OPEN LIMITED DISCECTOMY FOR LUMBAR DISC PROLAPSE; SHORT TERM CLINICAL OUTCOME

Ali Saleh Mahdi Aljanabi1, Mousa I. Alghazali1; and Muna Zamil Alshabbani 2

1. Orthopedic department, College of medicine, University of Al-Qadisiyah/Iraq
2. Ministry of health, Iraq

Corresposng author:
Muna Zamil Alshabbani
*E-mail: moaedalgazally@yahoo.com

ABSTRACT
Prolapsed intervertebral lumbar discs happens in about 5-10% of patients presented with backache and contributes to considerable morbidity with significant economic and functional loss. It may occur at any age, but is uncommon in the very young and very old. After failure of conservative treatment trial, the mainstay treatment of lumbar disc prolapse is discectomy which can be done by different methods. The aim of study is to evaluate the short term clinical outcomes of open limited discectomy for lumber disc prolapse. This is a prospective cohort study included 42 patients who are suffering from back pain and or leg pain due to lumbar disc prolapse treated surgically by the same surgical team at Al-Diwaniyah Teaching Hospital from October 2016 to October 2018. Clinical assessment was done for them using preoperative and postoperative Japanese Orthopaedic Association Score (JOAS). Additionally MacNab criteria were used to determine the functional improvement for all patients were open limited discectomy for them was done at the time of their final follow up. All patients were satisfied with their treatment. The mean±SD for their pre-operative JOAS was 9.02±1.38 which improved to 23.19±1.19 after the operation, these improvements were statistically significant (P<0.001). Twenty-nine patients (69.05%) showed excellent result and 13 patients (30.95%) showed good result. Fortunately, no complications were encountered. Open limited lumbar discectomy is an effective procedure with less complications and early return to work and this procedure can performed with no need for expensive instruments.

Keywords: limited discectomy, lumbar disc prolapse, short term clinical outcome

INTRODUCTION
Intervertebral discs are complex structures consist of nucleus pulposus (NP), annulus fibrosus (AF) and cartilage endplate, and together, they determine the disc state and submit to significant axial loading, lateral bending and rotational as well as flexion vs. extension forces (1). Lumbar disc herniation is defined as a localized or focal displacement of disc material beyond the limits of the intervertebral disc space that can lead to substantial radicular symptoms, which if persist, may require surgical intervention (2). Herniated discs typically classified as extrusions, protrusions, or sequestrations. Narrowed-base herniations have termed extrusions; usually there will be a large herniation outside the canal (3). Wide-based herniations are called...
protrusions in which the diameter at the base of the herniation is wider than the canal diameter, while sequestrations are herniation in which there is no continuity between the herniation and the remaining intervertebral disc \(^4\). Lumbar disc herniation is mainly posterolateral herniation which thereby press on the traversing nerve root, and pain development could either be from mechanical compression or inflammatory chemical irritation of the nerve root. Mechanical compression can distort and stretch the nerve, as well as squeeze the microvascular circulation leading to hypoperfusion and ischemia symptoms \(^7\). Surgical treatment in patients with less than six months duration is suggested in those with symptomatic lumbar disc herniation whose complains are severe enough to justify surgery. Surgical options used are discectomy with either laminectomy, hemilaminectomy, laminotomy, fenestration, microdiscectomy or endoscopic discectomy \(^8-11\). The most common procedure is discectomy with hemilaminotomy approach. Complications include epidural bleeding, dural tears, nerve root injury and incomplete removal of prolapsed disc fragments. In this study we aimed to evaluate the short term clinical outcome of open limited discectomy for lumbar disc prolapse.

**MATERIALS AND METHODS**

A prospective study was conducted in the orthopaedic department, Al-Diwanyah Teaching Hospital during the period from October 2016 to October 2018 on (42) patients with lumbar disc prolapse, who underwent open limited discectomy. Of those (42) patients there were (30) male and (12) female. The age ranged from 20-40 years with mean (30.7 years).

**The inclusion criteria:** the patients had single level, more than 20 years old and all of them had been tried at least 6 weeks of conservative treatment.

**The exclusion criteria:** The patient with previous surgery for lumbar disc prolapse, other comorbidities such as uncontrolled diabetes and morbid obesity, severe spinal stenosis and or instability, quadra equine syndrome, spinal infection, spinal deformity (kyphosis and scoliosis) and lastly vertebral fracture.

Included patients were complaining from backache, leg pain, and functional disability related to daily living activities. All patients, at time of admission, were carefully evaluated by detailed history and a thorough clinical examination.

