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Surgical management of Spondylolisthesis by pedicular screw rod system and postero-lateral fusion

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Abstract

Introduction: 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 posterolateral fusion on functional outcome.

Methodology: From July 2009 to September 2011, a total of 43 patients, operated with postero lateral fusion were followed up and evaluated based on VAS for low back pain, ODI and neurological deficits.

Results: Follow up was 83% of original study population (43). Average follow up was 13 months. The mean difference between pre-operative and post-operative VAS at final follow up was 3.5 cms (SD= 2.94); ODI was 28% at 4 months and 36% at 8 months. Claudication pain relieved in all; functional outcome was Good in 67%, Fair in 27.5% and Failed in 5.5%; 75% had fusion at an average of 5.5 months.

Conclusion: PLF is still a safe, promising and appealing technique especially in low grade listhesis, even though PLIF and TLIF have come up in a large way.

Keywords: Spondylolisthesis, Posterolateral fusion, PLF, Functional outcome

Introduction

Spondylolisthesis is derived from the greek words – Spondylosis (Vertebra) and Olisthanein (to slip or fall). This most commonly describes the forward slippage of a cephalad vertebra on a caudal vertebra. Two processes – dysplastic and traumatic – can give rise to spondylolisthesis. These can occur simultaneously, but generally one precedes the other. The dysplastic pathway is initiated by a congenital defect in the bony hook or its catch. The hook is composed of the pedicle, pars interarticularis, inferior articular process of cephalad vertebra and the catch is the superior articular process of the caudal vertebra. Dysplasia of any of these structures sets the stage of olisthesis when the weight of the trunk is transferred through the area at the initiation of upright stance and ambulation. Subluxation occurs when the soft tissue restraints – (Intervertebral disc, anterior and posterior longitudinal ligaments, ligamentum flavum and the posterior ligamentous complex) undergo plastic deformation due to repetitive loading, unopposed by bony constraints. There is evidence to support a genetic predisposition to this process, although no pattern of inheritance has been identified [1, 2].

The traumatic pathway is initiated by repetitive cyclic loading that ultimately results in a stress fracture. Impingement between the inferior articular process of the cephalad vertebra creates a bending movement that must be resisted by the pars.

Repetitive impingement causing loads in excess of the fatigue limit results in a fatigue fracture of an otherwise normal pars interarticularis. The hard cortical bone of the pars interarticularis predisposes to non – union or healing in an elongated position. Either outcome permits vertebral subluxation [3].

Isthmic spondylolisthesis has been defined as a condition in which fibrous defects are present in the pars interarticularis, which permit the forward displacement of the upper vertebra and separation of the anterior aspects of the vertebra from its neural arch [4, 5].

Degenerative spondylolisthesis represents segmental instability and subluxation caused solely by degenerative change in the intervertebral disc and facet joints. The degree of subluxation is necessarily mild because the intact neural arch provides a bony limit to the forward translation.

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Relatively more sagittal orientation of the facet joints is associated with degenerative spondylolisthesis.

Methodology

This study to evaluate the outcome of surgical management of spondylolisthesis by pedicular screw rod system and postero – lateral fusion.

All patients of spondylolisthesis who are operated upon with posterior stabilization using pedicular screw rod system and posterolateral fusion and followed up

Inclusion criteria

- 1) All patients in the age group of 20 – 75 yrs.
- 2) Both sexes.
- 3) Patients diagnosed with spondylolysis and spondylolisthesis with failed conservative treatment and operated with posterior stabilization using pedicular screw rod system and posterolateral fusion in our hospital.

Exclusion criteria

- 1) Patients of age less than 20 yrs and more than 75 yrs.
- 2) Patients with Grade – V spondylolisthesis.
- 3) Patients who did not have a regular follow up for a minimum period of 6 months.
- 4) Patients with any other spinal pathologies.
- 5) Patients who have had earlier surgeries on their spine.

Methods and Analysis of the results

A total of 43 patients diagnosed with spondylolisthesis and operated with posterior stabilization using pedicular screw rod system and posterolateral fusion in our hospital were included in the study. Clinical outcome (based on VAS for low back pain, ODI, Radicular pain, Neurological deficits and claudication) and spinal fusion was then assessed by plain lumbar spine radiographs at 2, 4, 8 and 12 months after operation.

Results

All patients were in the range of 21 yrs and 60 yrs with an average age at the time of surgery being 43 yrs. The patients have duration of symptoms ranging from 1 month to 10 yrs with a mean time period of 25.7 months. The majority of the patients were housewives followed by those doing heavy manual work. All the 36 patients had low back pain; Radicular pain present in 28 patients; Neurological deficits present in 6 patients; Claudication pain present in 18 patients. No involvement of bowel and bladder in any patient All the patients have undergone posterior stabilization with pedicular screw rod system and posterolateral fusion using autogenous iliac crest graft. Decompression by laminectomy and Facetectomy was done in degenerative type and decompression with excision of pseudoarthrosis, foraminotomy and laminotomy was done in isthmic type.

Table 1: Complications

Complication	Our study (%)	Literature (%)
Instrumentation failure	Nil	6%
Pedicle failure	2.7%	2%
Vascular injury	Nil	Nil
Dural tear	8.3%	12%
Neurological deficits of new onset	2.7%	5%
Infection	Nil	6%
Re – operation rate	2.7%	Nil

In our study, 4 of the 36 patients, that is 11.1% developed complications. Intra operatively 3 patients had dural tear, one patient had pedicle failure leading to medial wall penetration and post operatively she developed radicular pain on right side which was of new onset, hence she was revised with removal of instrumentation. Dural tear was tackled by placing free fat graft and water tight closure of all layers.

