Bowel and bladder rehabilitation [Normal-2,self catheterisation-1,foley's-0]

Results are categerised as with score of Good [11 to 13] Fair [7 to 10] Poor [0 to 6]. In our study out of 24 cases good result in about 19 cases, fair result in 4 cases and poor result in 1 case.

DISCUSSION:

The goal of treatment of every spinal injury is restoration of the patient to maximum possible function with disability free life. Operative intervention is intended for immediate stability to the spine, allow for the correction of deformities, and optimize neurologic improvement
In our series of twenty four cases followed up for a period of three

months to sixteen months, ten cases underwent direct decompression and posterior stabilization and fourteen cases underwent indirect decompression and posterior stabilization. Posterior stabilization is done by means of short segment pedicle screws and rods system. Among them no patient showed neurological complication per-operatively.

INFECTION:
Superficial wound infection occurred in one case(4%). James L West et al. reported 2.4% infection rate in his study . our study rate is comparable to that.

PLACEMENT OF SCREWS:
All the cases were operated under "C" arm control. Screws were placed in position in all cases and no patient had loosening of screws or pull outs.We did not encountered any case of screw breakage,implant failure due to mechanical causes.All these implants were holding in good position until follow up of one and half years.

PRESSURE SORES:
In our series one patient with complete paraplegia developed pre operative grade 2 bed sore. Early surgical intervention and early rehabilitation of the patients prevent the complication of prolonged bed rest.

NEUROLOGICAL DEFICIT:
In our series no case showed post-operative deterioration of neurological deficit. In our series average period of intervention is Fourteen days. The most important factor determining the extent of possible recovery is the severity of the damage sustained by the neural tissues at the time of the injury. In our series 8 cases with complete neurological deficit showed about 60% recovery, 16 cases with incomplete neurological deficit showed 93.5% recovery. We have done indirect decompression for 14 cases which included 12 wedge compressions without more comminution and canal compromise. Direct decompression was done for 10 cases with more canal compromise According to our study Indirect decompression is good and easy for wedge compression and minimal canal compromise. Direct decompression gives good results for burst fractures and with canal compromise.

SPINAL FUSION:
Spinal fusion is indicated in all spinal instability. Spinal fusion is advantageous for early mobilization and spinal stabilization by achieving bony union across the vertebral space. The fusion of spine is the ultimate aim in management of an unstable spine. In our series we have done direct decompression and posterolateral fusion in ten cases by using cancellous bone grafts obtained from iliac crest. No fusion is done for indirect decompression.

EARLY REHABLITATION
The early surgical stabilization is helpful in early rehabilitation and early mobilization of the patient. In our series the average period of intervention is 14 days and rehabilitated quickly. Earlier stabilization is believed to prevent further cord damage and provides optimal environment for recovery. The advantage of early surgical stabilization gives the possibility of early mobilization of the patient and the potential for reducing the complications associated with prolonged bed rest.

POSTERIOR STABILIZATION:
Posterior spinal stabilization is technically easier than the combined procedures. The average time duration for surgery is 1hour and 10 min. The blood loss is minimal . Only 6 patients needed peroperative blood transfusion. Post operative anaesthetic complications are less. The follow up results were good

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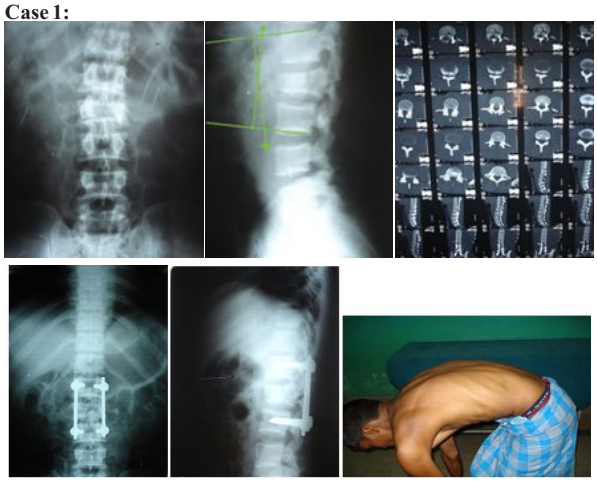
Comparision with Other Studies
The use of posterior instrumentation without fusion following indirect reduction have been increasing in recent years. The use of pedicle screw have decreased the use of anterior approach. [4]

In a meta analysis of 220 patients, it was resulted that the fusion was not necessary when the thoracolumbar burst fracture was treated by posterior pedicle screw fixation.[6]

In a study comparing anterior versus posterior surgery, it was found that posterior surgery is as effective as anterior surgery with less complications. [7].

Case 1:



Case2:

Case3:
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Patient details:

S.NO	AGE/SEX	PRE-OP FRANKEL	POST-OP FRANKEL	INFECTION	LOCOMOTION	BLADDER CONTRL
1	47/m	A	E	Nil	Without aid	Normal
2	23/m	D	E	Nil	Without aid	Normal
3	38/m	C	E	Nil	Without aid	Normal
4	40/m	C	E	Nil	Without aid	Normal
5	21/m	C	E	Nil	Without aid	Normal
6	23/m	A	E	Nil	With walker	Normal
7	30/m	C	E	Nil	Without aid	Normal
8	20/m	E	E	Nil	Without aid	Normal
9	30/m	A	A	Superficial infection	Wheel chair	Self catheterisation
10	27/m	A	C	Nil	Without aid	Self catheterisation
11	35/m	C	E	Nil	Without aid	Normal
12	18/m	B	E	Nil	Without aid	Normal
13	48/m	C	E	Nil	Without aid	Normal
14	38/m	C	E	Nil	Without aid	Normal
15	15/f	A	E	Nil	Without aid	Normal
16	18/m	C	E	Nil	Without aid	Normal
17	28/m	A	A	Superficial infection	Wheel chair	
18	19/f	C	E	Nil	Without aid	Normal
19	21/f	C	E	Nil	Without aid	Normal
20	33/m	C	D	Nil	Stand with aid	Intermittent catheter
21	42/m	A	B	Nil	Wheel chair	Foleys
22	35/m	A	C	Nil	Wheel chair	Foleys
23	28/m	C	D	Nil	Stand with aid	Foleys
24	35/m	A	D	Nil	Walk with aid	Normal

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