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

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Abstract: *Object*: Endoscopic discectomy is a common procure 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 from19-72 (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 1 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 ofendoscopic 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 fomat. 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 from19-72 (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.

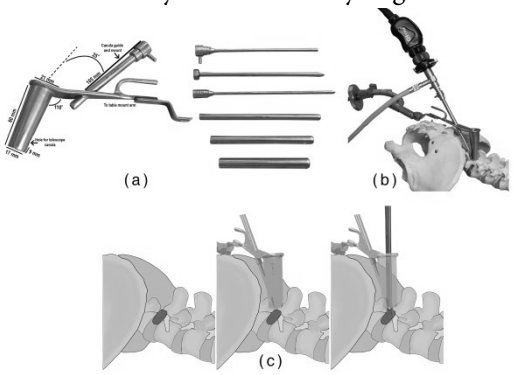

Figure 1 - Instruments design. 1a. Photograph of the device with its measurements; 1b. Device placed in a spine model; 1c. Diagrammatic representation of the device with disc forceps in inside the device showing the ease of using regular instruments through the device without clutter

- 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 upto 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 tune 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 upto 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.

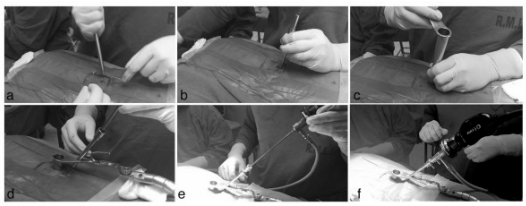

Figure 2 - steps of the procedure
2a. 1st dilator with sharp trocar being passed; 2b. 2nd dilator being passed over the 1st dilator; 2c. Final working tube being passed; 2d. Cannula for Telescope being passed through separate channel in the working tube; 2e. Telescope being passed; 2f. Complete the device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

The medial part of the facet and contiguous lamina are identified. A small hemiliaminotomy medial facetectomy is made using Kerrison rounger. 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.

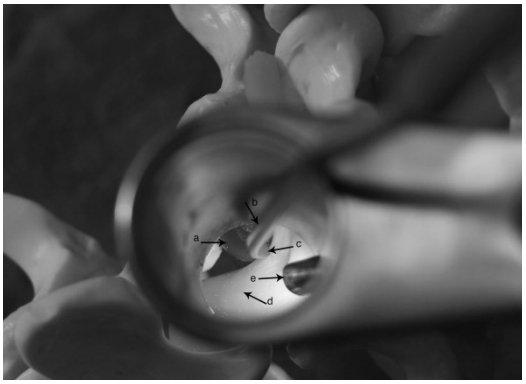

Figure 3 - Magnified view through the device
3a. Extruded disc; 3b. Dissector; 3c. Nerve root; 3d. Thecal sac; 3e. Telescope

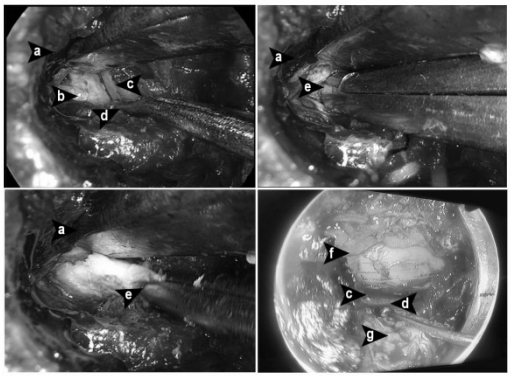

Figure 4 - Endoscopic view
4a. Nerve root retractor; 4b. Intervertebral disc; 4c. Nerve root; 4d. Ball Dissector; 4e Disc forceps holding the disc; 4f. Thecal sac; 4g. Facet joint

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 siginifinat improvement in the outcome (Table 2).

Table 1 - Studies of Open laminectomy/laminotomy with discectomy

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

Table 2 - Studies of Microdiscetomy

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

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]. Varoius authors have described their results of MED which is mentioned in Table 3.

Table 3 - Studies of Endoscopic Discectomy

Author & Year	No. of patients	Tech	Outcome measures	Outcome	recurrence	Complication
Li et al. 2015	72	IL	VAS,ODI, Mcnab	97% good to excellent	1	No complications
Xu et al. 2014	36	IL	VAS	Excellent	2 patients converted to open	None
Hussein et al. 2014	185	IL	NRS, Mcnab ODI	Statistically significant pain releirf	2 converted to open	3 dural tears
Kulkarni et al. 2014	188	IL	VAS,ODI	Statistically significant pain releirf	3(1.5%)	11 (5%)dural tears,1(0.5%)infection, 1(0.5%) wrong level
Kim et al. 2013	224	IL	VAS ODI	Statistically significant pain releirf	5%	None
Yadav et al. 2013	400	IL	Vas, Mcnab	90% significant improvement	2(0.5%)	3 facet injuries, 7 dural tears,2 infections,1 persistent paresthesia
Kim et al. 2012	18	IL	Mcnab	98% complete removal	2 residual	1 duraltera
Kaushal et al. 2012	300	IL	Mcnab	90% excellent to good		2 nerve root injury
Kim et al. 2012	30	IL		Significant improvement		None
Chumnanvej et al. 2011	60	IL	Mcnab	91.6% excellent outcome	2	None

Chen et al. 2011	123	IL	VAS, ODI	Significant improvement	3	1 dural tear
Dezawa et al. 2011	30	IL		Statistically significant improvement	1 persistent radiculopathy	
Wang et al. 2011	30	IL	VAS	Significant improvement	20% converted to open	4.1% duralteras, 4 nerve root injury, 1 DVt, 1 discitis
Jhala Mistry et al. 2010	100	IL	Mcnab	91% excellent to good	4	4 discitis, 1 nerve root damage
Kaif et al 2017	66	IL	Mcnab,ODI	86.36% excellent to good	Second surgery in 2	Discitis 1, dural tear 2, transiet foot paresis 1

Jensdottir et al in their retrospective study reported a good/excellent outcome of micro discectomy after up a mean followup 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 followup 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.

Casalmoro 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 theinterlaminar 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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