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www.mcmed.us/journal/abs **Research Article**

STUDY ON EVALUATION OF SURGICAL MANAGEMENT OF SPONDYLOLISTHESIS IN LUMBAR SPINE WITH PEDICLE SCREW ROD FIXATION AND POSTEROLATERAL FUSION

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ABSTRACT

Spondylolisthesis is a subluxation of vertebral body over another in sagittal plane. Incidence of Spondylolisthesis in general population is 5-7%. No matter what the etiology is, patients usually have significant functional disability. Few studies have investigated the long-term effect of pedicle screws fixation and posterolateral fusion on functional outcome. To assess the corrections of slip angle and meyerding grading after application of pedicle screw fixation and finally observed the neurological outcome & complications of the instrumentation and its efficacy. In our study, we have cases with age ranging from 35-60 yrs. The average age of presentation in 45 yrs. Post operatively we had 12 cases of grade 4 with return to grade one and 4 cases remained grade 4 and 6 cases with grade 1 remained grade 1 with reduced displacement. 2 cases of grade 3 return to grade 2. In our study, we had patients slip angles ranging from 10-50 o with 16 cases having slip angles from 25-50 o and 6 cases having slip angles from 10-30 and case had 55 o slip angle initially. In our study we had 10% neurological defects post operatively. Posteriolateral fusion is still a safe, promising and appealing technique. We found in our study that posterolateral fusion with Pedicle Screws fixation minimizes dislocation, achieves adequate decompression, corrects the sagittal axis, and accomplishes fusion. We successfully achieved solid fusion with good mechanical alignment in majority of the patients.

Keywords :- Spondylolisthesis, Posterolateral Fusion, Functional Outcome.

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INTRODUCTION

Spondylolisthesis is defined as anterior or posterior slipping of one segment of the spine on the next lower segment. The term Spondylolisthesis first coined by Killian in 1854 who first described this condition as a separate entity. It is derived from the Greek Spondylo means spine and „Listhesi means to slip or slide down.[1] Spondylolisthesis is a common cause for lower-back pain, radiculopathy, and neurogenic claudication among the adult population. [2] Chronic pain affects function and quality of life of large number of individuals. “Back-problems” is among the most common cause of medical and socioeconomic problems in the world today.[3]

The commonest level involved is L5 – S1 (89%). The displacement is a result of loose posterior locking mechanism which in turn leads to instability with symptomatic thecal sac and nerve root compression. In a pars interarticularis defect, the facet joints no longer resist anterior translation shear motion..

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A bilateral pars defect may lead to spondylolisthesis, which implies that anterior displacement of the vertebral body at the spondylolytic level occurs over the subjacent vertebral body.[4] There are different types of spondylolisthesis. Wiltse et al. performed the first systematic classification according to etiology, differentiating between congenital, isthmic, degenerative, pathological and iatrogenic.[5] The mainstay of treatment is conservative, but patients who failed to respond should be considered for surgical treatment which accounts to 15% of the total.[6] The purpose of the surgical treatment is to reduce low back pain and radiating pain, to relieve the neurologic symptoms, and to improve the posture and gait byeliminating the instability of the lumbosacral region

The goals of surgical treatment for lumbar spinal stenosis include relief of leg and back pain [7] [8]. Although decompression is a standard treatment regimen for the surgical treatment of lumbar spinal stenosis, additional fusion after extensive decompression can be required in many cases. In particular, an extensive facetectomy is needed for decompression of the foraminal stenosis in many cases. Thus, for cases of lumbar foraminal stenosis,a combination of neural decompression and spinal fusion can be performed to achieve the goals of surgical treatment. However, these surgeries are accompanied by substantial complications in patients with multilevel lumbar foraminal stenosis. Lumbar spinal fusion is a common surgical treatment used in disc degeneration, which is related to chronic lower back pain and other spinal disorders, such as disc herniation, spondylolisthesis, facet arthropathy, and spinal stenosis [9] [10]. Since spinal arthrodesis was first reported 90 years ago, various techniques have been developed for lumbar spine fusion [11]. Posterior lumbar fusion has the advantages that these are the purely dorsal approach thus avoiding the risks inherent to an anterior approach. [12], PLF construct reduces the postoperative segmental mobility and permits better graft incorporation [13]. Posterior spinal decompression, stabilization and fusion are associated with acceptable postoperative complication rate when done under fluoroscopic guidance [14]. OFF late we are receiving more number of these patients mostly with backache and seiatica with or without neurological deficits. A special spinal ward is created in the new premises of the SLIMS. We underlook this study in July 2017 to July 2018 in our patients who underwent surgery with this latest instrumentations. Our study aim is to assess the corrections of slip angle and meyerding grading after application of pedicle screw fixation, to study the fusion rate and stability in the follow up period in postlateral fusion in spondylolisthesis, to study the neurological outcome at the end of the study period and to study the complications of the instrumentation and its efficacy.