All patients assessed preoperatively regarding the clinical symptoms via Japanese Orthopaedic Association Score (JOAS) \(^12\). And this score include the following:

1. Subjective symptoms (9 points): low back pain, leg pain and/or tingling gait.
2. Clinical signs (6 points): straight-leg raising test, sensory disturbance, motor disturbance.
3. Restriction in activities (14 points): turn over while lying, standing, washing, leaning forward, sitting about 1 hour, lifting or holding a heavy object and walking.
4. Urinary bladder function (-6 points maximum).

Total score = Sum points for all parameters

**Interpretation:**

- Minimum score: -6
- Maximum score: 29
- The higher the score the more normal the patient's overall status.
Postoperative improvement in percent = \( \frac{\text{Postoperative score} - \text{Preoperative score}}{\text{Preoperative score}} \times 100 \)

After full clinical assessment and selection of patient for surgery according to patient indication and inclusions criteria we admit the patient to the hospital and the following were prerequisite:

- Informed Consent for surgery was taken from the patients.
- Medical and anesthetics consultation for fitness for general anesthesia.
- Preparation of one unit cross matched blood for each patient.
- Prophylactic antibiotic intravenously one hour before surgery.

**Operative technique**

Patients were in knee-chest position during the surgery, after induction of general anesthesia the lumbar spine was approached posteriorly by midline incision about 3-5cm in length over the affected level which is marked by using the iliac crest as intraoperative anatomical landmark. Fascia was incised longitudinally and paraspinal muscle stripped off from the spinous process of the symptomatic side with a self-retaining retractor being inserted. Then stepwise dissection was done to reach the affected level in between the laminae. The ligamentum flavum was removed piecemeal with rongeurs and sometimes one 3rd of lamina width above or below was cut to get clear window. The neural elements were retracted with a nerve retractor then the extruded and sequestrated loose disc debris were removed, and if the annulus and posterior longitudinal ligament were intact incised bluntly by dissector and the disc material removed piecemeal fashion with disc forceps. The exiting nerve root was decompressed in all cases. The discspaces were washed by saline and t Gentamycin 80mg were applied locally in the disc space. Wound was closed in layers without drain. The surgery took about 30-40 minutes and the patients stayed in bed for 12 hours after surgery and during this period the lower limb movement was encouraged by asking the patient to stand up and gradual walking as tolerated, prolonged standing and bending were avoided for first 6 weeks. Patients were advised to do a back exercise postoperatively for paraspinal muscle rehabilitation after 4 weeks. Patients are advised to return to original work after 8-12 weeks. Japanese Orthopaedic Association Score (JOAS) was used to assess patients postoperatively at 2 weeks, 6 weeks, three months, six months, and one year postoperatively. Mac Nab’s criteria were used to evaluate the functional outcome in which, the patients were classified as: Excellent, Good, Fair, and Poor.

**Statistical analysis**

Descriptive statistic for continuous variable expressed as mean ± SD and for the other variable as percentages. Paired student t-test was used to analyze data. (p <0.001) was statistically significant for our study.

**RESULTS**

A total of 42 patients were studied. The oldest one in the group was 40 years and the youngest one was 20 years with a mean age of (30.7). There were 30 male (71.43 %) and 12 female (28.57 %). The mean duration of symptoms was (6.1) months. All patients received a trial of conservative treatment for six weeks durations. Eighteen patients (42.86%) presented with back pain, (14) patients (33.33%) presented with leg pain, and 10 patients (23.80%) had both leg and back pain as shown in figure (1). All patients were underwent limited discectomy and sometimes use laminotomy.
The decompressed level was (L4-L5) in 24 patients (57.14%) and (L5-S1) in 18 patients (42.86%) as shown in table 1.

![Figure 1: Patients symptoms](image)

**Table 1: Affected Level**

<table>
<thead>
<tr>
<th>Level</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>L4-L5</td>
<td>17</td>
<td>7</td>
<td>24</td>
<td>57.14%</td>
</tr>
<tr>
<td>L5-S1</td>
<td>13</td>
<td>5</td>
<td>18</td>
<td>42.86%</td>
</tr>
</tbody>
</table>

Regarding the disc positions, out of 42 patients there were 20 patients (47.61%) with posterolateral, 14 patients (33.33%) with paracentral and 8 patients (19.06%) with central disc prolapse. Additionally we found that the herniation was left side disc in 26 patients (61.9%) and right side disc in 16 patients (38.1%). Fortunately there is no one of the known complications encountered in all operated patients during surgery and all patients were discharged during the 1st postoperative day. The pain and function were assessed by JOAS and MacNab’s criteria. Regarding patients with back and leg symptoms their preoperative JOAS (mean±SD) was 9.11±1.13 which improved to 20±1.92 postoperatively at one year, those with leg pain their preoperative JOAS was 8.35±1.49 which improved to 21±1.21 postoperatively at one year, and for patients with back pain the preoperative JOAS was 9.8±1.31 which improved to 22.24±1.76 postoperatively at one year as shown in table 2. Preoperative JOAS (mean±SD) was 9.02±1.38 which improved to 23.19±1.19 after one year and postoperative improvement for all patients was 70.92% as shown in table 3 and figure 2.
Table 2: Pre and post-operative JOAS scores expressed as mean±SD.

