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A Study Of Functional Outcome Of Lumbo-Sacral Spondylolisthesis Treated By Posterior Stabilisation With Moss Miami Instrumentation And Spinal Fusion

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Abstract

Introduction: Spondylolisthesis is derived from the Greek words – spondyl (vertebra) and olisthesis (to slip). The prevalence of spondylolisthesis in general population is approximately 5% and is about equal in men and women. Spondylolysis is a descriptive term referring to a defect in the pars interarticularis. Few studies have investigated the long term effect of posterior lumbar interbody fusion on functional outcome.

Objectives : Objectives of the study are to evaluate the safety, efficacy and functional outcome of surgical management of spondylolisthesis with moss-miami instrumentation and posterior spinal fusion were evaluated based on VAS and modified ODI score**.**

Methodology : From October 2019 to December 2021, a total of 25 patients operated with moss-miami instrumentation and posterior spinal fusion were followed up and evaluated based on VAS and modified ODI score.

Results : There were 25 patients with spondylolisthesis at L3-L4 ,L4-L5 and L5-S1 who were managed with Moss Miami instrumentation and posterior spinal fusion. 70% of patients had spondylolisthesis at L5 – S1. Most of the patients were in 4th and 5th decade of life, with a female predominance of 20 cases (80%). In this study 76% of patients had Grade I listhesis and 24% had Grade II listhesis. Bony fusion was achieved for 92% patients. In this study 19 (76%) patients had excellent, 6 (24%) had good outcome based on modified ODI scoring.

Conclusion: Surgical fixation of spondylolisthesis using Moss – Miami instrumentation and posterior lumbar interbody graft is still a safe, promising and appealing technique in low and high grade listhesis

Keywords: Spondylolistheis, Moss – Miami instrumentation, Functional outcome, modified oswestary index

Introduction

The term spondylolisthesis is derived from Greek word spondylos – vertebra, olisthesis – to slip or slide down a slippery path. It is defined as anterior or posterior slipping of cephalad vertebra over the caudal vetebra[1] "Spondylolisthesis" term was first coined by Killian[2].

The biomechanical force causing this translation is the anteriorly directed vector created by the contraction of the posteriorly located erector spinae muscles, coupled with the force of gravity acting on the upper body mass through the lordotic lumbar spine and lumbosacral junction, which explains why this deformity is not seen in children before they are ambulatory. For spondylolisthesis to occur there must be a failure of anatomic structure(s) that normally

resist this anteriorly directed force. These structures include facets, annulus fibrosus, posterior bony arch, and pedicles[3]. Symptoms of spondylolisthesis include axial pain, neurogenic claudication, radiculopathy, and even cauda equina syndrome. In addition, the deformity associated with spondylolisthesis can range from not clinically apparent to severe with significant sagittal imbalance and associated truncal shortening, chronic muscle contraction (spasm) when body attempts motion around a painful pseudoarthrosis of the pars interarticularis, by tears in the annulus fibrosus of the degenerating discs, or by compression of the nerve roots. Although symptoms of spinal stenosis are more common, with leg pain and claudication in 68%, 32% have axial back pain only. Radiculopathy occurs in 32%, and cauda equina is rarely noted (3%).Tight hamstrings cause the peculiar gait that has become pathognomic in children who have spondylolisthesis. The excessively tight hamstring muscles tilt the pelvis backward and do not allow hip to flex sufficiently for a normal stride. Consequently patient has a stiff legged and short stride gait, and the pelvis rotates with each step. This gait is called a pelvic waddle. The patient may prefer to jog or run rather than walk, or to walk on toes with knee bent[3].On examination, the paraspinal muscles are in spasm to splint the under lying motion segment, and the hamstring muscles contracts to stabilize the pelvis under painful spinal motion segments. Spondylolisthesis is suggested by a posterior "**Step sign**" when there is a step at the level of slipping vertebra. A transverse furrow is usually seen at the level of L5 vertebra in L5 over S1 spondylolisthesis. As the vertebral body is displaced anteriorly, the patient assumes a lordotic posture above the level of the slip to compensate for the displacement. The sacrum becomes more vertical, and the buttocks appear heart shaped because of the sacral prominence.In this study we analyze the surgical results and functional outcome of lumbosacral spondylolisthesis treated by posterior stabilization with moss Miami instrumentation and spinal fusion.

