Endoscopic Transforaminal Discectomy Vs. Far Lateral Discectomy for Extraforaminal Disc Protrusions: Our Experience

Leonello Tacconi*, Enrico Giordan

ABSTRACT

**Background:** Extraforaminal disc herniations are challenging occurrences, requiring a more disruptive approach in terms of bony removal and muscles dissection. We compared outcomes and intraoperative findings between endoscopic transforaminal and far lateral discectomy in the treatment of extraforaminal disc protrusions

**Methods:** We prospectively collected 38 patients who underwent surgery for lumbar extraforaminal disc prolapse, from January 2014 to December 2018. Twenty patients underwent far lateral microsurgical discectomy, whereas eighteen a percutaneous transforaminal endoscopic discectomy. Patients were randomly assigned to a treatment group and were followed-up at intervals of 3, 6, and 16 months. No patients were lost at follow-up. Data were collected on leg pain and disability degree, preoperatively and at follow-up visits, along with demographic data, operative time, amount of intraoperative blood loss, and any postoperative surgical adverse events. Eventually, data analyzed and compared between the two groups.

**Results:** Mean operative time was significantly shorter for endoscopically treated patients compared to patients who underwent microdiscectomy (59.4 vs. 98 minutes, p-value < 0.001). Also, intraoperative blood loss was almost negligible (< 50 ml) for all endoscopically treated patients. There were no differences in terms of postoperative outcomes between patients treated with standard microsurgical techniques and patient who underwent endoscopic transforaminal discectomy at 3, 6, and 16 months of follow-up.

**Conclusions:** Transforaminal endoscopic discectomy is a feasible and safe procedure for the treatment of extraforaminal lumbar disc herniation. Our series highlighted the utility and feasibility of the technique, showing similar results to far lateral microsurgical technique.

Key Words: far lateral disk, endoscopic approach, ganglion, transverse process, transforaminal endoscopic discectomy

DOI Number: 10.14704/nq.2019.17.07.2562

Introduction

After the introduction of endoscopic techniques in the spinal surgical field, we witnessed significant changes in the lumbar disc protrapse treatment paradigm of (Lee et al., 2016; Yang et al., 2017). In selected patients, endoscopic transforaminal discectomy proved to be a safe and effective procedure to treat lumbar disc prolapses (Vogelsang and Maier, 2008). However, a certain percentage of disc protrusions may be localized outside the vertebral foramen: the so-called far lateral or extraforaminal herniations. Such occurrences are uncommon and way more challenging to treat than paramedian or intraforaminal disc protrusions (Kong et al., 2016). In

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Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.
Received: 05 July 2019; Accepted: 18 July 2019
this study, we compared outcomes and intraoperative findings between endoscopic transforaminal and far lateral discectomy in the treatment of extraforaminal herniations. We also suggest a series of intraoperative tips and tricks to identify the prolapsed disc in the extraforaminal space.

**Material and Methods**

We prospectively collected 38 patients who underwent surgery for lumbar extraforaminal disc prolapse, treated at our Neurosurgical Department, from January 2014 to December 2018. Inclusion criteria were 1) age ≥ 18 years; 2) a clinical diagnosis of extraforaminal lumbar disc prolapse; 3) a confirmed extraforaminal disc protrusion on spinal magnetic resonance imaging (MRI); 4) symptom duration > 6 weeks, not responsive to painkillers and physical therapy; and 5) at least 14 months of clinical follow-up. All patients with recurrent herniation, a positive surgical history in the corresponding segmental sites, or with an intraforaminal disc herniation were excluded. All patients had an MRI within four weeks before surgery. Patients were randomly assigned to a specific treatment group (microsurgery vs. endoscopic surgery), and the first author made all the surgical procedures (L.T.). Twenty patients underwent a far lateral microsurgical discectomy, whereas eighteen a percutaneous transforaminal endoscopic discectomy. The far lateral discectomy procedure utilized was the paramedian Wiltse approach (Wiltse and Spencer 1988; Guiroy et al. 2018)

**Patient demographics**

In 23 patients the extruded disc was localized the L4/L5 extraforaminal space while 15 at the L3/L4. In the far lateral microdiscectomy group, we had twelve females and eight males, while in the endoscopic group, we had ten females and eight males. Mean age at presentation was 45 years (range 25 and 56 years).

All the patients had been followed-up at intervals of 3, 6, and 16 months with clinical visits, and none of those were lost at follow-up. Data were collected on leg pain by Visual Analogue Scale (VAS) and disability degree by Oswestry Disability Index (ODI) preoperatively and at follow-up visits, along with patients demographic data (age, sex, and disc protrusion location), operative time (minutes), amount of intraoperative blood loss (millilitres, [ml]) and any postoperative (within 30 days) surgical adverse event (dural tear, postoperative leg paresthesia, postoperative neurologic deficit, infection, paravertebral muscle hematoma, etc.).