<table>
<thead>
<tr>
<th></th>
<th>Preop. mean ±SD JOAS</th>
<th>Postop 2 wks</th>
<th>Postop 1 month</th>
<th>Postop 3 months</th>
<th>Postop 6 months</th>
<th>1 year postop.</th>
<th>% of improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Back and leg pain</strong></td>
<td>16 ± 1.13</td>
<td>16.11 ±0.86</td>
<td>18.22 ±1.51</td>
<td>19.4 ± 1.02</td>
<td>20 ± 1.92</td>
<td>54.75</td>
<td></td>
</tr>
<tr>
<td><strong>Leg pain</strong></td>
<td>17.1 ±1.51</td>
<td>17.21 ±1.02</td>
<td>19.32 ±0.96</td>
<td>20 ± 0.86</td>
<td>21 ± 1.21</td>
<td>63.26</td>
<td></td>
</tr>
<tr>
<td><strong>Back pain</strong></td>
<td>17.06 ±0.86</td>
<td>17.43 ±0.28</td>
<td>19.12 ±0.14</td>
<td>21 ± 1.13</td>
<td>22.24 ±1.76</td>
<td>64.79</td>
<td></td>
</tr>
<tr>
<td><strong>All patients</strong></td>
<td>8.82 ± 1.38</td>
<td></td>
<td></td>
<td>23.19 ±1.19</td>
<td>70.92</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Pre and post-operative JOAS scores for all patients expressed as mean±SD.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Preoperative mean</th>
<th>Postoperative mean</th>
<th>% of improvement</th>
<th>p. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>JOAS</td>
<td>8.82±1.38</td>
<td>23.19±1.19</td>
<td>70.92</td>
<td>p.&lt;0.001</td>
</tr>
</tbody>
</table>

Figure 2: Pre and post-operative mean JOAS

Functional improvements for all patients were assessed after one year postoperatively by using MacNab’s criteria. We found that: 29 patients (69.05%) showed excellent result and 13 patients (30.95%) showed good result (Table4).
**DISCUSSION**

The lumbar disc prolapse contributes to life morbidity as well as economic and functional loss due to potential work hours lost. Prolapsed intervertebral disc is a common cause of sciatica and occurs in about 5-10% of all backache patients. Yet with a small prolapsed disc and in the presence of a narrow spinal canal, a compression of the caudaequina and its roots could occur \(^{(14)}\). Most of the patients get well with conservative treatment but after failure of conservative treatment trial the mainstay treatment of lumbar disc prolapse is discectomy by different methods. Many studies reveals success rates for lumbar disc surgery ranging from 66-90\% \(^{(15-17)}\). In our study; lumbar disc prolapse is more common among males than females may be due to heavy working and driving for long periods in our community regarding male patients; this increases intradiscal pressure and in turn increases risk of lumbar disc prolapse and this finding goes with finding of Marshall et al \(^{(16)}\) and Palmer et al \(^{(17)}\) since he found that male gender is a risk factor for lumbar disc prolapse. Regarding surgical treatment of lumbar disc prolapse, many authors showed that conventional laminectomy created more morbidity and complications when compared to less extensive procedures as limited discectomy \(^{(18)}\). The final assessment for any therapeutic modality is the functional outcome, as it reflects the patient’s appreciation. The patient must show good functional outcome and go back to his premorbid state as much as possible, and this depend on many factors, the most important aspect in the success is the maintenance of the posterior elements \(^{(19)}\). Conventional method by wide exposure can be complicated by damaging or shortage of the pars interarticularis or facet joints, resulting in paravertebral muscle atrophy and segmental instability. It has been found that preservation the elements of posterior spinal could reduce the hazard of developing postoperative alteration in spinal alignment and/or acceleration of disc and facet degeneration. Loss of the ligaments and spinous process leads to paraspinal muscles dysfunction. The lumbar spine may not cope up with stress due to the loss of levers \(^{(20)}\). The integrity of posterior osteoligamentus structure plays a very important role in preserve the segment steadiness of the lumbar spine. Over a flexion load; many ligaments sharing that load, the supraspinous ligament carries the maximum load, followed by the ligamentum flavum, intertransverse ligament, capsular ligament, and interspinous ligament. The ligaments transection increases the joints on the rest of the ligaments and augments the flexibility of the joint, as well as the movement on the disc \(^{(21,22)}\). Chen et al. \(^{(23)}\) in a cadaveric study found that the integrity of the posterior complex acts as a strain band in joint flexion and helps stabilize the decompressed spine. In conventional method, the extensive retraction of the paraspinous muscles bilaterally following their stripping for revealing the lumbar posterior elements, have potentially serious consequences. Sihvonen et al \(^{(24)}\) stated that four years postoperatively there were long-term changes in EMG studies with atrophy on post-operative CT studies in addition to a decrease in muscle strength. This occurred most likely because the innervation of

