

# MICRODISCECTOMY AND STANDARD DISCECTOMY FOR LUMBAR DISC HERNIATION: A COMPARATIVE STUDY

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## Abstract

*Objective:* To compare surgical outcome between lumbar microdiscectomy and standard lumbar discectomy to evaluate the benefits of usage of the microscope in lumbar discectomy.

*Methodology:* This randomized clinical trial was conducted on 40 patients with unilateral single level prolapsed lumbar intervertebral disc (PLID) with radiculopathy who had been operated during the period of May 2009 to March 2011 in the department of Neurosurgery, BSMMU, Dhaka. Operative outcome was studied in two groups of 20 patients each, having lumbar microdiscectomy and standard lumbar discectomy with a follow-up period of 3 months.

*Result:* The study found statistically significant differences ( $P < 0.05$ ) between the surgical outcome of the microdiscectomy and standard discectomy in the skin incision length, postoperative hospital stay, postoperative VAS for lumbar pain, postoperative JOA score and time of return to normal work. In this study, according to Macnab's classification, excellent or good outcomes were obtained in 95% for microdiscectomy and 85% for standard discectomy.

*Conclusions:* Microdiscectomy procedure technique offers the benefits of a smaller skin incision, limited tissue trauma, shorter postoperative hospital stay and earlier return to normal work than standard discectomy.

*Key Words:* Microdiscectomy, Standard discectomy, surgical outcome.

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## Introduction:

60-80% of the world's population experience low back pain at some time in their lives. In western countries, low back pain is the most common cause of sickness related absence from work. In the U.K. 7% of the adult population consult their GP each year with low back pain at a cost of 650 million dollars and 80 million days lost.<sup>(1)</sup> In 85% of cases, no specific diagnosis can be made. Only 1-3% has lumbar disc herniation<sup>2</sup> and only about 10% of these patients require discectomy.<sup>(2)</sup>

The lumbar discectomy technique described by Mixter and Barr involved an extensive removal of the lamina and offending ruptured disc through an intradural

approach in 1934. In 1939 Love described the extradural approach to disc herniation.<sup>(3)</sup> Standard lumbar discectomy (Macrodiscectomy) is widely known as a common surgical procedure for lumbar disc herniation. Yasargil (1977), Caspar (1977) and Williams (1978) developed and pioneered the microsurgical technique for the treatment of herniated lumbar disc. Microdiscectomy technique provides the surgeon with excellent illumination and magnification of the operative field, which in turn enable the use of a smaller incision and facilitate a less traumatic procedure. Potential advantages of this procedure compared to standard discectomy are obvious: decreased blood loss, less postoperative pain, a shorter hospital stay, and fewer missed work days. These results have been supported by several studies.<sup>(3-11)</sup> Other authors have reported, no difference in long term results, however, a short term advantage to microdiscectomy was found.<sup>(4, 12, 13)</sup>

There has not been yet a study conducted to compare lumbar microdiscectomy and standard lumbar discectomy in our perspective. The aim of this study is to compare the outcome following lumbar microdiscectomy and standard lumbar discectomy for prolapsed lumbar intervertebral disc.

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### Methods and Materials:

This randomized clinical trial was carried out in the department of Neurosurgery of BSMMU during the period of May, 2009 to March, 2011. 40 patients with unilateral single level prolapsed lumbar intervertebral disc with radiculopathy, who had been operated during the study period, meeting the inclusion and exclusion criteria, were enrolled for the study. Two groups, comprising of 20 randomly selected patients in each group, underwent lumbar microdiscectomy and standard lumbar discectomy respectively. Surgical approach and 3 months' follow-up data were recorded and analyzed.

Preoperative evaluation for low back pain and leg pain was assessed using VAS (Visual analogue scale)(14) and JOA score (Japanese Orthopaedic Association score).(15, 16) For the microdiscectomy procedures, per operative X-ray were used to confirm the level whereas the level was identified anatomically in cases of standard discectomy. For both the procedures data of length of skin incision, amount of blood loss, duration of operation, operative complications like dural tear or nerve root injury, postoperative complications like superficial wound infection or discitis and postoperative hospital stay were noted. Outcome of both procedures were assessed through postoperative follow-up examination at time of discharge, at 1 month, and at 3 months with VAS, JOA score, outcome according to Macnab's classification(17) and time of return to normal work.

### Results:

In this study, 40 patients were enrolled and operated. The results of 20 patients having lumbar microdiscectomy were compared with the group of 20 patients who underwent a conventional open lumbar standard discectomy. In the microdiscectomy group there were 16 men (80%) and 4 women (20%) with a mean age of 37.05 years (range 19 – 60 years). The conventional standard discectomy group had 15 (75%) men and 5 (25%) women with a mean age of 39.1 years (22- 60 years). In both the groups there was male predominance with higher incidence in 4<sup>th</sup> and 5<sup>th</sup> decades.

All of our 40 patients except one were operated at either at L5-S1 or L4-L5 level. There was high incidence at operative level L5-S1 in Microdiscectomy but at L4-L5 in Standard discectomy. Mean operative time was found to be 88.25±32.12 minutes (range 40-140 minutes) in microdiscectomy and 74.85±27.33

minutes (range 30-120 minutes) in standard discectomy. (Table – I) The difference was not statistically significant ( $P > 0.05$ ).

