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Treatment of Lumbar Intervertebral Disc Prolapsed with Fragmentectomy, more than Ten Years Follow Up

Ziad Ali Audat*, Ali Ahmad Al-Omari, Mohammed M Barbarawi, Ahmad Mohammad Radaideh, Mahmoud H Hajyousef, Yazan Abdulamjeed Haddad, Khaldoon M Alawneh, Mohammad Ahmad Abojelban and Mohammad Z Audat

Department of orthopeadic, Level 8A, King Abdullah University Hospital, Jordan University of Science and Technology, Jordan

Abstract

Background: Open lumbar discectomy is the most commonly performed surgical procedure in the spine. Conventional microdiscectomy was developed to excise the herniated and non-herniated parts of the disc, but these results in early degeneration of the disc and spine instability. Fragmentectomy was developed to excise only the herniated disc part.

Objectives: To evaluate the results of fragmentectomy and more than ten years follow up of 71 patients operated at our university hospital.

Methods: Seventy one patients; 43 males and 28 females with age 17 and 63 (average 36.49) years; were operated for disc prolapsed at the lumbar area. All patients were operated by single surgeon and evaluated pre and post-surgery by many surgeons. Patients were followed up for more than 10 years (on discharge, 0.25, 0.5, 1, 2, 3, 5 and 10 years). Oswestry Disability Index and the Stanford Score were used to evaluate patient outcomes.

Results: Operating time ranged between 25 and 120 (average 71) minutes, blood loss 5-70 (average 35) cubic centimeters and hospital stay ranged 3-5 (4.21) days. Intraoperative a small dural tear was seen in 6 cases and postoperative hematoma in 4 cases in whom one had permanent paralysis below the know. Seven patients (0.099) needed fusion after 1-3 years. ODI decreased from around 80/100 before surgery to 20/100 after 10 years with P-Value <0.001. The Stanford score shows dramatic improvement from around 2/10 pre operation to around 9.2/10 after 10 years of follow up, P-value < 0.001 (P-value <0.001 is considered insignificant).

Conclusion: Fragmentectomy or sequesterectomy is effective with fewer complications while our study size is moderate; the utility of this study is in demonstrating the long-term results of this novel intervention.

Keywords: Lumbarspine; Intervertebral disc herination; Microdisectomy; Fragmentectomy; Sequesterectomy

Introduction

Open lumbar disc surgery is still the most frequent and important intervention of spine even with the development of many surgical techniques [1]. Intervertebral disc surgery by removing ligamentum flavum and part of the lamina to reach the herniated disc started in 1977 by Casper and Yasargil [2-4]. Conventional discectomy (microdiscectomy) was later developed by many surgeons who remove the whole disc (the herniated and intact parts) to prevent reherniation of the left part of the disc. There is no definite limitation on how much of the non-herniated disc material to remove. Conventional microdiscectomy accelerates degeneration of the disc and instability of the segment that can lead to back pain and sometimes radiculopathy; in other words, failed back surgery syndrome [2,5-7]. Comparison studies have showed the results are comparable to that of open surgery [8,9].

Previous literature has advised against doing conventional discectomy, and has supported doing just fragmentectomy or sequesterectomy. Sequesterectomy is the excision of a free segment of herniated disc outside the posterior longitudinal ligament, while fragmentectomy is the excision of a fragmented disc, which is still contained by posterior longitudinal ligament [2,8-16]. Minimally invasive techniques, such as endoscopy, were developed to minimize surgical dissection of paraspinal muscles, perineural trauma and avoid epidural fibrosis that result in less postsurgical complications and pain [16-18]. Multiple studies have compared results of conventional microdiscectomy and fragmentectomy and found that both are comparable in outcome without increased incidence of recurrence, as well as fewer complications (failed back surgery) [2,8,18,19].

In this study, we retrospectively review the clinical results of our patients on whom we operated for lumbar disc prolapsed with fragmentectomy and for which we completed follow-ups for more than ten years. None of our patients underwent endoscopic or other minimally invasive techniques. The aim of this study is evaluate our results and compare them with previous results.