Patients characteristics are summarized in Table 1

Fig. 1; 2 and 3 shows an illustrative case.

**Endoscopic tips and tricks**

The surgical procedure performed by the first author was described in a previously published study (Tacconi, 2019). It has to bear in mind that in case of extraforaminal herniations the target is no more the vertebral foramen, as for standard transforaminal endoscopic discectomy for paramedian or intraforaminal protrusions, but its external inferior border. The upper and lateral part of the vertebral pedicle is a useful landmark to find intraoperatively. In case of difficulty in localizing the exiting nerve root, it can be helpful, to localize the upper part of the transverse process because the extraforaminal part of the nerve root points just inferior and medial...
and proportion and percentage for categorical variables. Mann Whitney-U tests were used for between-group comparison analysis. When the p-value was <.05, the difference was regarded as statistically significant. All statistical tests were 2-tailed. All statistical analyses were performed using Stata Version 13.0 (StataCorp, College Station, TX).

**Results**

**Far lateral discectomy group**

Mean operative time was 98 minutes (range 48-155 minutes), with a mean intraoperative blood loss of 87.8 ml (range 50 – 134 ml). Mean leg VAS went from a preoperative value of 7.5 to 3.5, 2.6, and 1.6 at 3, 6- and 16-months follow-up. Mean ODI scores went down from a preoperative value of 67.5% to 37.9% at 3 months; 23.4% at 6 months and 16.3% at 16 months follow-up.

We had three post-operative adverse events: one patient experienced a wound infection successfully treated with antibiotics while another had a transient postoperative L4 paresis (3/5 MRC) that improved spontaneously after 3 weeks. One patient experienced a disc recurrence and required a revision surgery 72 hours later.

**Transforaminal endoscopic group**

Mean operative time was 59.4 minutes (range 25-150 minutes), and intraoperative blood loss was almost negligible in all patients (< 50ml). Mean Leg VAS went from a preoperative value of 6.9 to 3.8, 2.8, and 1.9 at 3, 6, and 16 months postoperatively. Mean ODI scores went down from a preoperative value of 65.4% to 35.4% at 3 months; 23.7% at 6 months and 13.4% at 16 months.

One patient experienced hypothermia (35°) after a lengthy procedure (150 minutes). During the surgery, 13 liters of saline solution irrigation was employed. No other adverse events occurred.

The mean operative time was significantly shorter for endoscopically treated patients compared to patients who underwent microdiscectomy (59.4 vs 98 minutes, p-value < 0.001). Also, intraoperative blood loss was almost negligible (< 50 ml) for all endoscopically treated patients. There were no differences in terms of postoperative outcomes between patients treated with standard microsurgical techniques and patient who underwent endoscopic transforaminal discectomy.

A summary of postoperative outcomes are summarized in Table 2.

descriptive statistics were reported as a median and range and mean and range for continuous variables
Postoperative outcomes.

<table>
<thead>
<tr>
<th></th>
<th>Microsurgery</th>
<th>Endoscopic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative time</td>
<td>98 ± 22.2</td>
<td>59.4 ± 12.8</td>
<td>0.00012</td>
</tr>
<tr>
<td>Intraoperative blood loss</td>
<td>87.8 ± 27.5</td>
<td>&lt;50 ± 0.01</td>
<td>&lt;0.001</td>
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</tbody>
</table>

Leg VAS

<table>
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<tr>
<th></th>
<th>Postoperative score</th>
<th>at 3 months</th>
<th>at 6 months</th>
<th>at 16 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsurgery</td>
<td>7.5 ± 1.1</td>
<td>6.9 ± 1.3</td>
<td>6.0 ± 1.4</td>
<td>5.7 ± 1.3</td>
</tr>
<tr>
<td>Endoscopic</td>
<td>3.5 ± 1.3</td>
<td>2.8 ± 1.1</td>
<td>1.4 ± 0.7</td>
<td>1.0 ± 0.7</td>
</tr>
<tr>
<td>p-value</td>
<td>0.603</td>
<td>0.873</td>
<td>0.313</td>
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</table>

ODI scores

<table>
<thead>
<tr>
<th></th>
<th>Postoperative score</th>
<th>at 3 months</th>
<th>at 6 months</th>
<th>at 16 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsurgery</td>
<td>67.5 ± 11.4</td>
<td>65.4 ± 11.9</td>
<td>64.0 ± 12.9</td>
<td>61.4 ± 12.8</td>
</tr>
<tr>
<td>Endoscopic</td>
<td>37.9 ± 11.7</td>
<td>35.4 ± 12.9</td>
<td>35.0 ± 12.9</td>
<td>34.5 ± 12.9</td>
</tr>
<tr>
<td>p-value</td>
<td>0.465</td>
<td>0.912</td>
<td>0.276</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

