

**TRANSFORAMINAL LUMBAR INTERBODY FUSION IN LOW GRADE COMBINED LYTIC AND DEGENERATIVE SPONDYLOLISTHESIS: FUNCTIONAL OUTCOME OF 21 CASES**Suresh Padya<sup>1</sup>, Sivananda Patri<sup>2</sup>, Diddi Shravan Kumar<sup>3</sup>, Varun Kumar P<sup>4</sup>**HOW TO CITE THIS ARTICLE:**

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**ABSTRACT: BACKGROUND:** Spondylolisthesis is a heterogenous disorder characterised by subluxation of a vertebral body in sagittal plane occurring frequently at L4-5 and L5-S1 commonest being isthmic and degenerative variety. While majority are asymptomatic, a subset do produce pain with neurology. Complete decompression of roots is essential, as is the need for solid stabilization. Several fusion techniques were reported in literature like PLF, TLIF, PLF, ALIF. On theoretical grounds, TLIF has been suggested to be safe and result in an improved outcome compared to other techniques. Data to support this view, are lacking. **METHODS:** A total of 21 patients (age range, 27-62 years) with adult isthmic and degenerative spondylolisthesis were operated. There were 8 males and 13 females with mean age of 46.8 pre-op and 2-year follow-up, pain (VAS) and functional disability were quantified by Oswestry Disability Index (ODI). Radiological union assessed with xrays by Brantigan and Steffee criteria. The global outcome was excellent in 90%. and 92% fusion. 2 patients presented motor deficit which did not recover. **RESULTS:** The follow-up was for 2 years. The mean VAS score for low back pain improved from 7.0 preoperatively to 2.1, as did the mean VAS score for leg pain from 6.7 to 1.4 and the mean ODI from 59.5% to 11.3%. **CONCLUSION:** TLIF does affect the 2-year outcome of surgical treatment of spondylolisthesis with decreased back pain and ODI's, with advantages of minimal thecal retraction, restored segmental lordosis and preserved posterior tension band.

**KEYWORDS:** Pars Interarticularis, Ligamentotaxis, Pedicle Screw, Lordosis.

**INTRODUCTION:** Spondylolisthesis entails a forward shift of the spinal column<sup>1</sup> characterized by severe instability secondary to a failure of the 3-column support. Reconstruction of the altered supporting structures is necessary.<sup>2</sup> About 50% of such patients have lytic defects in pars interarticularis, whereas 25% have degenerative the changes in which the facet and disc translate forward secondary to intersegmental instability.<sup>1</sup> Although isthmic tends to have early onset, it is usually manifested when degenerative changes set in. Surgery is indicated to prevent further progression of the slip, relieve back and leg pain, reverse neurological deficit, and stabilize the segment.<sup>3</sup> Fusion of the posterior lumbar elements combined with instrumentation achieves spinal fusion in up to 95% of cases.<sup>4, 5</sup> Posterolateral fusion is considered the gold standard of treatment for adults with spondylolisthesis<sup>6</sup> Transforaminal lumbar interbody fusion<sup>7</sup> (TLIF) is an alternative to posterior lumbar interbody fusion<sup>8,9</sup> (PLIF). The interbody space is accessed through the far lateral portion of the vertebral foramen<sup>10</sup> and necessitates less dissection and minimizes nerve root manipulation.<sup>11</sup> It minimizes the risks of neural injury<sup>12</sup> and postoperative

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instability and enables the placement of the grafts within the anterior or middle of the disc space to restore the lumbar lordosis reduction of the slip via ligamentotaxis.<sup>13</sup> Also, removal of the supposedly pain-generating degenerated disc has been claimed to favor anterior fusion or TLIF.<sup>14,15,16</sup> The additional surface of the contralateral lamina and spinous process enhances fusion.<sup>17</sup> Additional use of posterior lumbar pedicle screw instrumentation is the standard for reconstruction.<sup>18</sup>

Despite numerous publications, the scientific support for the TLIF method is, however, weak. In the randomized Swedish Lumbar Spine on degenerative disc disease, no difference in outcome was observed between interbody fusion and PLF.<sup>13</sup> Similarly, in a Korean study of a mixed patient population with spinal stenosis and spondylolisthesis, Kim et al found no difference in outcome between interbody fusions and PLF.<sup>14</sup>

The purpose of this study was to evaluate the outcome of TLIF in 21 patients of combined lytic and degenerative spondylolisthesis.

