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STUDY ON HIGH GRADE SPONDYLOLISTHESIS (GRADE 3 AND GRADE4) TREATED BY POSTERIORLUMBAR INTERBODY FUSION

Orthopaedics

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ABSTRACT

This study is to evaluate decompression, reduction and instrumentation for high grade spondylolisthesis with posterior lumbar interbody fusion technique in alleviating clinical symptoms and signs of mechanical back pain and radicular pain with or without neurological deficit, achieving the correction of the % slip. and avoiding the progression of slip. We operated upon 15 patients with high grade spondylolisthesis at our institution, 11 were females and 4 were males. We used Meyerding system of grading in our series and patients in our study belonged to Grade III and Grade IV spondylolisthesis All our patients came under the category of isthmic type of spondylolisthesis. Implants used were MOSS Miami system of rods, 5mm pedicle screws (mono axial, poly axial), stainless steel cage. . We were able to achieve full correction of % slip in 12 patients where as only partial correction was achieved in 3 patients (1 male; 2 female). All the three patients belonged to Grade IV and they were reduced to Grade III. In conclusion, we would suggest PLIF technique supplemented with posterolateral bone grafting is an ideal technique in high grade listhesis for the achievement of reduction, direct decompression of nerve roots, interbody fusion, good biomechanical support by pedicular instrumentation This technique is also advisable in view of low complication rate.

KEYWORDS

1.INTRODUCTION :

The term spondylolisthesis is derived from Greek word (spondylos –vertebra, olisthesis – to slip or slide down a slippery path).[1] It is defined as anterior or posterior slipping of one vertebra on another. Herbineaux, a Belgian obstetrician was the first to identify it. But the term was first coined by Killian.[2] Prevalence of spondylolisthesis in general population is 5% and is equalin male and female. Depending on the grade of slip it is graded as grade I to grade IV. High grade slips definitely needs surgical intervention[3].Numerous treatment options have been recommended for the treatment of high grade slips. Treatment options include instrumented reduction and achieving fusion by means of any one of the following techniques such as[4]

1. Anterior Lumbar Inter body Fusion (ALIF)[5] 2. Transforaminal Lumbar Inter body Fusion (TLIF)[6] 3. Posterior Lumbar Inter body Fusion (PLIF) [7] 4. Anterior Fusion and Release with posterior fusion (360° fusion)[8] All these have produced varying degree of success and contributed their own share of complications. We took the option of PLIF with MOSSMIAMI system of rods and screws with stainless steel cage packed with autologous bone graft and evaluated the results for correction of percentage slip

2. AIM

The purpose of this study is to evaluate decompression, reduction andinstrumentation for high grade spondylolisthesis with posterior lumbarinterbody fusion technique in

1. Alleviating clinical symptoms and signs of mechanical back pain and radicular pain with or without neurological deficit.
2. Achieving the correction of the % slip.
3. Avoiding the progression of slip.

3. MATERIALS AND METHODS

We operated upon 15 patients with high grade spondylolisthesis at our institution, 11 were females and 4 were males. We used Meyerding system of grading in our series and patients in our study belonged to Grade III and Grade IV spondylolisthesis. 12 patients belonged to grade III and 3 belongedto grade IV of Meyerding's system. Age of the patients ranged from 35-55 yrs. All patients werefollowed regularly and the average period of follow up was 14 months.All our patients came under the category of isthmic type ofspondylolisthesis. All our patients had unremitting back pain, leg pain with orwithout neurological deficit (EHL weakness Grade 4/5 in 3 cases). Dynamicplain radiography of all our patients showed spinal instability.Patients with low grade spondylolisthesis (Meyerding Grade I and II)and spondyloptosis were excluded from our study.Implants used were MOSS Miami system of rods, 5mm pedicle screws(mono axial, poly axial), stainless steel cage.

Pre operative planning :

Plain radiography in AP view to identify any lucency in pars regionsuggesting fracture, reactive sclerosis, lateral view in standing position to load the disc and to translate any spondylolisthesis, flexion-extension lateral view toidentify hypermobility were taken.Pre operative MRI was done to detect compression of neural elementsand disc desiccation. Sagittal images to delineate the disc and spinal canal,parasagittal sequences for delineating neural foramen on T1-weighted images.After initial clinical and radiographic evaluation, patient was taken upfor surgery.

Operative technique

Anaesthesia:-

General anaesthesia in supine position.

Position:-

Patient is then changed to prone position after the induction of anaesthesia with the bladder on catheter with two transverse pillows, one below the chest and the other underneath the pelvis so that abdomen is not compressed. Eyes are protected with cotton pads. Shoulders are placed in 60°abduction over the arm boards.

Image intensifier:-

They are used for the assessment of reduction of the slipped vertebra andof drilling trajectory.

Incision:-

Posterior midline incision centered over the spinous process of theforwardly slipped vertebra extending one above and one below it. During theprocedure when the incision is not adequate enough, we prefer to extend theincision rather than strong retraction to avoid the muscle necrosis which maypredispose to infection.