Material and Methods:

On an average 40 cases of spondyolisthesis are admitted in RVS, Chittoor and FIMS, Kadapa in a year. In July 2017 to July 2018 40 patients were admitted to this hospital. Among these 40 cases 24 cases were selected for pedicle screw fixation and posterolateral fusion. The material for this study was selected from the initial 24 out of 40 cases where we performed pedicle screw fixation and posterolateral fusion for spondylolisthesis treatment during the period of July 2017 to July 2018. All the cases were followed up 1 year. Initial evolution includes a detailed history, clinical examination and important investigations which included haematological, radiological and neurological studies. The cases were initially subjected in all referrals like physician, general surgery to rule out other diseases.

Each case was studied in the following protocol:

Detailed history, General examination, Neurological examination, Investigations, Treatment pedicle screw rod fixation and posteolateral fusion, Periodical follow-up

Follow-up evaluation and results:

The minimum follow-up period was 6 months while the longest period was 2 years. With an average of 6 months and while the longest period was 24 months with average of 16 months. The clinical evaluation includes symptomatic relief, neurological improvement, spinal,deformity and return to work. Radiological evaluation includes correction of slip angles, and meyerding grading.

Investigations done for present study Haematological:

Haemoglobin,Complete blood picture,Clotting time,Bleeding time,Plate late count Erythrocyte sedimentation rate,Blood grouping and Rh Typing,Other haematological investigation wherever necessary

Biochemical:

Blood urea, Blood sugar, Serum creatinine

Microbiological:

HIV, HbS Ag

Radiological:

Plain X-Ray, Standing lumb/sacral spine AP and lateral views,Flexion and extention lateral view of lumbosacral spine,City scan and MRI scan lumbosacral spine Chest X-ray PA view

Selection criteria for surgical interventions:

Patients with failed conservative treatment

Positive straight leg raging test (SLRT) Presence of leg and back pain,Neurogenic claudication pain.

Table 1. Sex Incidence

Sex	Number (N=24)
Male	20
Female	04

Table: 2. Age Incidence

Age Distribution	Number (N=24)
0-10	00
10-20	00
20-30	00
30-40	04
40-50	16
50-60	04

Table: 3. Levels of Spondylolisthesis

Levels of Spondylolisthesis	Number (N=24)
L5	20
L4	04

Table: 4. Time of Surgery with respect to time of symptoms

Time	Number (N=24)
1 Year	04
2 Years	08
3 Years	08
4 Years	04

Table: 5. Meyerding Grading

Meyerding	Number (N=24)
Grade 1	06
Grade 2	16
Grade 3	02

Table: 6. Slip Angle

Slip Angle	Number
30 º (Pre Ope)	16
20 º (Post Ope)	06
25 º (Follow-up)	02

Discussion:

We have admitted 24 cases of spondylolisthesis out of which 4 are female and 20 are male. This incidence supports that degenerative spondylolisthesis is more common in male.

Age incidence

In our study, we have cases with age ranging from 35-60 yrs. The average age of presentation in 45 yrs . All the patients have symptoms ranging from <1 to 4 yrs so the average age of symptomatic years is 2 yrs.

Functional status

All the patients not able to perform their work preoperatively. Postoperatively there could return their same work or with some modifications.

