Clinico- Radiological profile of indirect neural decompression Using cage or auto graft as interbody construct in PLIF in spondylolisthesis, which is better?
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Citation
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Abstract

Study design
A prospective clinical study of PLIF in grade I and II degenerative spondylolisthesis was conducted between Mar 2007-Aug 2008. The objective was to assess the clinicoradiological profile of structural v/s non-structural graft on intervertebral disc height and its consequences on the LBP assessed by VAS score and ODI. This study involved (n=28) patients.

We included
Age of 30-70 years, symptomatic patient with disturbed ADL, single level L4/L5 or L5/S1 Grade I or grade II degenerative spondylolisthesis.

We excluded
Patients with osteoporosis, recent spondylodiscitis, subchondral sclerosis, visual and cognitive impairment, and all other types of spondylolisthesis All the patients underwent short segment posterior fixation using CD2 or M8 instrumentation, laminectomy, discectomy, reduction and distraction of the involved vertebral space. In 53.5% (n=15) patients snugly fitted local bone chips were used while in 46.4% (n=13) patients Cage was used. Among Cage group, titanium cage was used in 9[32.1%] and PEEK cages in 4[14.2%] patient. In one patient unilateral PEEK cage was used. The mean follow-up period was 24 months. Among (n=28) patients, 67.8%(n=19) were females and 32.14%(n=9) were males. 68.24%(n=18) were having L4/L5 and 35.71%(n=10) L5/S1 spondylolisthesis. 39.28%(n=11) were of grade I and 60.71%(n=17) were of grade II spondylolisthesis.

Conclusion
There was a statistically significant correlation (p<.012 and p<.027) between the change in disc height we achieved and the improvement in VAS score in both graft group and cage group. The increment in disc height and VAS score were significantly better in Cage group(2mm+- S.D visa-viz 7.2(88%)) than the graft group(1.2mm+- S.D visa-viz 5(62%))

INTRODUCTION
Spondylolisthesis is a disease of mankind in which original description was of lyric listhesis, later degenerative was described. It is classified based on etiology into 5 types: congenital or dysplastic, isthmic, degenerative, traumatic, and pathologic (Wiltse, 1976). In 1854, Killian coined the term spondylolisthesis to describe the gradual slippage of the L5 vertebra due to gravity and posture. The incidence of isthmic type of spondylolisthesis is believed to be approximately 5% based on autopsy studies. Degenerative spondylolisthesis is observed more frequently as the population ages and occurs most frequently at the L4-L5 level. Up to 5.8% of men and 9.1% of women are believed to have this type of listhesis. The etiology of spondylolisthesis is multifactorial. Spondylolisthesis can be graded based on the amount of vertebral subluxation in the sagittal plane, as adapted from Meyerding (1932): Grade 1 - Less than 25% of vertebral diameter Grade 2 - 25-50% Grade 3 - 50-75% Grade 4 - 75-100% Spondyloptosis - Greater than 100%

Posterior Lumbar interbody fusion: PLIF is a procedure that has enjoyed popularity over past 50 years. Ralph Cloward pioneered it in 1940. Recent advances in spinal instrumentation and minimal access techniques have revitalized interest in PLIF. The indications of PLIF and variants of it as TLIF have expanded and include numerous
pathologies. A surgical technique of PLIF with the use of autogenously posterior elements cut into 2-4 mm as graft material has distinct advantages.\(^8\) James Walter, Simmons et al studied about 113 patients treated between 1974-1980 and noted good objective results as high as 79%. Chip PLIF appears to decrease the morbidity associated with taking autogenously bone from the other sites. They preferred to use corticocancellous chips which would allow far more bone to be put into the intervertebral disc space and provide less dead space for the fibrous tissue. Anie F ,Mannion MD et al \(^1\) studied the importance of neurogenic claudication in the diagnosis of spondylolisthesis and as such assessed the pain in these patients. The importance of pain was highlighted in 1990’s when the American Pain Society declared it as the fifth vital sign of medical examination. Interbody fusion being near the centre of axis of rotation close to the weight bearing column has fusion rates of 97% in many series.

**MATERIAL AND METHODS**

In the present study all patients were asked history and subjected to thorough clinical examination. The preoperative VAS and ODI scores were noted down. The preoperative dynamic x-rays were taken [fig 3] and the Disc Heights[fig 2, Fig 3].

