Long term results of Endoscopic Lumbar Discectomy using Side viewing Conical working tube

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Abstract: Object: Endoscopic discectomy is a common procedure performed worldwide with various devices being used and studies have reported their long term results. In this study we present the long term results of the unique device with separate side viewing channel. Methods: 66 patients of lumbar disc herniation treated between March 2009 to April 2012 using the unique conical working tube with separate side viewing endoscopic channel. Their preoperative and postoperative Oswestry Disability Index (ODI) and Macnab scores were used to evaluate the outcome after a minimum follow of 5 years with mean follow up of 76.18 months. Results: There were 46 males and 20 females with age ranging from 19-72 (mean-38.4 years). The follow up ranged from 61 months to 95 months with mean of 76.18 months. The mean preoperative ODI score was 74.7 which decreased to a mean of 7.8 and the outcome evaluated by Macnab criteria was 69.69% excellent, 17 % good, 10% fair, 3.03% poor. 2 patients underwent second surgery. None of the patient had to change their occupation due to their lumbar disc disease. Complications occurred were dural tear in 2 patients, transient foot paresis in 1 patient and discitis in 1 patient which improved on medical management. Conclusion: Endoscopic discectomy using thins Conical working tube is a safe and effective technique for lumbar disc prolapse. It has the advantage for early mobilization, short hospital stay and low cost. The long term results are comparable to the conventional techniques.

Key words: endoscopy, discectomy, herniated disc, prolapsed intervertebral disc, lumbar spine

Introduction

Surgery for Prolapsed Lumbar Intervertebral disc is one of the most common surgery performed by spinal surgeons. Open Micro discectomy or endoscopic inter-laminar or transformational lumbar discectomy are preferred modality of
treatment by most spinal surgeons with proven safety and outcome and each having is advantages and disadvantages. Xue-Song Wang in their meta-analysis concluded that the inter-laminar endoscopic surgery has the advantage of decreased hospital stay and blood loss in comparison to microdiscectomy and with similar results for long term pain control, functional recovery or incidence of complication [32]. Various authors have reported their experience of endoscopic discectomy using different devices with excellent to good long term follow up. In this report with summarize the long term results of endoscopic discectomy using the conical working tube with separate viewing channel.

Clinical material and methods

This is a retrospective study based on long term follow up of 66 patients of lumbar disc herniation treated using the unique conical working tube with side viewing endoscopic channel [14]. The hospital records of 212 patients who underwent endoscopic lumbar discectomy using this device between March 2009 to April 2012 were retrieved. Only those patients were included in this study who could be contacted on telephone and responded to the ODI and Macnab format. The indication for surgery was low backache with radicular pain in lower limb with or without neurological deficit and failed conservative management. The patients who had segmental instability, no clinic-radiological correlation or evidence of infection were excluded from this study.

There were 46 males and 20 females with age ranging from 19-72 (mean-38.4 years). The follow up ranged from 61 months to 95 months with mean of 76.18 months.

- Instrument design: this device consists of a conical working tube which is passed over coaxial dilators and secured in position by a holding device attached to the operating table. It has a separate side viewing channel for the telescope which is attached to light source and camera. No special instruments are used for laminotomy and discectomy. Figure 1.

![Figure 1 - Instruments design. 1a. Photograph of the device with its measurements; 1b. Device placed in a spine model; 1c. Diagrammatic representation of the device with disc forceps in inside the device showing the ease of using regular instruments through the device without clutter](image)

- Operative technique: after general anesthesia the patient is positioned in prone position on a Wilson’s frame or foam bolsters. The level is localised using fluoroscopy and 18-20mm skin incision is given in midline. The fascial incision is made 1 cm lateral to midline. The first dilator is passed with a 5mm trocar up to the lamina and the trocar is removed. A gentle medial to lateral and cranial and caudal sweeping movement is done for
elevation of soft tissue. Two subsequent dilators are passed over this first tube. Finally the working tube is passed over these dilators and fixed to table. The position of the working tube is confirmed using fluoroscopy. A cannula with trocar is passed from the separate side channel through a separate stab incision and locked in the working tube using the locking mechanism. The telescope “0” degree, 4 mm diameter and 180 mm length is passed through this separate channel. The tip of the telescope just reaches up to the inner part of the working tube. The light source and camera is attached to the cannula and the image orientation is done by rotating the camera on scope. Figure 2.

The medial part of the facet and contiguous lamina are identified. A small hemilaminotomy medial facetectomy is made using Kerrison rongeur. The Ligamentum flavum is detached from the undersurface of the lamina above using an angle micro-curette. Ligamentum flavum is then removed and the traversing nerve root and thecal sac are identified using ball probe. The nerve root is retracted medially and the disc is removed by entering the disc space through the annular tear or an annulotomy with No 11 surgical blade. The disc space is irrigated with Normal Saline to wash out loose disc fragments. The nerve root is inspected to ensure adequate decompression. Figure 3, Figure 4. The entire assembly is removed and the fascia is closed with absorbable suture. Skin is closed using subcuticular sutures.