Extraforaminal lumbar disc prolapses incidence rates range between 7 to 12% (Yoshimoto et al., 2014), with the protruding disc generally located at the distal end of the vertebral foramen, pointing downwards in almost 30% of cases (Papavero and Kothe, 2013). Commonly, extraforaminal disc protrusions compress the nerve root a close to the ganglion zone, causing a distal nerve root involvement. In our opinion, such a lateral relationship could be the reason why patients usually experience a more severe back and leg pain than patients with a paramedian or intraforaminal disc protrusions.

Currently, the best options for extraforaminal disc protrusion treatment are interlaminar fenestration and far lateral discectomy (Papavero and Kothe, 2013; Al-Khawaja et al., 2016; Zheng et al., 2016). In the interlaminar approach, a more considerable amount (> 1/3) of facets joint need to be removed to reach the compressed portion of the nerve root (Wang et al., 2012). Such aggressiveness has a high chance of destabilizing the spine, with patients possibly requiring spinal arthrodesis over time (Kong et al., 2016). However, the interlaminar route is the easiest way for the surgeon to reach the protruded disc, just by following its lateral border outside the spinal canal.

A more anatomical approach is the far lateral access route (Guiroy et al., 2018). The procedure does not require bone removal and allows to reach the extraforaminal disc just by dissecting and retracting the paravertebral muscles. However, the surgeon is often forced to work in deep space within tissues, and skin incision can be quite long, especially for obese patients (Zheng et al., 2016; Al-Khawaja et al., 2016). It is also challenging and time-consuming to find the nerve root in the extraforaminal space, raising the chance of nerve injury during the manipulation (Tacconi, 2018).

In our series, we did not find any significative differences in terms of postoperative outcomes between microsurgical far lateral and endoscopically treated patients, confirming, the validity of transformaminal endoscopic discectomy in the treatment of far lateral approach. On the contrary, we did find a significative difference in terms of operative time and blood loss, with significantly lower values in the endoscopic transformaminal discectomy group. Unfortunately, data were scarce to make any conclusions about differences in postoperative adverse events rates between the two groups, even if they were all transient complications.

However, the endoscopic transformaminal approach requires a smaller skin incision and a much milder muscles dilatation compared to an open far lateral discectomy (Choi et al., 2018), resulting in less tissue damage and shorter hospitalization (Matsumoto et al., 2010). In the first cases of our series, when we were still at the beginning of our experience, it was quite challenging to identify the involved nerve root, necessitating two surgeons to stabilize the endoscopic working channel and requiring a quite amount of tissue dissection. At a later stage, after having mastered the technique, the procedure became faster and more natural to identify the protruded disc and the compressed nerve in the extraforaminal space. Even if all of our patients were operated under general anesthesia, without muscles relaxant to make any accidental stimulation of the nerve root evident as a muscle contraction, we believe that this endoscopic procedure could be performed even under spinal or local anesthesia. We also believe that during the endoscopic transformaminal approach it could be possible to reach the intraforaminal part of the prolapsed disc, when present, and to remove it without being destructive. That, in our opinion, is a prerogative of the endoscopic technique.

Limitations

The main limitation of this study is the limited number of patients, which may limit any prognostic analysis. However, few studies have debated the role of percutaneous transformaminal endoscopic discectomy for far lateral disc prolapse, also comparing the effectiveness of that technique to traditional far lateral discectomy procedures. We believe that this study
could be of interest for spinal surgeons. However, more extensive prospective randomized studies, also analyzing outcomes of mini-invasive techniques are needed to describe the advantages and shortcomings of endoscopic surgery for far lateral disc prolapse.

**Conclusion**

In our opinion, transforaminal endoscopic discectomy is a feasible and safe procedure for the treatment of extraforaminal lumbar disc herniations. Our series, although small, highlighted the utility and feasibility of this technique to treat prolapsed discs in the extraforaminal area, showing similar results to far lateral microsurgical technique but with smaller skin incision, shorter operatitme, and lesser soft and muscle tissues manipulation.

**References**


Choi KC, Shim HK, Hwang JS, Shin SH, Lee DC, Jung HH, Park HA, Park CK. Comparison of surgical invasiveness between microdiscectomy and 3 different endoscopic discectomy techniques for lumbar disc herniation. World neurosurgery 2018; 116: e750-e758.