Materials and Methods

Seventy-one patients (43 males and 28 females) were treated at our hospital for herniated intervertebral disc at one or two levels of the lower lumbar spine. Age of patients ranged between 17 and 63 (mean: 36.48 and SD: 10.057) years. All patients had lower back pain, sciatica and sensory disturbance (right side 32, left side 32 and bilateral seven patients), half of them had dorsiflexion muscle weakness of the foot and toes and 56 patients had neurogenic claudication. One had completed loss of sensation below the knee and paraplegia of the right lower limb. Duration of symptoms range between one week and 15 years (mean: 2.73 and SD: 3.5). Nine patients (12.7%) had an acute onset of symptoms while the other 62 (87.3%) had a more gradual progression

***Corresponding author:** Ziad Ali Audat, Department of orthopeadic, Level 8A. King Abdullah University Hospital, Jordan University of Science and Technology, Irbid-Amman Street, P.O.box 3030, Irbid, Jordan, Tel: 962 2 709 5777; E-mail: ziadaudat@yahoo.com

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of symptoms. Six patients (8.45%) had comorbidities including hypertension and diabetes mellitus and 8 (11.27%) were smokers.

Radiographic investigations included X-Rays (anteroposterior and lateral) and Magnetic Resonance Image (MRI) was used to evaluate the patients. Sixty-two (87.3%) patients had one level IVDP (L3/4=3, L4/5=36 and L5/S1=23) and nine patients (12.7%) had two levels IVDP (L3-5=3 and L4-S1=6). Most of the patients (67=94.3%) were conservatively treated with none steroidal anti-inflammatory and physiotherapy for 1-3 months and a one-time epidural corticosteroid injection. Four cases that developed sudden weakness of foot and toes underwent urgent surgery. Consent form was signed by all patients and Institutional Review Board (IRB) approval was obtained.

All patients underwent excision of the herniated part, fragmentectomy and sequesterectomy without going inside the intervertebral disc space. Our believe at that time not to do more than fragmentectomy because we didn't need to do too much dissection that result in less complications. None of them underwent minimally invasive discectomy. A fatty flap was applied over the dura after discectomy and a vacuum drain was inserted for 24 hours (not with dural injury). The next day we mobilized the patient and discharged those 3-5 days post-surgery. Patients who had a dural tear stayed in bed 2-3 days and were mobilized and discharged two days later.

Patients were evaluated pre surgery, on discharge and intervals of 0.25, 0.5, 1, 2, 3, 5 and >10 years post-surgery by a team of physions. The Oswestry Disability Index and the Stanford Score were used for clinical results evaluation.

ODI scoring

0% to 20% (minimal disability): Patients can cope with most activities of daily living. No treatment may be indicated except for suggestions on lifting, posture, physical fitness and diet. Patients with sedentary occupations (ex. secretaries) may experience more problems than others.

21%-40% (moderate disability): Patients may experience more pain and problems with sitting, lifting and standing. Travel and social life are more difficult. Patients may be off work. Personal care, sleeping and sexual activity may not be grossly affected. Conservative treatment may be sufficient.

41%-60% (severe disability): Pain is a primary problem for these patients, but they may also be experiencing significant problems in travel, personal care, social life, sexual activity and sleep. A detailed evaluation is appropriate.

61%-80% (crippled): Back pain has an impact on all aspects of daily living and work. Active treatment is required. 81%-100%: These patients may be bed bound or exaggerating their symptoms. Careful evaluation is recommended.

Patients with degenerative disc disease, previous lumbar spinal surgery, mild isthmic spondylolisthesis or facet joint cyst were excluded.