![Figure 2](image1.jpg)

**Figure 2** - steps of the procedure
2a. 1st dilator with sharp trocar being passed; 2b. 2nd dilator being passed over the 1st dilator; 2c. Final working tube being passed; 2d. Cannula for Telescope being passed through separate channel in the working tube; 2e. Telescope being passed; 2f. Complete the device assembly in situ and fixed to the operating table

![Figure 3](image2.jpg)

**Figure 3** - Magnified view through the device
3a. Extruded disc; 3b. Dissector; 3c. Nerve root; 3d. Thecal sac; 3e. Telescope
Postoperative management- Patients were mobilized in the evening of day of surgery after and discharged on the next day. In this study the mean hospital stay was 1.6 days.

Complications
The most common complication was found to incidental dural tear, observed in 2 patients. This was managed by sealing the defect by fibrin glue. No postoperative CSF leak or pseudomeningocele or any long term sequelae was observed. The other postoperative complications were transient foot paresis in 1 patient and 1 discitis in 1 patient which improved on antibiotic therapy.

Results
The patients were evaluated using ODI score and the total score was calculated. The score was interpreted into 0% to 20% (minimal disability), 21% to 40% (moderate disability), 41% to 60% (severe disability), 61% to 80% (crippled) and 81% to 100% (bed bound/ exaggerating their symptoms). Both the preoperative and postoperative ODI were compared and its difference was calculated. The outcome at the last visit was evaluated by Mcnab criteria in to excellent, good, fair and poor. The follow up ranged from 61 months to 95 months with mean being 76.18 months. The mean preoperative ODI score was 74.7 which decreased to a mean of 7.8. The outcome evaluated by Macnab criteria was 69.69% (n=46) excellent, 17% (n=11) good, 10% (n=7) fair, 3.03% (n=2) poor.

One patient experienced persistent radicular pain of same intensity was diagnosed to have a residual disc fragment which was removed by microsurgery and the other patient developed recurrence of symptoms 2 years after 1st surgery. He was diagnosed with bony canal stenosis at the same level with instability and underwent intervertebral fusion. None of the patient had to change their occupation due to their lumbar disc disease.

Discussion
The technique of classical discectomy as described by Mixter and Barr has undergone significant change to minimize the trauma of long incision, extensive muscle dissection and laminectomy leading to prolonged post operative hospital stay, morbidity due pain, scarring around nerve root and instability [27], (Table 1). To over these disadvantages Microsurgical technique was adopted which has made a signifinat improvement in the outcome (Table 2).
Table 1 - Studies of Open laminectomy/laminotomy with discectomy

<table>
<thead>
<tr>
<th>Author &amp; Year</th>
<th>No. of patients</th>
<th>Results Excellent/good</th>
<th>Followup in years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlas et al. 2005</td>
<td>217</td>
<td>69</td>
<td>10</td>
</tr>
<tr>
<td>Bakhsh et al. 2010</td>
<td>39</td>
<td>79</td>
<td>10</td>
</tr>
<tr>
<td>Butterman et al. 2004</td>
<td>100</td>
<td>92</td>
<td>2.5</td>
</tr>
<tr>
<td>Hsu et al. 2011</td>
<td>226</td>
<td>82</td>
<td>2</td>
</tr>
<tr>
<td>Jansson 2004</td>
<td>22261</td>
<td>78</td>
<td>6</td>
</tr>
<tr>
<td>Mariconda et al. 2006</td>
<td>201</td>
<td>90</td>
<td>27.8</td>
</tr>
<tr>
<td>Martinez quinones et al. 2011</td>
<td>142</td>
<td>93</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 2 - Studies of Microdiscetomy

<table>
<thead>
<tr>
<th>Author &amp; Year</th>
<th>No. of patients</th>
<th>Criteria</th>
<th>Results Excellent/Good</th>
<th>Mean Followup In Years</th>
<th>Recurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Findlay et al. 1998</td>
<td>79</td>
<td>macnab</td>
<td>83%</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Jensdottir et al. 2007</td>
<td>134</td>
<td></td>
<td>91%</td>
<td>20.7</td>
<td>12.7%</td>
</tr>
<tr>
<td>Moore et al. 1994</td>
<td>100</td>
<td></td>
<td>93%</td>
<td>8.6</td>
<td>10.5%</td>
</tr>
<tr>
<td>Schoeggl et al. 2003</td>
<td>672</td>
<td>prolo</td>
<td>77%</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>Vik et al. 2001</td>
<td>62</td>
<td></td>
<td>81%</td>
<td>8.5</td>
<td></td>
</tr>
</tbody>
</table>

To further minimise the disadvantages of open surgery Foley and Smith described Microendoscopic Discectomy (MED) in 1997 for root decompression in cases of lumbar disc disease [12]. Various authors have described their results of MED which is mentioned in Table 3.