Procedure:-

Transverse process of L4 or L5 are exposed bilaterally. Sacral ala were exposed in cases where sacral screws insertion were planned preoperatively.

Pedicle screw instrumentation

Guide wire was inserted at the infero lateral aspect of superior articular facet. Entry point was made easy by projecting the view of c-arm in AP plane and the trajectory of the wire was made easy by projecting the view of c-arm in lateral plane. Once position was confirmed, the guide was removed and the hole was enlarged with a pedicle probe with care not to penetrate the pedicle walls. All the 4 walls of the pedicle was then assessed with ball tipped probe for its intactness. The hole was

then tapped with 5mm cancellous tap and 5mm pedicles crew as per length measured with guide wire assistance. Either mono axial or poly axial screw was inserted. The remaining three pedicle screws were inserted in the same mannera nd the position and length of the screws were confirmed with c-arm guidance in AP and lateral view.

Decompression

Once pedicle screws were inserted, we proceeded with decompression ofnerve roots by doing laminectomy of the slipped vertebra, as well removing uncovertebral osteophytes if any and made sure that the nerve root was thoroughly decompressed. Perineural adhesions if any present was also released. Mobility of the root was assessed under direct visualization. Fusion bed was then prepared by decorticating the transverse processes bilaterally at the level to be fused. Sacral ala was prepared if the level of fusion includesL5S1. Care was taken to leave intact the immediate proximal functional joint for eg., we leave intact the L3L4 facet capsule, supraspinous, infraspinousligament between L3L4 if the level of fusion was planned to be L4L5. Themorselized posterior elements was preserved as a graft source for interbodyfusion.

FIGURE1: PREOP-SLIP %60%

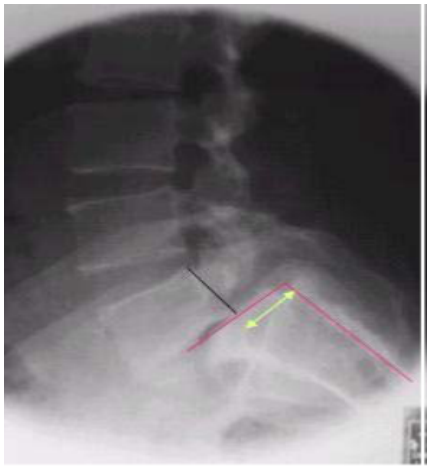
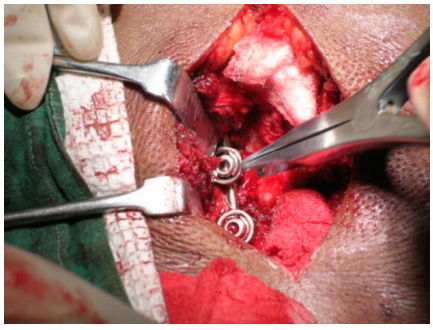


FIGURE 2: PPOST OPAP VIEW

FIGURE 3: POST OP-LATERAL VIEW

FIGURE 4: SURGICAL STEP

FIGURE 5 : SURGICAL STEP



Cage placement and Reduction

MOSS Miami rod was bent to appropriate sagittal contours and wasconnected to the screw, first to the distal and then to the proximal screw.Temporary distraction was then done to create a adequate working window.The annulus fibrosus was incised with 15 blade knife attached to long BPhandle and thorough discectomy was done with disc punch. Vertebral endplates were then removed with 30° to 45° angle osteome and ring curette.Under image intensification, anterior decortication was then done in thedisc space carefully. Morselized autograft was then placed in the anterior 1/3rdof the interspace and impacted. With distraction in place stainless steel cage

(12mm) packed with autologos bone graft was then impacted into the disc spaceso as to occupy the posterior aspect. With the rods attached to the sacral screwsand by cantilever maneuver withcage acting as a fulcrum, lumbar lordosis wasreproduced and the anterior translation of the slipped vertebrae was corrected. In case where full correction couldn't be achieved we acceptedpartial reductionand we instrumented the spine in that position itself. Compression was thengiven between the screws to enhance arthrodesis and to increase lordosisproduction using the structural cage as fulcrum.

Posterolateral arthrodosis

With the reduction complete, posterolateral grafting was done. We usedmorselized bone from the resected posterior spinal elements as the source andwhen it was found to be inadequate, we used posterior iliac crest as graftsource. Routine closure over a deep drain was accomplished. Compressivedressing applied. Patient turned onto the bed, awaked, and L5, S1 root function verifiedbilaterally by physical examination.