**MATERIALS AND METHODS:** Between September 2011 and September 2013, 13 women and 8 men aged 27 to 62 (mean, 47.8) years underwent TLIF for lytic (n=16) or degenerative (n=5) spondylolisthesis in Preethi Hospital Madurai. The inclusion criteria were low grade lytic and degenerative spondylolisthesis, Low back pain with or without sciatica, and severely restricted functional ability, failed conservative treatment after 6 months. The exclusion criteria were traumatic listhesis, degenerative scoliosis, infection and generalized bone diseases.

Of the 16 patients with lytic spondylolisthesis, 4 involved L4/L5 and 11 L5/S1. Of the 5 patients with degenerative spondylolisthesis, 3 involved L4/L5, one at L5/S1, and one at L3/L4. 2 with lytic spondylolisthesis had motor and sensory L5 deficits.

The study was approved by the Medical Ethical Committee of Cairms, Karimnagar.

The TLIF method included transforaminal disc space clearing with shavers and introduction of spacers and cages (titanium & peek) to create lordosis. Autologous bone graft from posterior iliac crest was placed in the disc space as sentinel graft and cage was packed with the same, posterolateral fusion with shingling and iliac bone graft was added in patients on contralateral side. The mean operating time was 150 minutes and the mean blood loss was 300 ml. The mean length of hospital stay was 8.5 days. Post operatively patients wore brace for 2 months, received a postoperative exercise or physiotherapy program.

All patients completed questionnaires on functional disability and pain, treatment and at 6 months, 1 and 2 years at outpatient visits.

Results were classified into three categories (excellent and good, fair, and poor) using the Parker et al criteria.<sup>19</sup> A good or excellent result means a VAS<sup>20</sup> less than or equal to 4, no medication or NSAID only, and return to more than 75% of pre-morbid work capacity. A fair result means that VAS is more than 4 and less than or equal to 6, occasional use of narcotics, and more than 50% of previous work capacity. A poor result means a VAS above 6, daily narcotics, and less than 25% of previous work capacity.

**Radiographic Fusion:** Radiographic fusion at the interbody levels was assessed and graded into five grades according to the criteria described by Brantigan and Steffee:<sup>21</sup> Grade 1 means obvious

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radiographic pseudarthrosis; grade 2: probable radiographic pseudarthrosis; grade 3: radiographic status uncertain; grade 4: probable radiographic fusion; grade 5: radiographic fusion.

**Outcome Measurements:** Functional Disability was measured by the Visual Analogue Score & the Oswestry Disability Index. The ODI is a validated disease-specific instrument for assessment of spinal disorders consisting of a 10-item ordinal scale instrument with 6 response alternatives for each item.<sup>22</sup> The total score ranges from 0 to 100, where 100 is the worst disability. The items are pain intensity, personal care, ability to lift, walk, sit, stand, sleep, sex life, social, and traveling. For each item, normal function is 0 and worst is 5. The sum of the 10 items multiplied by 2 constitutes the ODI (0-100).

**RESULTS:** Patients were followed up for at 2 years. The mean VAS score for low back pain improved significantly from 7.0 preoperatively to 2.1 at 2 year, as did the mean VAS score for leg pain from 6.7 to 1.4 and the mean ODI from 59.5% to 11.3 [Table]. Improvements in each follow-up at 3, 6, 12 months and 2 years for both the lytic and degenerative groups were also significant (Table). However, between the lytic and degenerative groups, the improvements in the mean VAS scores for both low back pain and leg pain were significantly better in the lytic group at 2 years. 2 patients persisted with residual neurological deficit, and all achieved radiological fusion except 1. In the lytic and degenerative groups, the comprehensive outcome was excellent and good in 14 and 5 patients. Only one patient had poor outcome for which implants were removed.