**Figure 1**
Fig1: Measuring grade

**Figure 2**
Fig 2 Measure Disc height

Meyerding grade[fig 1] and the slip angles were measured. Patients written and informed consent was taken. All the investigations relevant from the point of view of anaesthesia were done and the Pre-Anaesthetic clearance was taken. After proper written consent patients were taken then for the said surgical procedure.

Operative technique : After satisfactory induction of anaesthesia, the patient was positioned prone on a four-poster frame and all pressure points were well padded.

Fig 3-4 Laminectomy & decompression
A standard midline posterior approach was used to expose the spine as per the level of involvement. Laminectomy and decompression was done [Fig 3] to [Fig 4] The spinous processes and the laminae were made into chip grafts. Total discectomy was performed at the degenerated level. The level involved was fixed using transpedicular monoaxial/polyaxial screws with reduction screws put into the listhesed vertebra

Fig 5-6 Instrumentation stages

The interbody spacer was placed [Fig 6] and the reduction maneuver performed by lifting the upper body in a cranial and posterior direction. The screws were connected with rods.
and disc space gradually distracted to achieve lordosis along with the good reduction. The final construct was tightened in compression. After completion of the discectomy and the transfixation, cancellous bone chip grafts were used as interbody graft and well packed snugly into the level for an interbody fusion in group II while cages were put into Group I patients. We did not perform any SSEP during the procedure. Haemostasis was achieved and wound was closed in layers over a suction drain. Patient was subjected to X-ray L/S spine AP & Lateral views on first postoperative day [Fig 7 and Fig 8] and the various measurements were again taken for comparison.

Immediate post-op x-rays

**Figure 7**
Fig 7 [LAT]

**Figure 8**
fig 8[AP]

After surgery patients were braced in LSO for a period of 3 months for comfort. Patient was discharged on third post operative day and advised to follow the OPD on tenth day for removal of stitches and subsequently to every month for about 24 months. Fusion was assessed by Lumbosacral X-rays

**Figure 9**
Fig 9 fusion [graft group] Fig 10; Fusion [Cage Group]

The total operative time averaged 3.2 hours (Range 2-5hrs). The estimated blood loss was 200ml (Range 100-350 ml).

**RESULTS**

Among (n=28) patients, 71.5% (n=19) were females and
28.5% (n=9) were males. 71.5% (n=18) were having L4/L5 and 28.5% (n=10) L5/S1 spondylolisthesis. 42.9% (n=11) were of grade I and 57.1% (n=17) were of grade II spondylolisthesis.

Following were our observations.

**Figure 10**

**Table-1 age group**

<table>
<thead>
<tr>
<th>S no</th>
<th>Age in yrs</th>
<th>No of patients</th>
<th>% age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30-40</td>
<td>6</td>
<td>21.4</td>
</tr>
<tr>
<td>2</td>
<td>40-50</td>
<td>10</td>
<td>35.7</td>
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<tr>
<td>3</td>
<td>50-60</td>
<td>9</td>
<td>32.14</td>
</tr>
<tr>
<td>4</td>
<td>60-70</td>
<td>3</td>
<td>10.71</td>
</tr>
</tbody>
</table>

Gender out of total 28 cases 19 were females while 9 were males.

**Figure 11**

**Table-2 Gender**

<table>
<thead>
<tr>
<th>S no</th>
<th>male</th>
<th>female</th>
<th>Grand total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>19</td>
<td>9</td>
<td>28</td>
</tr>
</tbody>
</table>

No of patients as per level involvement.

**Figure 12**

**Table-3 level wise**

<table>
<thead>
<tr>
<th>S no</th>
<th>L4/L5 level</th>
<th>L5/S1 level</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>G.total</td>
<td></td>
<td></td>
<td>28</td>
</tr>
</tbody>
</table>
We used spinous process chip grafts in 15 patients and cage in 13 patients. This is comparable with in which though the number of patients was more, also the spinous processes were used as chip grafts and fusion was assessed. We observed a mean change in disc height of 1.2mm+_S.D in the graft group and 2mm+_S.D in the cage group of patients. This is comparable with the research project of P.gopinathan et al in which the mean change in disc height was 4mm. The mean change in VAS score in graft group was 5(62%) in graft group and that in the cage group was 7.2(88%). This is comparable with the research work of P.Gopinathan et al in which 2 points better VAS score improvement than ours was seen. In both the two groups the mean improvement in slip angles was about 3.2deg+_S.D.

In this series we noted complications in about 4 patients with implant loosening in 1(3.5%) of patients[Fig 11],pedicle wall breakage in 1(3.5%) and wound infection (MRSA) in 1(3.5%) patient[Fig 12]. One patient with implant loosening and another with pedicle wall breakage was reoperated.

