Clinical Article

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CLINICAL OUTCOME OF FUSION IN RECURRENT HERNIATED LUMBAR DISC

Clinical Outcome of Fusion in Recurrent Herniated Lumbar Disc

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Abstract

Background Data: Discectomy in recurrent lumbar disc herniation may not be an efficient treatment without fusion especially with prominent low back pain after primary surgery; therefore discectomy with fusion may be a good solution in recurrent lumbar disc herniation.

Purpose: The goal of this study was to focus on the efficacy of fusion in recurrent lumbar disc surgery.

Study design: This study was carried out at different hospitals and the data was collected prospectively and retrospectively.

Patients and methods: 50 patients (30 males and 20 females) underwent revision surgery following primary lumbar discectomy between 2009 and 2013. This study includes (50) patients with clinically and radiologically documented recurrent lumbar disc herniation scheduled for surgery. This includes (30) males and (20) females. All patients had a discectomy and postero-lateral fusion in re-operation. Patients' age ranged from 25 years to 45 years with mean age 30 years. All patients in this study were presented with low back pain and recurrent radicular pain with mean duration of 21 months.

Peri-operative assessments were carried using "Japanese Orthopedic Association score" (JOAs), and radiographic follow-up.

Results: Follow-up ranged from 12-36 months with a mean follow-up 22.9 months; 25 patients had an excellent outcome, 20 patients had a good outcome, 3 patients had a fair outcome, and 2 patients had a poor outcome.

Conclusion: Fusion surgery for recurrent lumbar disc herniation is effective and beneficial procedure. (2014ESJ062)

Keywords: recurrent disc herniation - postero-lateral fusion- recurrent discectomy

Introduction

The reoperation rate following the initial lumbar discectomy ranges between 4% and 18%.[7,8,9,11,20] The superiority of repeated disc excision alone or disc excision with fusion is controversial. Relief of sciatica after primary surgery is satisfactory, however, recurrent sciatica, may have different surgical outcomes. The problem of repeated lumbar disc surgery is challenging.[4,5,8,12,17,23] Since the report by Mixter and Barr in 1934,[14] numerous studies demonstrated the efficacy of repeat lumbar disc surgery. The outcome of repeat lumbar disc surgery varied owing to the mixed populations. Patients with spinal foraminal stenosis, perineural fibrosis or instability in primary surgery are particularly in need for fusion in repeat lumbar disc surgery.[1,2,3,6,10,16,21]

Various factors may contribute to the failure of repeat lumbar disc surgery however, discectomy alone without fusion remains the major source of disability.[4,5,12,17] The aim of this study was to draw attention to the beneficial role of fusion in repeat lumbar disc surgery.

Patients and methods

This study is partially prospective and retrospective study. It had been done at different hospitals in the period from 2009 to 2013. It included 50 patients (30 males and 20 females). The age ranged from 25 years to 45 years with a mean of 30 years. Inclusion criteria were: (1)- At least 6 months of pain relief after primary disc surgery. (2)- the presence of recurrent disc herniation and radicular pain unresponsive to conservative treatment (3)- disc herniation with a pathological state which needs facetectomy in re-operation such as foraminal disc herniation, segmental spinal canal stenosis, massive epidural and perineural fibrosis, adhesions and spondylolysis. Also severe loss of disc height was evident in imaging studies and during repeat surgery at the same level. In these pathological situations easier mobilization of the nerve root, adequate neurolysis of the nerve root and adequate exploration to the herniated disc, facetectomy and fusion is needed.

Exclusion criteria involved cases with disc herniation and other pathology rather than the same level as the primary discectomy such as multi segmental spinal canal stenosis, adjacent level disc herniation, spondylolisthesis with previous decompression and spinal deformities.

One of the cases was male patient 39 years old who had been operated upon for discectomy and posterolateral fusion (***Figure 1***).