Methods

During the period October 2019 to December 2021, 25 cases diagnosed with lumbosacral spondylolisthesis which was surgically treated at our institution. This is a prospective analysis of the 25 consecutively treated cases with 6 months of minimum follow up. All patients provided written & informed consent prior to procedure. There were 5 male and 20 female patients. The ages of the patients ranged from 32 to 59 years (average 48 years). All patients had classically described symptoms that are attributed to spondylolisthesis, which include lower back claudication pain and radiation along the posterior aspect of the legs (25) and weakness of muscle groups (12).The modified Oswestry Disability Index (ODI) [2] and visual analog scale (VAS) were used to grade the symptoms. Radiological observations are summarized in Table 1. All patients were investigated both before and after surgery with plain radiographs and MRI. Patients in whom there was radiographic and clinical evidence that suggested infection, tumour were excluded. Injectable antibiotics were continued for 5 days and then changed to oral with adequate analgesia given. Drain tube were removed usually after 48 hrs and patient is allowed to turn in bed. Sutures removal was done on 14th day. Patients were allowed to ambulate after drain removal with a lumbosacral belt. Patient is then discharged with lumbosacral belt which is gradually withdrawn after 6 months.

Table 1: Radiological features in 25 cases of Spondylolisthesis

Distribution of levels of Spondylolisthesis among study patients			
Variable	Category	n	%
Level	L3-L4	1	4%
	L4-L5	8	32%
	L5-S1	16	64%

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Figure 1: Distribution of levels of spondylolisthesis

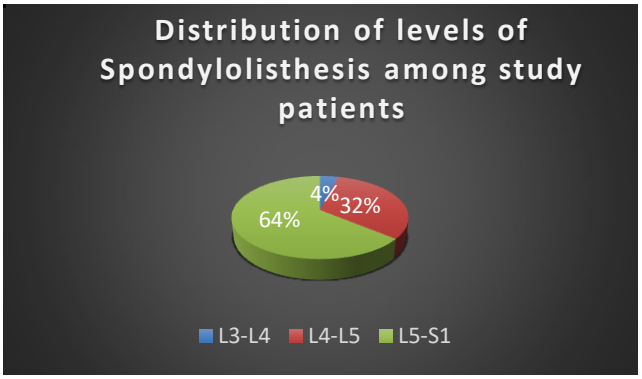

Table 2:Distribution of grade of Spondylolisthesis

Distribution of Grade of Spondylolisthesis among study patients			
Variable	Category	n	%
Grade	Grade 1	19	76%
	Grade 2	6	24%

Surgical Procedure

After palpating the spinous processes ,a line is drawn between the highest points on the iliac crest is in the L4-5 interspace. The line is a rough guide, however the best means of determining the exact level is either to insert a small needle into the spinous process under the C – Arm guidance and carry the dissection distally and identify the sacrum. A midline skin incision relative to the disc space and over the marked spinous process. On furthur incision through fat and fascia in line with the skin incision until the spinous process itself is reached. Detach the paraspinal muscles subperiosteally as one unit from the bone, using a dissector, such as a Cobb elevator, or with cautery. Dissect down the spinous process and along the lamina to the facet joint. In a young patient, the tip of the spinous process is a cartilaginous apophysis it can be split in the midline, making subperiosteal muscle removal easier. If necessary, dissection can be continued laterally, stripping the facet joint capsule from the descending and ascending facets. If the transverse processes must be reached, continue dissecting down the lateral side of the ascending facet and onto the transverse process itself. Close to the facet joints, in the area between the transverse processes, are the vessels supplying the paraspinal muscles on a segmental basis. Pedicle screw instrumentation with posterior lumbar interbody fusion with allograft bone from the excised spinous process was performed on all the patients. The self tapping polyaxial and reduction screws of 5.5mm were used. Following screw implantation, all interspinal ligaments were widely resected, and bone of the lamina and the screw-adjoining surface of the facets were decorticated to make the environment suitable as the host bone for graft. The patients were mobilized as soon as possible, but were advised to use lumbar spinal belt and to restrict activities for a period of 6 weeks. The patients were then advised to engage in normal physical activity after confirmation of the status of screws. Postoperative imaging was done in the immediate postoperative phase and at follow up examination.

CASE 1 PREOP XRAYS AND MRI

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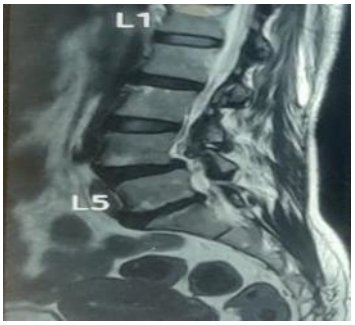
Figure 2 **Figure 3** **Figure 4**