The patients had an average duration of follow up of 13 months with the maximum follow up being for 23 months and the least being for 7 months.

Post operatively, 5 patients had low back pain, while 3 had radiculopathy and 2 had a limp at the time of their last follow up.

The mean difference between pre-operative and post-operative VAS at final follow up was 3.5 cm (SD = 2.94) which is more than the minimal clinically important change.

The mean difference between pre-operative and post-operative ODI at 4 months follow up was 28% and 8 month follow up was found to be 36%.

Overall outcome has been graded into Good, Fair and Failed depending on VAS, ODI, improvement in radiculopathy and neurological deficits.

Table 2: VAS Difference

Points	3	2	1
VAS difference	>3.5	>3	<2.94
ODI difference (8 month post op)	>40%	10-40%	<10%
Radiculopathy	Absent	Occasionally Present	persisting
Neurological deficits improvement	2 grades	1 grade	Not improved

Maximum score – 12. Minimum score – 4

* Whatever may be the score persistent radiculopathy is considered as Failed response.

Table 3: Outcome

Outcome	Score	No. of pts (%)
Good	>= 10	24 (67%)
Fair	5 – 10	10 (27.5%)
Failed	<= 5	2 (5.5%)

The establishment of fusion was strictly derived from radiographic confirmation of continuous bone traversing the grafted segments, which showed no evidence of motion on flexion – extension radiographs. Pseudo arthrosis is defined as a discontinuous or fibrous interface, but may also refer to translational motion (typically more than 4 mm) in an apparently fused segment.

27 of the 36 patients (75%) had obtained bony fusion while 9 patients did not. The average time for bony fusion was 5.5 months with the earliest being 4 months and the latest 11 months.

Discussion

Spondylolisthesis is a fascinating condition reported over two centuries ago, with so many different types and degrees of slip. Community prevalence rates for the condition are not known but probably around 5-6% in the adult population. Thus widely disparate figures for those who are symptomatic has been reported – 50% in Magora’s study [6] and less than 25% in Lafond’s study [7]. It is clear however, that only a small minority of affected individuals ever have symptoms but this proportion increases with severity of slip.

In our study of 36 patients, the mean age of patients was found to be 43 yrs. This could possibly be because 42% of patients had isthmic spondylolisthesis which presents in 2nd & 3rd decade while 58% of patients had degenerative spondylolisthesis which presents in the 4th & 5th decade of life. Many other observations in this study are also comparable to the established facts described in the literature. This includes the overwhelming female preponderance in this condition (F:M – 2:1) and the fact that spondylolisthesis being commonest in the lower lumbar level. Dysplastic type of listhesis was uncommon whereas isthmic and degenerative were the commonest.

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.

In general the younger the patient with painful spondylolisthesis, the more definite is the indication for surgery and the more likely is surgery to be successful. Persistence of symptoms in spite of adequate conservative management constitutes the main indication in our study. '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 [8] have described a reasonable policy for the surgical treatment of spondylolisthesis and is widely accepted. In isthmic spondylolisthesis, conservative management is the main stay of treatment. Only if it fails, surgical management is considered. With the available literature, instrumented spinal fusion is the current method of choice with or without decompression. In our study, in isthmic type when indicated, decompression with excision of pseudoarthrosis, foraminotomy and laminectomy was done. 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 study of 15 cases of isthmic lytic spondylolisthesis, our management involved instrumented posterolateral fusion with autogenous iliac crest bone graft and decompression as mentioned when indicated.

Degenerative spondylolisthesis is a special problem, that it produces symptoms of stenosis of either the canal or the lateral recess. A study suggested that if patients fail a reasonable course of therapy of 4 – 6 weeks, they may benefit in the short term from a course of epidural steroid injections. Physiotherapy mostly used method to apply non-operative treatment of symptoms associated with degenerative Spondylolisthesis. Despite many surgical options exist for the treatment of degenerative spondylolisthesis, it is generally agreed that in most cases non-operative treatment should be attempted before surgical intervention is pursued. Surgical management should include decompression. In our study of 21 cases of degenerative spondylolisthesis, our management involved decompression by laminectomy, facetectomy and foraminotomy and posterolateral fusion with pedicular screw rod system accompanied by bone grafting obtained from iliac crest in many and laminectomy bone chips in few. Decompression has shown excellent results in follow up. Thus decompression has a definite role in most cases of degenerative spondylolisthesis.

With regard to spinal fusion, fixation of the unstable spine by posterolateral fusion is the treatment most surgeons prefer. 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. A high rate of successful fusion by the posterolateral technique has been reported by Watkins, Wiltse and others. In our study fusion rate achieved was 75% which is comparable to 82% fusion rate for posterolateral fusion, mentioned in literature. Difference in the rates of fusion probably can be attributed to short follow up period.

Reduction of spondylolisthesis has been reported by many authors using both skeletal traction and instrumentation. There are a number of methods available for improving the degree spondylolisthesis. In our study reduction has been achieved using reduction screws and reduction instruments and achieved very good improvement in the degree of slips. Pre operatively 21 patients had grade I; 12 patients grade II and 3 had grade 3 slips which were reduced to grade 0 in 17; grade I in 12 and grade II in 7 patients.

Conclusion:

Spondylolisthesis does not need treatment if it is symptomatic. Back ache alone, without neurological symptoms are often due to over exertion, long travel or strenuous activity. It lasts for a few days gradually becoming normal, and needs only muscle developing exercises for both flexor and extensor muscles.

In the earlier stages of this condition, the patient can be managed by non operative methods like rest, traction, 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 patient for surgery must be chosen carefully and he/she must be explained about the expected results. The goal of surgery must also be explained to the patient.

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