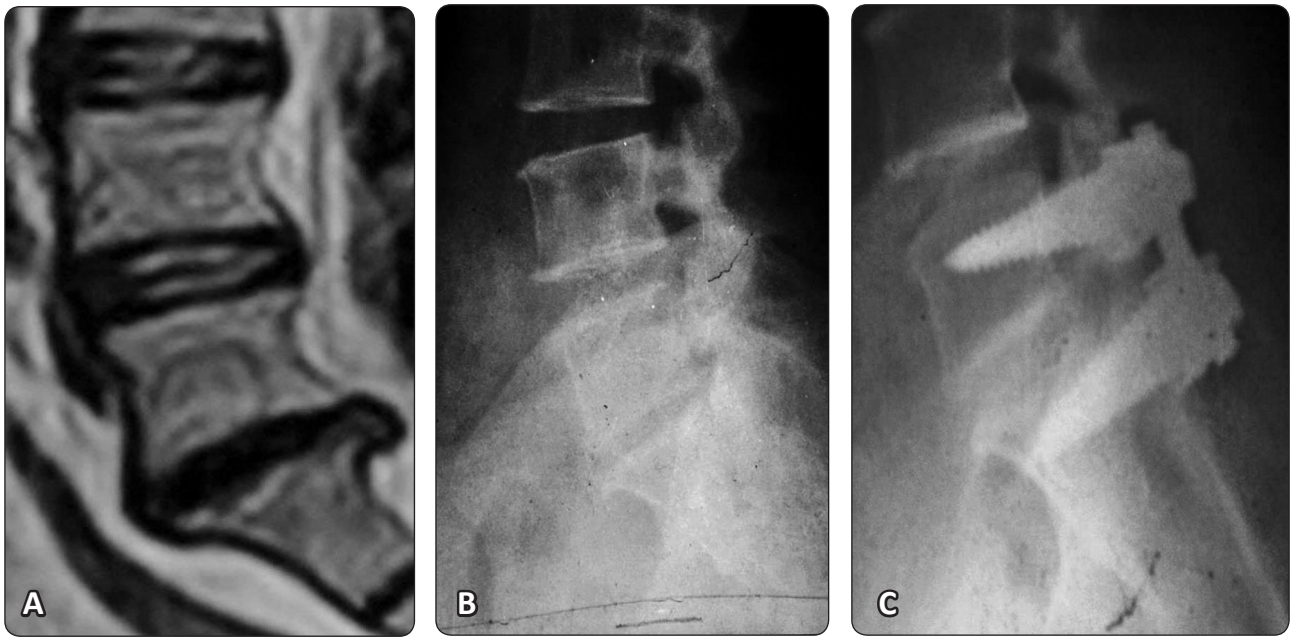

Figure 1. **(A):** T2W2 sagittal MRI of lumbosacral spine in male patient 39 years old showing recurrent disc herniation at L5-S1, **(B):** plain x-ray of lumbosacral spine (lateral view) after the first surgery, **(C)**: post-operative plain x-ray of lumbosacral spine after re-do discectomy and posterolateral fusion augmented with transpedicular screw fixation.

Preoperative Evaluation:

All patients had full general and neurological examination. Preoperative examination included plain X-rays of lumbosacral spine (A-P-Lateral- and dynamic films "flexion, extension and oblique"); Magnetic resonance imaging (MRI) with gadolinium enhancement had been done for all cases.

Surgical Technique and Approach:

Following general anesthesia, all patients were positioned prone on frame or rolls to avoid abdominal compression and hence reduce venous congestion. All the revision surgeries were performed from the original operative site of the recurrent disc herniation. Using a curette, the epidural scar tissue at the area was separated from the margin of the residual lamina. Access to the normal anatomic planes of the epidural space was achieved by removal of the residual lamina. The epidural scar tissue enclosing the dural tube is partially resected. Exposure was carried out laterally, so that the lateral edge of the nerve root was visualized. The nerve root was then mobilized gently and retracted medially to expose the disc fragments. If the nerve root adhered to the extruded disc fragments or to the ligamentous structures, adequate dissection was required for separation. Regarding the identification of the nerve root, a wide laminectomy of the residual lamina with excision of the facet joint is required until the pedicle is visible. This facilitates complete decompression of the neural structures. Postero-lateral fusion and trans-pedicular screw fixation were performed simultaneously since iatrogenic instability can occur following the removal of the facet joint during lumbar procedures. Closure was then done in a routine fashion after insertion of a subcutaneous suction drain.

The demographic characteristics of the patients are presented in table (2). All patients received prophylactic antibiotics perioperatively and were encouraged to ambulate the day after surgery. Patients were advised to wear a lumbosacral corset for 3 months following the posterolateral fusion. Clinical symptoms were evaluated pre- and post-operatively according the criteria of the (JOA) score. Results after surgery were assessed according to the rate of improvement[22] which =

$$\frac{\text{Postoperative score-Preoperative score}}{\text{15 (full score)-Preoperative score}} \times 100$$

These results were classified into a four-grade scale: excellent improvement >90%, good 75-89%, fair 50-74% and poor <49%. Differences in preoperative symptoms and post-operative outcomes were statistically analyzed. The statistical significance was set at a P-value. The differences in the JOA score of the whole patient group were assessed using a student's paired t test, before surgery and at final follow-up to assess the recovery rate.