Results

All patients underwent fragmentectomy and irrigation of the disc space to remove free sequestrate without removing the non-herniated part of the disc. Operating time ranged between 25 and 120 minutes for each level (mean: 71.7 and SD: 33,4), blood loss 5-70 (mean 34.9 and SD: 18.46) cubic centimeters and hospital stay range 3-5 (mean: 4.21 and SD: 2.31) days except one patient with below knees paraplegia who stayed at the hospital for 60 days.

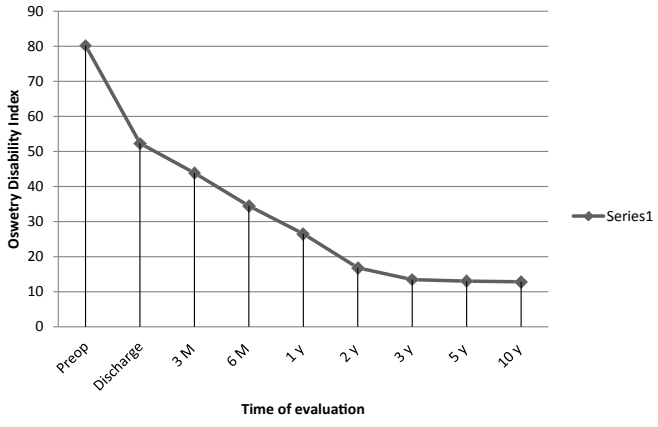
Intraoperative complications included a small dural tear in six patients with a small cerebrospinal fluid leak that caused no symptoms. Postoperative complications were seen in four patients. Three patients developed a hematoma at the site of surgery which resulted in severe sciatica, numbness and weakness of the big toe dorsiflexion that needed evacuation and improved completely within six months. One patient, who had completed below knee weakness of the right lower limb developed bilateral below knee weakness which didn't improve after revision at the last follow up.

Seven patients (0.099) had recurrence of symptoms and needed revision surgery: three patients (0.042) had two levels of IVDP and 4 (0.056) had one level of IVDP. One patient (0.014) had a recurrence one month after surgery due to residual sequestrum and was revised without instrumentation while six patients (0.085) had recurrence after 1-3 years post-surgery and were revised with instrumentation (Transforaminal Lumbar Interbody Fusion and Posterior Lumbar Interbody Fusion). Ten patients (14%) experienced 1-3 attacks of back pain after 3-7 years of surgery that responded to conservative treatment (painkillers and physiotherapy except one patient who was treated with epidural). During the last 3-4 years of follow-up, none of the patients complained of symptoms that were significant enough to require even a simple analgesia.

ODI and the SS for all patients, except patients who needed revision and one who developed bilateral complete below knee weakness, show dramatic improvement at all periods of follow up. ODI was around 0.8 before surgery and dropped at the first three months to 0.4, and 0.2 after two years with no further obvious decrease after that, P-value <0.001 (P-value <0.001 is considered insignificant). The SS was around 2/10 and improved to 8/10 after three months of surgery and 9.5/10 after two years without significant improvement after that (Figures 1 and 2). We didn't find significant difference of the indices between males and females, age groups (below 35 and above 35 years old) and level of IVDP (mainly L4/5 and L5/S1), (P-value<0.001) (Table 1).

Discussion

Williams in 1978 was the first who described a fragmentectomy operation; in which he removed only the herniated part of the disc to treat the lumbar IVDP. Williams described a success rate of 90% and a recurrence rate between 4-9% [20]. Several articles were published following that, which confirmed Williams's results [21-24]. By this technique, the surgeon avoids entering the disc space and avoids



Figures 1: ODI average for all patients, Shows best improvement at the first 3 months, and less till 2 years and no more after that.