Two patients presented initially with a motor deficit. persisted till latest follow-up. The overall clinical outcome according to the Parker et al<sup>19</sup> scale was as follows: 19 patients (90.4%) were rated as excellent or good, while 2 patients (10%) were rated as poor. The radiological outcome, according to the criteria of Brantigan and Steffee<sup>21</sup> was as follows: 19 levels or 90.4% grade 4 & 5; 1 was grade 3, 1 was grade 2 requiring implant removal.

**DISCUSSION:** Several fusion techniques were reported in literature like PLF, TLIF, PLIF, ALIF. Traditional treatment included standard posterolateral fusion with decompression. However its drawbacks were, disc space settling due to compression, torsion, shear forces centered over the void disc space. Failure of load bearing capacity due to lack of support in anterior and middle column. High implant failure and pseudoarthrosis with graft on tension side instead of compression side. [Wolf's law] Large amounts of graft and extensive far lateral muscle stripping. The interbody space has more vascularity than the posterolateral space, hence less potential for a solid fusion mass to form<sup>3,4</sup> With evolution of fusion armentarium and novel implants, not only have the fusion rates improved technical advances in implants have improved their safety and ease of application further adding to the popularity of inter body fusion techniques like plif and tlif.<sup>6-14</sup> Inter body fusions are superior-are more biomechanically sound because with each technique the bone graft is placed along the weight-bearing axis of the spine under maximal compression. Because grafts are placed near the center of rotation for a spinal motion segment, this results in greater stability with the goal of treating those problems that are discogenic in origin more directly<sup>6,7,8</sup>

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PLIF for spondylolisthesis enables neural decompression, stabilization of the deranged motion segment, reconstruction of the disc height, and restoration of the sagittal plane translation and rotational alignment.<sup>23</sup> Nonetheless, there is a risk of neural damage during retraction manoeuvres and damage to the cauda in higher levels.<sup>24</sup> Unilateral TLIF with pedicle fixation is a variation of PLIF that requires less dissection and minimizes nerve root manipulation, compared with other interbody fusion methods.<sup>25</sup> In a study by Munnamaneni and Roseberg of 22 patients undergoing TLIF,<sup>26</sup> 21 had good-to-excellent outcomes (96%) with minimal complications. In another study by el-Masry MA, Khayal 30 patients (33 levels) who underwent unilateral TLIF using a single cage for multi-level, low-grade, lytic spondylolisthesis,<sup>27</sup> 20 of the levels were at L4/ L5. 90% of these patients achieved excellent-to good results, and 91% achieved fusion and our study is similar with 90% excellent to good results and 92% fusion rates. Various studies demonstrated efficacy of TLIF in relation to pain, Yan D et al<sup>28</sup> comparing PLIF with TLIF for lytic listhesis the mean VAS score for pain improved from 7.2 to 2.8. In another study by Yahya et al<sup>29</sup> of 30 patients the VAS score for low back pain decreased from 7.0 to 2.1 and that for leg pain decreased from 6.4 to 2.0, whereas the ODI decreased from 69.3% to 11.8%. Ours study demonstrated similar results. In another study of 40 patients undergoing a unilateral portal TLIF using 2 cages,<sup>30</sup> 85% achieved good-to-excellent clinical results, and 90% achieved radiological fusion similar to our study in spite of single cage.

**CONCLUSION:** TLIF is today frequently used in lumbar fusion because of less violation of the spinal canal. Whether this results in an improved outcome is, however, unclear. By using a unilateral transforaminal access with the insertion of a single cage it is possible to achieve restoration of disc space height, segmental lordosis, and reduction of spondylolisthesis with its biomechanical advantages. These can be achieved with less dural retraction and less trauma to the spinal canal. Another advantage of a single cage is that it allows inserting more bone grafts into the disc space outside the cage, and the contralateral posterolateral fusion increase the grafting area resulting in a higher fusion rate.

Our study was limited by the short follow-up period and small sample size. Long-term studies involving larger group are required to examine sagittal lordosis of a fused segment, disc height reduction, and adjacent segment degeneration are needed proving its effectiveness.

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