All medical and surgical records were examined concerning intraoprative blood loss, operative time and hospital stay. All patients were followed up by plain X-ray of the lumbosacral spine (Antero-posterior- lateral-dynamic "flexion, extension, oblique).

Results

Clinical Outcome:

The mean follow-up was (22.9) months. The mean overall JOA score of the patients showed improvement, moving from (6.76 points) before surgery to (12.52 points) at the final follow-up. Low back pain, leg pain, ability to walk, straight leg raising, sensory abnormalities, and manual muscle testing evaluated by JOA score are shown in Table (3).

The mean JOA score of low back pain was (0.6) point before surgery and (2.3) points at follow-up with significant difference (P value <0.05). The final clinical outcomes were excellent in 20 patients (40%), good in 25 patients (50%) fair in 3 patients (6%), and poor in 2 patients (4%) table (4).

Plain X-rays were an informative tool in the follow-up with regards to assessment of alignment, curvature, fusion and stability. Magnetic resonance imaging (MRI) of lumbosacral spine was done for all complicated and symptomatic patients.

All patients reported (LBP) before surgery. Post operatively LBP was noted in 15 patients (30%) of 50 patients at follow-up. 2 patients(4%) showed worsening in comparison with their pre-operative state, 12 patients (24%) showed improvement despite some residual pain Table (5).

The segmental range of motion at the level of

surgery was 10.1° before surgery and (-0.1°) at the final follow-up. Pseudo-artherosis was found in 8 patients, and the bony union (fusion) rate was (81%). Average intra-operative blood loss was 200 ml, the average length of surgery was 180.6 minutes and the average length of post-operative hospital stay was 3.2 days.

Complications in this series are listed in table (6). No major complications were recorded. There were two cases with superficial infection and they had received parentral antibiotics with no need for surgical drainage and the wounds healed without significant sequelae. Three patients had dural tears which were repaired intra-operatively with no subsequent sequelae.

Table 1. Number of Disc levels Operated

Level	Number	Side	Percent %
L4-5	30	20Lt 10Rt	60 %
L5-S1	20	15 Lt 5Rt	40 %

Table 2. Age, Sex, and Duration of Recurrence

Age (Years)	Range	25-45
	Mean	30
Sex	Male	30
	Female	20
Recurrence time	Range	10 months-25 months
	Mean	16 months

Student's unpaired t-test

Table 3. Severity of Clinical Symptoms before and after Surgery

Pre-operative JOA Score	Score of Points	
	Range	Mean
Low back pain	0-2	0.6
Leg pain	0-1	1
Ability to walk	0-3	1.7
Straight leg raising	0-1	0.66
Sensory abnormalities	0-2	1.3
Motor weakness	0-2	1.5
Post-operative JOA score		
Low back pain	1-3	2.3
Leg pain	1-3	2.5
Ability to walk	0-3	2.62
Straight leg raising	0-2	1.8
Sensory abnormalities	0-2	1.54
Motor weakness	0-2	1.76

Table 4. Results Assessed by JOA Score

Score	No. of Patients
Excellent	18 (36%)
Good	27(54%)
Fair	3 (6%)
Poor	2 (4%)

Table 5. Post-operative Status

Post-operative Symptoms	No. of Patients
Low back pain (30%)	Occasional mild (22%) Continuous severe (8%)
Leg pain (30%)	Occasional mild (26%) Continuous severe (4%)
Post-operative Sign	
Straight leg raising	Normal (76%) 30°-70° (14%) <30° (1%)
Sensory abnormalities	Non (80%) Slight disturbance (16%) Marked disturbance (4%)
Motor weakness	Normal (90%) Slight weakness (6%) Marked weakness(4%)

Student's t-test

Table 6. Reported Complications

Complication	No. of patients
Deep infection	0
Superficial infection	2 (4%)
Vascular injury	0
Dural tear	3 (6%)
Neurological insult	0

Discussion

The optimal surgical approach (simple discectomy with or without fusion of the affected segment) for recurrent disc herniation remains a subject of controversy.[18, 19] Proponents of discectomy with fusion have proposed that fusion has several theoretical advantages. Specifically, lumbar fusion reduces or eliminates segmental motion, immobilizes the spine, reduces mechanical stresses across the degenerated disc space, and may reduce additional herniation at the affected disc space.[23]

The current study includes (50) patients with clinically and radiologically documented recurrent lumbar disc herniation scheduled for surgery. This includes 30 males and 20 females. All patients had a discectomy and postero-lateral fusion in re-operation. Mean age is 30 years with range from (25-45) years all patients in this study were presented with low back pain and recurrent radicular pain with mean duration 21 months.