Clinical Photos Preop

Figure 5 **Figure 6** **Figure 7** **Figure 8** **Figure 9**





CASE 2 PREOP XRAY AND MRI

Figure 10 **Figure 11** **Figure 12**


Clinical Photos Preop

Figure 13 Figure 14 Figure 15 Figure 16 Figure 17

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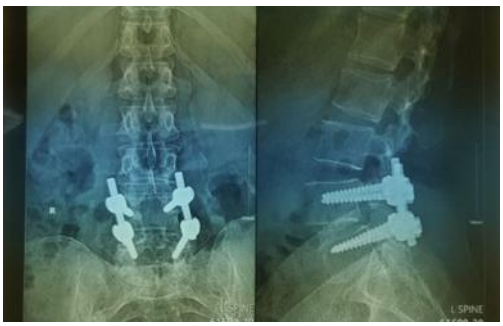
Results

The follow-up duration ranged from 6 months. The Chief surgeon himself and the subordinates did clinical assessment and radiological interpretations. All patients symptoms improved in the immediate postoperative period to varying degrees, mostly favourable. VAS and ODI scales were compared both pre and post operative. Apart from these measures, a patient satisfaction in the local vernacular language assessed the status of clinical recovery. No recurrence of symptoms in any case was noted in the minimum follow up period of 6 months. Arthrodesis of the treated spinal segments was considered to be successful when at the minimum follow-up of 6 months the screw position remained in place, bony fusion across the vertebra was observed, and no relative movement of any vertebral component observed on dynamic imaging. With these minimum parameters, successful segmental arthrodesis was achieved in all cases. All the patients were satisfied with the clinical outcome and are professionally active. The operation was not repeated in any of the cases nor any additional surgical maneuver done on the same level or at any other spinal level.

CASE 1 :

Figure 18 :IMMEDIATE POST OP

Figure 19 :POST OP XRAY AFTER 24 WEEKS



Post op clinical photos

Figure 20

Figure 21

Figure 22

Figure 23

Figure 24

CASE 2:

Figure 25 :IMMEDIATE POST OP

Figure 26:POST OP XRAY AFTER 24 WEEKS

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Figure 27 Figure 28 Figure 29 Figure 30 Figure 31

Table 3: Comparison of mean ODI score pre and post operatively

Comparison of mean ODI values between Pre & Post-Operative treatment among study patients using Wilcoxon Signed Rank Test							
Time	N	Mean	SD	Min	Max	Mean Diff	P-Value
Pre OP	25	43.92	3.81	52	30	28.16	<0.001*
Post OP	25	15.76	4.45	24	10		

Figure 32: Comparison of mean ODI values pre and post operatively

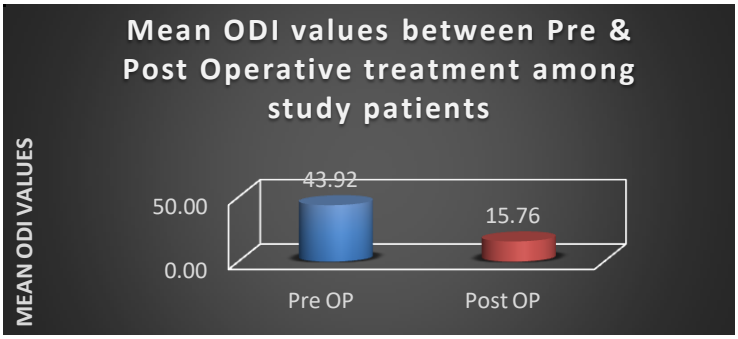

Table 4:Comparison of mean vas scores pre and post operatively

Comparison of mean VAS scores between Pre & Post-Operative treatment among study patients using Wilcoxon Signed Rank Test							
Time	N	Mean	SD	Min	Max	Mean Diff	P-Value
Pre OP	25	7.80	0.71	9	7	3.64	<0.001*
Post OP	25	4.16	1.03	6	2		

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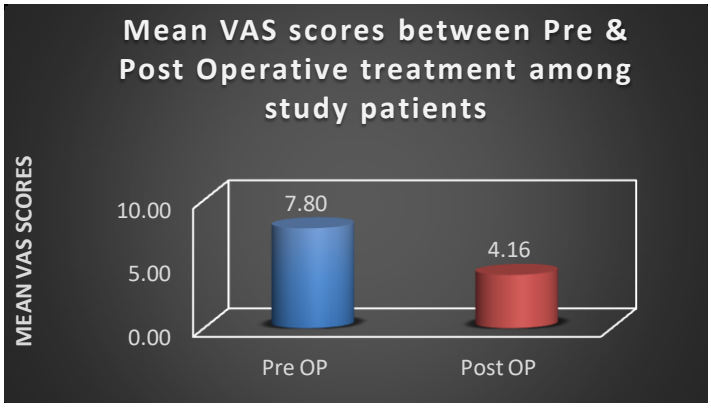
Figure 33:Comparison of Mean VAS Pre and Post operatively