One patient with implant loosening is having mild backache
on movement with improvement in VAS from 9 to 4. She is waiting for the implant removal. One patient with wound infection was managed with superficial wound debridement and her cultures showed MRSA positivity for which she was treated.

There was a statistically significant correlation (p<0.012 and p<0.027) between the increment in disc height we achieved and the improvement in VAS score in both graft group and cage group. The increment in disc height and VAS score were significantly better in Cage group (2mm± S.D visa-viz 7.2(88%) ) than the graft group(1.2mm± S.D visa-viz 5(62%) ).

DISCUSSION

It is well known fact that weight transmission is the sole culprit for the progression of liss thesis. Disc space height maintenance Indicates total discectomy. As a result it, Increases neural foramina height, thus larger the height, stronger graft (volume) can be inserted.

In our study we operated 28 patients in the age group of 30-70 years out of which ,6 patients(21.42%) were in the age group of 30-40 yrs,10(35.71%) of 40-50 yrs,9(32.14%) of 50-60 yrs and 3(10.71%) was in the age group of 60-70 yrs. Among 28 cases 19(67.85%) were females and 9(32.14%) were males. In this series 18(64.28%) were having involvement of L4-L5 level while 10(35.71%) had involvement of L5-S1 level. About 11(39.28%) were having grade I while 17 patients(60.71%) had grade II spondylolisthesis. Out of The total 28 patients included in this study, all of them presented with LBA while 18(64.28%) had neurogenic claudication as the presenting symptom and 10(35.71%) patients had additional radiculopathy. Associated Symptoms appeared at approx. 1 km distance in 9(32.14%), 2 km distance in 7(25%) and 3 km distance in 12(42.85%) patients.

DISC HEIGHT RESTORATION:

Some advocate radical excision of the intervertebral disc to help with the reduction as well as placement of an interbody graft. Various methods used in the literature purpose include bone dowels, rectangular or threaded bone plugs, local bone chips or bone or metallic cages. In our series we used snugly packed local bone chips obtained from the spinous processes and the laminae in 15 patients, cages in 13 patients. we noted mean increment in disc height of about 1.2mm in 15 patients within graft group while mean increment of 2mm was seen in 13 patients of cage group. In our series a mean increase in VAS score of 5± SD was observed in graft group while a mean increase of 7.2± SD in VAS score was observed in Cage group of patients. This shows that more near the disc height is restored to normal during surgery and maintained well in post op period had better improvement in VAS scores. In both groups a 85% reduction, 3.2 °decrease in slip angle and 86% fusion was achieved. It was observed in this series that the values remained higher in the cage group with about 2.2 points higher vas score.0.8mm higher increment in disc height. This is a statistically significant difference (p 0.012 and 0.217) between the two groups, obtained using SPSS(Wiskonson) software. The probable reason for better restoration of disc space height is cage group is obvious. The structured graft resists the final Compression better than non structured graft. Though we achieved good distraction before final compression in all patients the only graft group lose some height compared to cage group with the final maneuver.

In our series we did decompression in all the patients in both the cage and the graft group. In 1942-50 Ralph Cloward his series of 165 patients operated by this technique has shown fusion rates of 93% (Fig 19) and clinical results of satisfaction in 97%. This is comparable to our series in which fusion rates of 86% and satisfying clinical results in 87% of cases. Neil ,Naohisa Miyakoshi et al showed in his series, intervertebral disc as an important cause of spondylolisthesis which is also the case in our series of 28 patients. In these our patients as per Kirkladdy Willis, the intervertebral discs were in various stages of dysfunction and instability. James Walter Simmons MD and Mureiy Y Imagama et al [8] noted the utility of local chip grafts in the fusion and noted a fusion rate of abt 100%. Anie F ,Mannion MD et al has stressed the importance of pain in the assessment of spondylolisthesis patients. They have compared the pre and postop Vas scores in their patients with mean improvement of 5 +_ S.D points which is comparable to our series with improvement of 6.1+_ S.D[Mean of both groups]. For solid bone union, some investigators recommended PLF+PLIF.

CONCLUSION

In this our series of twenty eight patients subjected to PLIF procedure it is concluded that maintenance of disc height with the help of Spacer Is preferred over graft. Using spinous processes avoids additional incision and graft site morbidity. Although a technically demanding procedure, PLIF procedure is a procedure of choice for the grade I,II
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and Grade III degenerative and isthmic spondylolisthesis.

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