Tsai-Sheng et al,[19] reported in their series that, 23 patients underwent a discectomy alone and 18 patients underwent a discectomy with postero-lateral fusion. This included 30 males and 11 females with a mean age of 41.1 years in the non-fusion group and 42.2 years in the fusion group and a mean duration of recurrence 57 months in the non-fusion group and 50 months in the fusion group. Takeshima et al,[22] reported in their study that 44 patients had a discectomy alone and 51 patients had a discectomy with postero-lateral fusion. This included 63 males and 32 females with a mean age 38 years in the non-fusion group and 40 years in the fusion group. All of the revision surgeries were performed at the original site of the recurrent disc herniation.

In this study the level of recurrent disc herniation were 30 patients at L4-5 including 20 on the right and 10 on the left and 20 patients at L5-S1 (12 on the right and 8 on the left side) Tsia-Sheng et al,[19] reported in their study that, the levels of recurrent disc herniation were 25 at L4-5 (12 on the right and 13 on the left) and (16) at L5-S1 (3 on the right and 13 on the left). Takeshima et al,[22] reported in their series that the levels of recurrent disc herniation were 4 patients at L3-4, 63 at L4-5 and 28 at L5-S1.

In this study, the clinical out-come assessed according to JOA score, was excellent in 18 patients (36%), good in 27 patients (54%), fair in 3 patients (6%) and poor in 2 patients (4%). Tsai-Sheng et al,[19] reported in their study that, general clinical outcome, based on the JOA score, was excellent in 20 (48.8%) patients, good in 13 (31.7%), fair in 4 (9.8%), and poor in 4 (9.8%). clinical outcome was satisfactory (excellent or good) in 78.3% of patients whom received discectomy in 83.3 % of those that underwent postero-lateral fusion. Takeshoma et al,[22] reported in their study that, clinical outcome, assessed according to JOA score, was excellent in (29.5%), good in (43.2%), fair in (20.5%) and poor in (6.8%) of the patients who had disc excision alone and was excellent in (47.1%), good in (35.3%), fair in (13.7%) and poor in (3.9%) of patients with postero-lateral fusion.

As regards LBP, in this study, it was found that all patients were with LBP preoperatively, post operatively LBP was found in (30%) of patients who showed improvement despite some pain. Takeshima T et al,[22] stated in their series that, all patients reported low back pain before surgery in both groups. In the non-fusion group, post-operative low back pain was noted in 27 (61%) of 44 patients at follow-up. Two patients had more low back pain in their post-operative sequlae, 21 patients got better but with some residual pain and 4 patients still had the same pain. In the fusion group, postoperative low back pain was noted in 18 of 51 patients (35%) at follow-up, many of them reported dullness in the low back. Sixteen patients showed improvement with some pain, and 2 patients were unchanged. Tsai-Sheng et al,[19] reported in their study that, in the non-fusion group, post-operative low back pain was noted in 16 (69.5%) of 23 patients at follow-up. One patient showed deterioration compared with the preoperative status, 12 patients displayed improvement despite some pain, and 10 patients were unchanged. In the fusion group, post-operative low back pain was noted in 13 (72.2%) of 18 patients at follow-up. Two patients showed deterioration from the preoperative status. 11 patients showed improvement despite some pain, and the condition of 5 patients was unchanged.

As regards the complications in this study, it was found that (3) patients had dural tear and (2) patients had superficial infection. Tsai-Sheng et al, [19] stated in their series that, there were five patients (3 in the non-fusion group and 2 in the fusion group) had a dural tear and one patient in the fusion

group had a superficial infection. Takeshima et al,[22] reported in their study that, there were 2 patients with thrombophlebitis in the non-fusion group and 3 patients (in the fusion group) had complications, one patient with superficial infection, one patient with deep venous thrombosis, and one patient with thrombophlebitis. Waddell et al,[24] noted that the outcomes of repeat operation were better in cases with a definite recurrent disc herniation. This view point is confirmed by the present data, which reveal satisfactory (good to excellent) results in (76.6%) of patients. This investigation only included those patients with a verified recurrent disc herniation during surgery, which may explain the satisfactory clinical outcomes of patients in this study.

Tsai-Sheng et al,[19] stated that, the optimal surgical approach (simple discectomy with or without fusion of the affected segment) for recurrent disc herniation remains a subject of controversy, but in this study it was found that the simple discectomy with fusion has several advantages in the clinical outcomes, specifically, lumbar fusion which reduces segmental motion, immobilizes the spine, reduces mechanical stresses across the degenerated disc space, and may reduce additional herniation at the affected disc space.