4. RESULTS

The operating time was calculated from the start of surgical incision to wound closure and had not changed significantly throughout the study period. It was about 3.5 hrs. The blood loss was calculated from the number of surgical mops used each corresponding to 50ml. Blood loss in our series was about 220ml.The duration of image intensifier usage was calculated in seconds. It varied from 50-100 seconds. All patients were followed up for an average period of 14 months and the results were analysed. Clinically by alleviation of back pain and radicular pair. Radiologically by the correction of % slip. Radiological union was defined as the presence of fusion mass whichwas usually seen in an

average period of 8-12 months and we achieved union in all the 12 patients who turned up for review. Three didn't turn up for follow upafter a period of 6 months and in these patients fusion couldn't be ascertained. The % slip was corrected completely in12 patients, partially corrected in 3 patients and there was no incidence of progression of slip or implant failure at a follow up period of 14 months. Inspite of thorough decompression and stabilization of sagittal spinal balance, 3 of our patients had the complaints of radicular pain postoperatively for a period of 6-8 weeks which then settled down in due course. These patients were allowed an additional period of restricted mobility for 3 months and the drug carbamazepine 200mg BD × 2weeks.The average lumbar spine movements was atleast 80% of that of thenormal and pain free. All patients regained 80% of their premorbid level ofindependence.No case of infection was noticed in the postoperative period which mightprobably be due to the strict sterile technique followed preoperatively and 2doses of broad. Spectrum antibiotics used, one dose, 2 hrs before surgery and another dose during the middle of the surgical procedure.We didn't encounter any neurological deficit in our patients postoperatively and the three patients who had motor weakness of Extensor Hallucis Longus (EHL) Grade 3/5 were also normalised to 5/5 after an average period of 8 weeks. We were able to achieve full correction of % slip in 12 patients where as only partial correction was achieved in 3 patients (1 male; 2 female). All the three patients belonged to Grade IV and they were reduced to Grade III.

5. DISCUSSION& CONCLUSION :

Though the incidence of high grade spondylolisthesis is low in thegeneral population, it is really a great menace to the patient and if left untreatedcan lead on to complete neurological deficit with or without bladder and bowelinvolvement. Also treating a high grade listhesis is a difficult task because of its complex pathoanatomy. There is no doubt that high grade listhesis are best treated by surgical means. There are many surgical options at present for treating this complex pathology and each one has its own merits and demerits. There are still controversies whether to fuse them insitu or reduce and fuse. Even with reduction there are controversies whether to reduce them partially orcompletely and then fuse. Fusion can be achieved posterolaterally or atinterbody level or combined and which one to choose among them is also a controversial problem.Posterolateral insitu fusion is technically a more demanding procedure in high grade slips because L5 transverse process is anterior and inferior to sacral ala and this causes the fusion to be more horizontally oriented putting the fusion mass under high tension and at great risk for failure resulting in increasedincidence of pseudoarthrosis and slip progression. The rate of pseudoarthrosis have ranged from 0 to 60%, rate of progression of slip of as much as 25% despite solid arthrodesis. Deformity also persisted. This has led to the recommendation of reduction high grade slips. Achieving reduction is a difficult procedure and after achieving reduction partial or complete, obtaining fusion can be by means of posterolateral or interbodyfusion. Various studies have proved that inter body fusion is better on biomechanical point of view. In a biomechanical analysis, conducted at neurosurgery clinic, Italy, it has been stated that inter body fusion confer ssuperior mechanical strength to the spinal construct and sole posterolateralfusion leads to progressive loss of correction achieved.[13]

There are various approaches to the spine with a goal of achieving solidinterbody fusion, each with their own share of success and complications. Among them PLIF appears to afford the surgeon of achieving anterior columnar throdesis and posterior transpedicular instrumentation through the same incision. It is successful in achieving and maintaining disc space height, making it a good option for a patient with mechanical back pain and foraminal Stenosis and resultant radiculopathy.

Advantages of PLIF

1. Single incision
2. Correction of lumbosacral kyphosis
3. Correction of percentage slip
4. Promoting and maintaining disc space height
5. Biomechanically superior

In a biomechanical analysis, pedicle screw fixation tended more strongly to increase the rigidity after 1-level, PLIF compared to TLIF[14] In an independent review of 71 cases of PLIF with cages, the procedureis effective with 90% fusion rate and 66% overall satisfaction.[15] We achieved 100% correction of % slip in 12 patients with Grade IIIspondylolisthesis and 50%-60 % correction in 3patients with grade IVspondylolisthesis. The construct was found to be biomechanically superior aswe didn't encounter the problem of screw breakage or progression of slip in anyof our patients at the end of average follow-up of 14 months but the long term outcome is not knownAlthough this study is limited by few number of patients and theduration of follow up is very short, the outcomes suggest that the managementof high grade listhesis can be accomplished successfully with PLIF technique.In conclusion, we would suggest PLIF technique supplemented withposterolateral bone grafting is an ideal technique in high grade listhesis for the achievement of

1. Reduction
2. Direct decompression of nerve roots
3. Interbody fusion
4. Good biomechanical support by pedicular instrumentation

This technique is also advisable in view of low complication rate.

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