Meyerding grading

In our study, we had 16 cases with meyerding grade 2, 6 cases with meyerding grade 1 and two case with meyerding grade 3 types initially. Postoperatively we had 12 cases of grade 2 with return to grade one and four cases remained grade 2 and six cases with grade 1 remained grade 1with reduced displacement. One case of grade 3 return to grade 2.

Slip angle

In our study, we had patients slip angles ranging from 10-50º with 8 cases having slip angles from 25-50 º and 6 cases having slip angles from 10-30 º and one case had 55 º slip angle initially. There was improvement in slip angle in 20 cases. Slip angles same as preoperative status in two cases.

- Average slip angle preoperative was (100 -55 ºo) 30 º
- Average postoperative slip angle was (5o-45 º) 20 º
- Average slip angle at follow-up 25 º (10o-50 º)

This results in average gain in reduction of 5 o and average loss at follow-up of 5 º

Neurological deficits

We have no cases with preoperative neurological deficits in our study. In two cases had we had foot drop in the postoperative period with loss of sensation over dorsum of foot where the attempted reduction of listhesis. So, in our study we had 10% neurological defects post operatively.

The study results that there was no evidence that surgical decompression or fusion were superior then the natural history, placebo, or conservative management. The posterior interbody fusions with pedicle screws provide a more solid mechanical construct when compared with the pedicle screws used alone. Both surgical procedures are effective, although Group II showed better clinical outcomes if quality of life, pain improvement, and functional recovery are considered.

In the treatment of spondylolisthesis, pedicle screws allow easy manipulation and reduction of displaced vertebrae, even if the posterior elements are not intact. Their use facilitates decompression of the neural elements by distraction, avoiding the need for laminectomy and permits stabilization of the segments without the requirement to extent fixation much behind the displaced vertebra. 15 Moss Miami system acts posterior tension band based on intact anterior and posterior spinal ligaments and intact facetal joints acting as fulcrome in cases of burst fractures. Since in anterior spinal instrumentation such as Canada system involves more risk to the patients the posterior stabilization has become more popular as it involves indirect reduction and maintenance of stability of the spine. [15] We had much favourable results using pedicle screw fixation and potserolateral fusion. We analysed the results in our 24 patients, 16 were females 4 were males. Age ranged from 35-60 yrs commonest involved level involved was L4 to L5. Degenerative (90%) was the commonest in our study causing fixation injury with wedge compression and burst fractures and 40% was due to road traffic accidents.

There are several instrument alternatives that may be used as reduction and fixation device in treatment of spondylolisthesis. There are pedicle screw/rods and threaded interbody cylinders, which are available as metallic cages or machined cadaveric cortical bone dowels. lumbar spondylolisthesis. Pedicle screw/rods allow resistance of both angular and shear motion far better than interbody devices due to its rigid insertion. This may be explained from the fact that effectivity of threaded interbody cylinders (cages or dowels alone) is heavily dependent to integrity of remaining ligaments and annulus, compared to pedicle screw/rods that depend on bone. However, pedicle screw/rods and threaded interbody cylinders are affected by bone quality, which is supported from the findings in which lower bone mineral density (BMD) are correlated with greater ROM and NZ.

A 3–4 cm paramedian longitudinal skin incision is made approximately 3 cm lateral to midline to perform unilateral spinal decompression and fusion cage placement. Paraspinal muscles are dissected along the spinous process to the articular process. The interlaminar space is exposed with the help of Caspar retractor. The disc and endplate cartilage are removed through an interlaminar approach. The bone graft-filled cage is then inserted to the empty disc space [16-17]. Other mini skin incisions are made for screw placements. A spinal needle is inserted through the deep fascia and advanced by the Wiltse intermuscular approach. Anteroposterior (AP) and lateral image intensifier views are used to confirm the position of the needle. As the needle tip is located at the medial border of the pedicle in the true AP view, the lateral view is used to assist advancement of the needle until it reaches posterior margin of the vertebral body. A guide wire is then inserted through the needle. The needle is removed and then tapering should be done to prepare the screw insertion until the junction between pedicle and vertebral body. A cannulated percutaneous long-arm pedicle screw is then advanced through the guide wire into the pedicle and vertebral body. Pedicle screws for the upper slipped vertebra are inserted with the wide-open rod passing space to reduce the slippage degree. Under image-intensifier, an adequately sized and pre-bend rod is placed in the percutaneous pedicle screw heads through a small incision made over the upper lumbar region. Rods are tightened with confirmation of the reduction in the slippage degree. Long arms of the screw are broken off and then wound irrigation and closure are performed [16-17].