Lehmann and La Rocca[13] treated 36 patients with chronic low back pain and leg pain following previous lumber surgery by spinal canal exploration and spinal fusion. With satisfactory clinical outcomes and their results are confirmed by the present data in the current study. On the other hand, in the studies of Cinotti et al,[2] Jansson and Stromqvist[10] and Suk et al,[21] the clinical outcomes was good with repeated decompression alone as they reported in their series. Tsai-Sheng[19] reported in their series, that they found (in recurrent lumbar disc surgery) that scar tissue quantity was not related to surgical outcomes and suggested that following removal of the true disc fragment, the epidural scar does not cause significant radicular pain.

In the current study, intra-operatively, the coexistence of disc fragments and perineural fibrosis was found in all cases. Exploration of the herniated disc fragment and its removal was the main aim in the operation. This good exploration may need facetectomy especially with other pathological states such as (foraminal disc herniation, segmental spinal canal stenosis, massive epidural and perineuralfiberosis and adhesions, missing instability (lysis) in primary surgery and great loss of disc height) which was required to prevent neurological injury and excessive nerve root manipulation and also to ensure adequate exploration and excision of disc fragment. In the present study, so facetectomy was performed in all cases with simultaneous postero-lateral fusion.

Conclusion

The decision of fusion in re-operation after lumbar disc surgery was and remains a critical decision. This is usually due to the question of "how much benefit the patient will obtain from fusion in repeated surgery?. Hence, although the optimal technique for re-operation after lumbar disc surgery is not standard between surgeons, fusion in repeated lumbar surgery is a worthy choice according to this study.

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الملخص العربي

النتائج الإكلينيكية لجراحة تثبيت وإحداث إنصهار الفقرات في حالات الإنزلاق الغضروفي المرتجع

مقدمة: معدل ضرورية تكرار العملية الجراحية بعد إستئصال الإنزلاق الغضروفي القطني في المرة الأولى يتراوح بين ٤٪ و ١٨٪. وقد أثبتت العديد من الدراسات فاعلية تكرار جراحة إستئصال الغضروف القطني المرتجع في تحسين شكوى المريض في معظم. والسؤال هو حول أفضلية تكرار إستئصال الغضروف المرتجع فقط أو فعل ذلك مع تثبيت الفقرات عن طريق شرائح ومسامير لإحداث الإنصهار فيما بينها حيث أن هذا الموضوع مثير للجدل ومختلف عليه بين العديد من الدراسات السابقة. وبصفة عامة فإن المرضى الذين يعانون من تضيق العمود الفقري الثقبي، والتليف حول الأعصاب أو عدم ثبات الفقرات بعد الجراحة الأولى يحتاجون بصفة خاصة إلى تثبيت للفقرات عند تكرار الجراحة.

الهدف: الغرض من هذه الدراسة هو إلقاء الضوء على أهمية وفعالية تثبيت الفقرات لإحداث الإنصهار فيما بينها عند تكرار جراحة الإنزلاق الغضروفي القطني كنهج فعال ومفيد.

الطرق: أجريت الدراسة في مستشفيات مختلفة وجمعت البيانات بأثر رجعي. حيث خضع ٥٠ مريضا (٣٠ ذكور و٢٠ إناث) لجراحة ثانية بعد جراحة إستئصال الإنزلاق الغضروفي القطني الأولية وذلك ما بين أعوام ٢٠٠٩-٢٠١٣. تراوحت أعمارالمرضى من ٢٥ سنة إلى ٤٥ سنة وكان متوسط العمر ٣٠ عاما. وقد وضعت التقييمات المرتبطة بالجراحة باستخدام «نظام تقييم جمعية جراحة العظام اليابانية «، بالإضافة إلى آشعات المتابعة الدورية. أما فترة المتابعة فقد تراوحت ما بين ١٢-٣٦ شهرا بمتوسط متابعة ٢٢,٩ شهرا.

النتائج: بحسب أساليب التقييم المتبعة فقد كانت كانت النتيجة ممتازة في ٢٥ مريض وجيدة في ٢٠ ومقبولة في ٣ وضعيفة المستوى في ٢ من المرضى. وقد توصلت الدراسة إلى أن إستئصال الإنزلاق الغضروفي القطني المرتجع قد يكون أكثر فعالية عند إحداث الإنصهار.

الإستنتاج: وعلى الرغم من أن الأسلوب الأمثل لجراحة الإنزلاق الغضروفي القطني المرتجع ليس موحد بين الجراحين، فإن إحداث الإنصهار هو الاختيار الأمثل وفقا لهذه الدراسة وذلك يرجع إلى «كم الفائدة» التي سوف يحصل عليها المريض.