Discussion

In our study youngest patient was 32 years old and oldest was 59 years of age. 28% of patients were in age group 30 – 40, 20% between age group 41 – 50 and 52% between age group 51 – 60 . The average was 48 years. Per Ekman et al[4] in their study found that average age was 40 years. S.Madan et al[5] in their study found that average age was 41. Yizhar Floman et al[6] in their study found that average age was 48 and Robert W. Molinari et al[7] in their study found that average age was 36. The aim of the surgical management in spondylolisthesis are to relieve pain and the neurological deficit, to provide stability and to prevent progression by fusion. While it is difficult to achieve these objectives, it is surprising that many different operative approaches are available to achieve them. The following are some of the pertinent points of debate.

a. Whether surgery is indicated or not
b. Whether spinal decompression is required
c. Spinal fusion – whether posterior or anterior or combined
d. Whether instrumentation required for improving fusion
e. Whether reduction should be attempted or not

'Risk of progression of slip if not surgically treated' is an often – used surgical indication. However, it is difficult to quantify what the real risk of progressive slipping is. Wiltse and Hutchinson have described a reasonable policy for the surgical treatment of spondylolisthesis and is widely accepted.In isthmic spondylolisthesis, conservative management is the mainstay of treatment. Only if it fails, surgical management is considered. With the available literature, instrumented with posterior lumbar interbody fusion is the current method of choice with decompression. Decompressive procedures in spondylolisthesis have their proponents and there are two basic methods – removal of the loose posterior element (Gill's operation)[8] or decompressive laminectomy. In dysplastic and isthmic types a true neurological deficit is rare and radicular symptoms occasionally encountered resolve with solid fusion, along with other symptoms such as Hamstring tightness. In our series of 25 cases, we did decompression and instrumented fusion with excellent results during the follow up. Thus decompression has a definite role in most of the cases of degenerative spondylolisthesis[9]. Posterior rather than anterior fusion is preferred by most because its technique is more flexible; it permits exploration of the defects, nerve roots and intervertebral discs. In addition it is relatively safe. In our study we achieved bony fusion for 92% patients with PLIF. Yizhar Floman et al[80] in their study achieved 97% fusion rate. Hosam A.M. Habib et al[10] reported 96% fusion in their study. Robert W. Molinari et al[11] reported 84% fusion in their study.

In our study mean Pre op ODI score was 40.15 and mean post Op ODI score was 17.1. Hosam A.M. Habib et al[10] in their found that mean pre-operative ODI score was 36.9 and mean post-operative ODI score was 16.2. Yizhar Floman et al[6] in their found that mean pre-operative ODI score was 49 and their post-operative ODI score were below 20 as compared to Swan et al study.

In our study 1 infection which recovered at the end of 6 month follow up and 1 patient had dural tear with no screw misplacement. Harri Philajamaki et al[12] reported screw misplacement for 2 patients and foot

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drop for 1 patient in their study. Per Ekman et al[4] reported 1 patient with transient foot drop, 1 with permanent foot drop, 3 patients had deep wound infection and 4 with postoperative radiculopathy. Robert W. Molinari et al[7] reported 3 patients with dural tear.

In our study 19 (76%) patients had excellent, 6(24%) had good with no poor results based on ODI scoring. S Madan et al[5] reported 14(60.8%) excellent, 2 (8.6%) good, 4 (17.3%) fair and 3 (13%) poor results in their study of 23 patients. M.W.Hu et al[13] reported 52.8% excellent, 30.6% good, 16.7% fair and no poor results in their study.

Conclusion

Low back ache is one of the common conditions that is seen in Orthopaedic practice. With spondylolisthesis being a common condition and is found in about 5% to 7% of the population.

In the earlier stages , the patient can be managed by nonoperative methods like rest, traction, lumbosacral corset, NSAID's, physiotherapy and exercises.When these methods do not bear the expected results and when the other indications for the surgery as mentioned earlier are met, then the option of surgery must be given to the patient.

The goals of surgical management are as follows:

1. Reduction of back and leg pain.
2. To prevent further slip when reduction is not possible especially for grade I and II.
3. Stabilization of unstable segment.
4. Restoration of normal spine mechanisms, posture and gait.
5. Reversal of neurological deficits.

Reduction of listhesis of grade I and II is necessary for better relief. After the listhesis is reduced, the tension of the roots does disappear, and the transverse processes come into same level to put the interbody graft. It arrests deformity progression, post-operative pain is decreased, fusion length becomes limited, body posture and mechanics are restored and it improves appearance and self-image. In situ fusion can be attempted in these cases while reduction and fusion in the reduced positions should be attempted in cases of severe spondylolisthesis. Surgical fixation of spondylolisthesis using pedicular screw rod system and posterior lumbar interbody graft is still a safe, promising and appealing technique especially in low grade and high grade listhesis.

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