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**Table 4: Functional improvement**

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>19</td>
<td>10</td>
<td>29</td>
<td>(69.05%)</td>
</tr>
<tr>
<td>Good</td>
<td>7</td>
<td>6</td>
<td>13</td>
<td>(30.95%)</td>
</tr>
</tbody>
</table>

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paraspinal muscle is through the medial branch of the dorsal ramus which passes around the superior articular process. The multifidus muscle retraction is rather likely to join this branch, with subsequent risk of muscle denervation. Furthermore, tissue trauma is the most devastating event leading to the stress response, with the greater the trauma, the greater the response and also aggressive surgical tissue handling results in worse function\(^{(25)}\). Open limited techniques have been developed to solve these mentioned problems. These do not damage the midline posterior osteoligamentous structure and conserve spinal stability but at the expense of a limited access. The development of minimally invasive techniques has led to effective and safe applications with the need for only a minimal tissue dissection and a small-skin incision\(^{(26,27)}\). Keeping all previous mentioned facts in mind, we use open limited discectomy in our department, by which we preserved the spinous process and supraspinous/ interspinous ligaments complex to avoid spinal instability, preservation of contralateral multifidus muscle attachments and less trauma to the tissue, by which can get a lesser risk of multifidus denervation, less trauma response and reduces the potential complications like postoperative infection, adhesion and scarring around the nerve and the dura mater by decreased dead space that is why in the current study there were significantly better postoperative results regarding improvements in clinical outcomes judged by the patient assessment according to JOAS and Mac Nab’s criteria. Also by our technique there were shorter surgical times (30-40 minutes), shorter hospital stay (< 1 day), shorter time to initiate mobilization, less need for analgesia, fewer overall complications, and shorter rehabilitation time and this in turn will add to the sustained lower costs connected with this technique. Additionally this technique can offer greater than ever options to those patients who may not be the candidates for extended procedures.

The open limited technique in the treatment of lumbar disc prolapse is suitable, simple and can done by any surgeon with good experience in the field of back surgery, where the other techniques like percutaneous and micro endoscopic discectomy need a lot of expertise, expensive equipment and experience which are not available at every center and these are relatively new techniques and have a long learning curve. We found that patient with leg pain get much improvement than other patient and this is statistically significant. Manish et al\(^{(26)}\) found that the good result in limited discectomy technique in comparison with conventional technique regarding early mobilization, early return to work and low incidence of postoperative back pain. JOAS was been used to assess the outcome in our study, by which we assess the pain and functional disability preoperatively and postoperatively, for both of them the score were statistically significant, which showed reduction in pain and improvement in functional capacity postoperatively. JOAS were significantly improved to (70.92 %) with (p<0.001) following surgery throughout the follow-up period which were comparable to the findings of Asgarzadie et al.\(^{(27)}\) The functional outcome of our study as evaluated by MacNab’s criteria found that approximately all patients gave excellent (69.05%) to good (30.95%) which were equivalent to other studies, like Nahar et al\(^{(28)}\) demonstrated good to excellent results in 90.4% cases, fair results in 17.2%. While, Manohara et al\(^{(29)}\) observed good to excellent results among 90% cases. This difference in studies results may be due to different patient’s selection criteria. Regarding functional outcome for patients who underwent microdiscectomy there is good to excellent outcomes, 84% as found by Martinez et al\(^{(30)}\) and regarding those who underwent endoscopic microdiscectomy the outcome were also good to excellent, 80% as found by Casal-Moro et al\(^{(31)}\) and this showed that minimal invasive surgery has comparable result to our findings.
CONCLUSIONS

1. Open limited lumbar discectomy is safe, simple and effective procedure provide early post-operative mobilization, rehabilitation, less complications and early return to work.
2. This procedure can be performed by surgeon with adequate experience in the field of disc surgery and no need for expensive instruments.

ETHICAL CLEARANCE

The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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REFERENCES

14. Manohara Babu KV. Surgical management of Lumbar disc prolapse by Fenestration technique J.Orthopaedics., 2006;3(4) 6