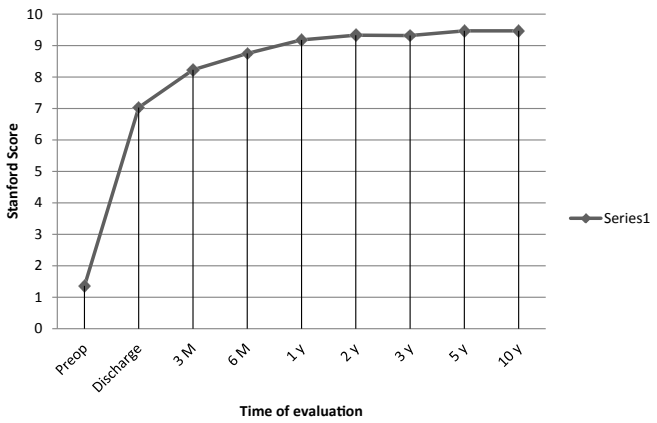


Figure 2: The Stanford score average for all patients, Shows best improvement at the first 3 months, and less till 2years and no more after that.

Time	ODI p-Value	SF p-Value
Males vs. Females	<0.001	<0.001
Age below 35 vs. age over 35	<0.001	<0.001
One level vs. more than one level	<0.001	0.003
Level L4/5 vs. level L5/S1	0.002	0.001

Table 1: Difference of the 22 indices between males and females, age groups (below 35 and above 35 years old) and level of IVDP 23 (mainly L4/5 and L5/S1), (P-value<0.001).

destruction of the intervertebral disc height and its complications. Kraemer et al. classified early complications of conventional microdiscectomy, in which the surgeon excised herniated and non-herniated part of the disc, to intraoperative and postoperative complications [1]. Intraoperative complications are related to position of patient (brachial plexus injury), wrong level, epidural venous injury, dural injury, nerve root injury and intra-abdominal vessels and visceral injuries and postoperative spondylodiscitis. Using the fragmentectomy technique, there are no intra-abdominal injuries and no postoperative spondylodiscitis.

Schroeder et al. reviewed articles of lumbar disc degeneration following discectomy. They found a significant increase of disc degeneration following standard discectomy that was significantly greater compared with both microdiscectomy (48.7% vs 9.1%) and asymptomatic controls (90% vs 68%) in two studies with mean follow-ups of 5.5 and 25.3 years, respectively [21,25] Matsumoto et al. found recurrence of symptoms in 37 out of 344 patients (10.8%) who underwent a microdiscectomy [23].

Fakouri B et al. reviewed the articles of comparison studies between microdiscectomy and sequesterectomy and found same VAS score improvement and the reherniation rate [24] Another comparative study between conventional microdiscectomy and sequesterectomy showed no difference in clinical results and recurrence rate. [18].

Our retrospectively study confirms the results of fragmentectomy surgery for lumbar IVDP that are seen by the above articles. The recurrence rate is 9.9% which is comparable to the previous studies. Intraoperative complications included small dural tears, which didn't require further intervention. We did not encounter any abdominal vessels or visceral injuries as seen in conventional microdiscectomy. Post-operative complications were small epidural hematomas that caused sciatica and paresthesia and needed drainage, but we didn't see any case of discitis or spondylodiscitis. None of the patients was investigated for degeneration of the disc as they were asymptomatic. Only seven needed revision surgery because of recurrence of symptoms, in which six patients underwent fusion and instrumentation.

Except transient pain exacerbation for 2-3 days in 10 patients, which responded to simple analgesia and physiotherapy, the ODI and the Stanford showed dramatic improvement of patients. At each follow-up interval (>10 years), the results are comparable with previous studies. We believed that the evaluation of patients by more than four specialists other than the primary surgeon, as well as a single surgeon performing the surgeries, may give the results more accuracy. The restriction of this study is the number of patients.

Conclusion

Excision of the herniated part of the lumbar intervertebral disc, fragmentectomy or sequesterectomy is effective with fewer complications. This operation decreases the risk of intra-abdominal vascular and visceral injuries, spondylodiscitis and acceleration of disc degeneration which are seen with conventional discectomy. While our study size is moderate, the utility of this study is in demonstrating the long-term results of this novel intervention. Further multi-centric trials with long follow-ups should be done to further validate fragmentectomy in the surgical management of lumbar disc herniation.

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