There was an average pre –op slip angle of 30 º of with maximum of 50 º and minimum of 20º in our patients. Post operatively the average slip angle was 25 º reduced to an average of 30 º. The slip angle was maintained the most of the cases with an average loss of correction of only 5 º in spite of doing an additional

procedures of bone grafting, the maintenance of corrections is attributed mainly to the rigid cortical purchase of the pedicle screws and deferred mobilization on individual basis with lumbar brace.

We observed in less than 50 º slip angle loop16 cases of meyerding grade 2 and 4 cases of meyerding grade 3 which improved to meyerding grade 1 &2 respectively four cases of meyerding grade 1 remained grade 1 with correction of slip angle.

Our observation is that there are more number of meyerding grade 2 patients in the < 25 º than in other group and that the improvement neurological observed maximally in less than 25 º group. This is probably less severity nerve root compression initially. We could not obtain separate evidence in our literary search for this observation. We reported screw breakage in one of the case which did not cause any neurological problem. Because of inter transverse fusion we did not plan for removal. We encountered foot drop in two cases post operatively in which one of the cases record and another is undergoing recovery. We applied foot drop splint in both cases. We had one case of CSF leakage intraoperatively which we repaired promptly and patient had no neurological problem.

Back pain is the most common. We had cases with the complaint of back pain which was not severe. No case had surgical site infection. Two cases has implant breakage in postoperative period. We planned for removal of screws but the patients did not turn up. Decompressive laminectomy was done for all cases where there was canal impingement by displaced vertebrae in no off patients. We did bone grafting procedures in all our cases. We did not observe any aggravation of kyphosis in any of our patients. There was one breakage of implant in our study in the postoperative period. four cases had foot drop in the postoperative period. We attempted reduction in one of these cases by reduction screws this complication is justified by the observation of Csécsei et al [18] who described that the greatest danger to the L5 nerve root during the reduction Maneuver occurred during the last 25% of the reduction of slippage. Jacobs et al., [19] also reported the development of cauda equina syndromes after insitu fusion in 12 adolescents with grade 3 or grade 4 spondylolisthesis.

Spondylolisthesis is a common condition that is seen in orthopedic practice for low back pain. To treat this many surgical and non-surgical methods have been described in literature. Surgical decompression and spinal stabilization is recommended for those patients who fail to respond to conservative management or who have significant spinal instability. Different techniques *i.e*. anterior, posterior and or combined approached have been used for various underlying degree of spondylolisthesis. Posterio-lateral lumbar fusion and spinal decompression is an effective method in the treatment of spondylolisthesis, as it provided good spinal fusion, less complication with satisfactory clinical outcome. Although the surgical fixation of spondylolisthesis using pedicular screw rod system and posterolateral graft with decompression is a safe, promising and appealing technique especially in low grade listhesis, there is a need to study, adopt and PLIF, TLIF and ALIF procedures to produce better clinical results and in high grade spondylolisthesis.

Conclusion:

Minimally-invasive surgery utilizing advance techniques and instrumentations can give a better outcome in spondylolisthesis surgery associated with lesser blood loss, pain level, and length of hospitalization. Symptomatic spondylolisthesis in adults improve with mossmiami pedicle screw rod system Patients can be ambulated early Intertransverse fusion process with stabilization of the motion segment with moss-miami is very successful in relieving symptoms of the patient. Posteriolateral fusion is still a safe, promising and appealing technique. We successfully achieve solid fusion with good mechanical alignment in majority of the patients. Further research to reduce the financial burden to patients is needed especially for the application in developing countries. We found in our study that posterolateral fusion with pediclescrew fixation minimizes dislocation, achieves adequate decompression, corrects the sagittal axis, and accomplishes fusion. We successfully achieve solid fusion with good mechanical alignment in majority of the patients.

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