Table 3 - Studies of Endoscopic Discectomy

<table>
<thead>
<tr>
<th>Author &amp; Year</th>
<th>No. of patients</th>
<th>Tech</th>
<th>Outcome measures</th>
<th>Outcome</th>
<th>recurrence</th>
<th>Complication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li et al. 2015</td>
<td>72</td>
<td>IL</td>
<td>VAS,ODI, McNab</td>
<td>97% good to excellent</td>
<td>1</td>
<td>No complications</td>
</tr>
<tr>
<td>Xu et al. 2014</td>
<td>36</td>
<td>IL</td>
<td>VAS</td>
<td>Excellent</td>
<td>2 patients converted to open</td>
<td>None</td>
</tr>
<tr>
<td>Hussein et al. 2014</td>
<td>185</td>
<td>IL</td>
<td>NRS, McNab, ODI</td>
<td>Statistically significant pain relief</td>
<td>2 converted to open</td>
<td>3 dural tears</td>
</tr>
<tr>
<td>Kalkarni et. 2014</td>
<td>188</td>
<td>IL</td>
<td>VAS,ODI</td>
<td>Statistically significant pain relief</td>
<td>3(1.5%)</td>
<td>11 (5%) dural tears,1(0.5%) infection, 1(0.5%) wrong level</td>
</tr>
<tr>
<td>Kim et al. 2013</td>
<td>224</td>
<td>IL</td>
<td>VAS,ODI</td>
<td>Statistically significant pain relief</td>
<td>5%</td>
<td>None</td>
</tr>
<tr>
<td>Yadav et al. 2013</td>
<td>400</td>
<td>IL</td>
<td>VAS, McNab</td>
<td>90% significant improvement</td>
<td>2(0.5%)</td>
<td>3 facet injuries, 7 dural tears, 2 infections, 1 persistent paresthesia</td>
</tr>
<tr>
<td>Kim et al. 2012</td>
<td>18</td>
<td>IL</td>
<td>McNab</td>
<td>98% complete removal</td>
<td>2 residual</td>
<td>1 dural tear</td>
</tr>
<tr>
<td>Kausal et al. 2012</td>
<td>300</td>
<td>IL</td>
<td>McNab</td>
<td>90% excellent to good</td>
<td>2</td>
<td>2 nerve root injury</td>
</tr>
<tr>
<td>Kim et al. 2012</td>
<td>30</td>
<td>IL</td>
<td>McNab</td>
<td>Significant improvement</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Chumnanvej et al. 2011</td>
<td>60</td>
<td>IL</td>
<td>McNab</td>
<td>91.6% excellent outcome</td>
<td>2</td>
<td>None</td>
</tr>
</tbody>
</table>
Jensdottir et al in their retrospective study reported a good/excellent outcome of micro discectomy after up a mean follow up of 20.7 years [17]. Casal Moro et al in their prospective study reported that MED is a safe and reproduce able technique with lesser tissue trauma with comparable results to that of conventional techniques [6]. Bhansare et al reported their 10 year experience using the Destandau technique with excellent short and long term results [4]. The other technique of minimally invasive lumbar discectomy commonly practiced via the transforaminal route through the Kambin’s triangle has been reported with improvement in the Japanese Orthopedic association score of 76% [34]. The disadvantage of this technique is that the contralateral component of the disc bulge and the diffuse bony canal stenosis are difficult to address.

The long term results with this device were excellent to good in 86.36% of cases after a mean follow up of 76.18 months which is comparable with the long term studies of all the minimally invasive lumbar discectomy techniques practiced worldwide. None of the patients had to change their profession in this follow up period.

Casal Moro reported surgical complication rate of 3 to 10 % in various techniques whereas Destandau in his series reported 3.5% and 4 of his patients required reoperation [11]. In our series we experienced 6.15 % (n=4) of such complications and 3.03% (n=2) required reoperation.

The popular device which is commonly used is the METRx system for the MED which a serial dilator system utilizing the interlaminar corridor. It has a telescope mounted at the top end edge of the working channel but as experienced by the senior surgeon this technique causes clutter while working bimanually through the working tube. The other disadvantage is the high cost of the specialized hardware. The Destandau system is the other popular device used worldwide with excellent to good long term result but it has the disadvantage that direct visualization using naked eye or microscope is not possible and also minimally invasive inter-body fusion cannot be performed through this device. The cost of these devices are very high which is a major deterrent in expansion of this technique and as this is an indigenous innovation it has very low cost. The hardware cost if further reduced as it utilizes the conventional discectomy instruments and same telescope which is used in transcranial endoscopic surgeries.
Conclusions

Endoscopic discectomy using this conical working tube is a safe and effective technique for lumbar disc prolapse. It has the advantage for early mobilization, short hospital stay and low cost. The long term results are comparable to the conventional techniques.

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