The mean length of skin incision was 3.4±2.607 cm (range 2.3-5 cm) in microdiscectomy and 5.4±1.91 cm (range 3.5-12 cm) in standard discectomy. The mean amount of blood loss was 43.3 ml ± 50.85 (2 - 220 ml) in microdiscectomy and 101.25 ml ± 66.72 (20 - 300ml) in standard discectomy. The mean duration of postoperative hospital stay was 5.05±2.30 days (range 2-9 days) and 8.25±3.58 days (range 3-17 days) in microdiscectomy and in standard discectomy respectively. Patients with microdiscectomy returned to their normal work within 34±16.35 days (range 15-60 days) after the operation and patients with standard discectomy returned to their normal work within 71.25±22.76 days (range 30-90 days) after the operation. But one patient (5%) in microdiscectomy and 3 patients (15%) in standard discectomy modified their original normal work. All the differences between the two groups regarding length of skin incision, amount of blood loss, post operative hospital stay and return to normal work were statistically significant ( $P < 0.05$ ). (Table – I)

There was no significant intraoperative complication (Dural tear or nerve root injury) in any of the groups. There was no postoperative complication (Superficial wound infection or discitis) in microdiscectomy group but one (5%) patient had discitis in Standard discectomy group.

VAS for lumbar pain (Table – II) improved from preoperative 8.15±2.68 to 0.07±1.12 at 3 months post operative follow up in microdiscectomy group and from preoperative 8.45±2.13 to 1.9±2.02 at 3 months postoperative follow up in standard discectomy group. The differences were statistically significant ( $P < 0.05$ ).

VAS for sciatica (Table – II) improved from preoperative 9.3±1.30 and 8.65±1.69 to 0.3±1.12 and 0.95±1.19 at 3 months postoperative follow up in microdiscectomy and standard discectomy respectively. The difference was not statistically significant ( $P > 0.05$ ).

JOA score (Table – II) improved from 5.30±3.79 before surgery to 26.45±2.79 at the 3 months follow up in microdiscectomy group and from 5.80±4.007 to 23.70±4.14 in standard discectomy group. The differences were statistically significant ( $P < 0.05$ ). JOA score improvement rate was 54.88%±15.06 at discharge, 82.07%±10.17 at 1 month, 89.53%±10.95

at 3 months in microdiscectomy group and  $42.49\% \pm 12.53$  at discharge,  $62.93\% \pm 20.12$  at 1 month,  $76.50\% \pm 20.00$  at 3 months in standard discectomy group. The differences were statistically significant ( $P < 0.05$ ).

According to Macnab's classification overall outcome was excellent in 12 (60%), good in 7 (35%) and fair in

one (5%) patient in microdiscectomy group and excellent in 6 (30%), good in 11 (55%) and fair in 3 (15%) patients in standard discectomy group. Excellent or good results were seen in almost equal numbers (95% and 85%) after both surgical techniques, microdiscectomy having little better outcome. (Table – III) The difference was not statistically significant ( $P > 0.05$ ).

**Table-I**

*Showing mean values of operative duration, incision length, blood loss, postoperative hospital stay, time of return to normal work in microdiscectomy and standard discectomy*

	Microdiscectomy	Standard discectomy	P value
Operative duration	$88.25 \pm 32.12$ minutes (40 -140)	$74.85 \pm 27.33$ minutes (30 -120)	0.164
Incision length	$3.4 \pm 0.60$ cm (2.3-5 cm)	$5.4 \pm 1.91$ cm (3.5 – 12 cm)	0.000
Blood loss	$43.3$ ml $\pm 50.85$ (2-220 ml)	$101.25$ ml $\pm 66.72$ (20-300ml)	0.007
Postoperative Hospital stay	$5.05 \pm 2.30$ days (2-9 days)	$8.25 \pm 3.58$ days (3-17 days)	0.002
Time of return to Normal work	$34 \pm 16.35$ days (15-60 days)	$71.25 \pm 22.76$ days (30-90 days)	0.000

**Table -II**

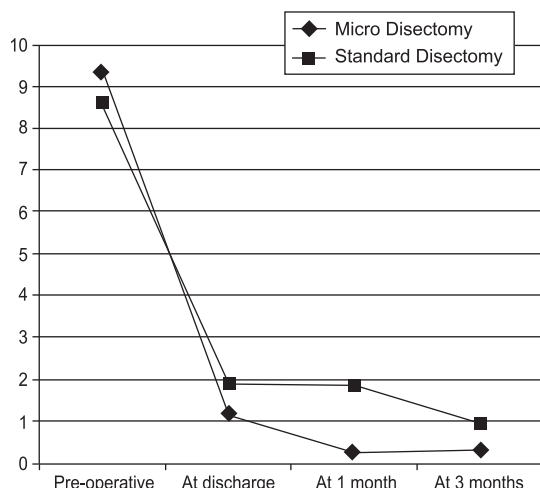
*Showing comparison of the mean values of VAS for lumbar pain, VAS for sciatica, JOA score at 3 months follow-up between Microdiscectomy and Standard discectomy*

	Microdiscectomy	Standard discectomy	P value
VAS for lumbar pain	$0.07 \pm 1.12$	$1.9 \pm 2.02$	0.026
VAS for sciatica	$0.3 \pm 1.12$	$0.95 \pm 1.19$	0.084
JOA score	$26.25 \pm 2.79$	$76.50\% \pm 20.00$	0.015

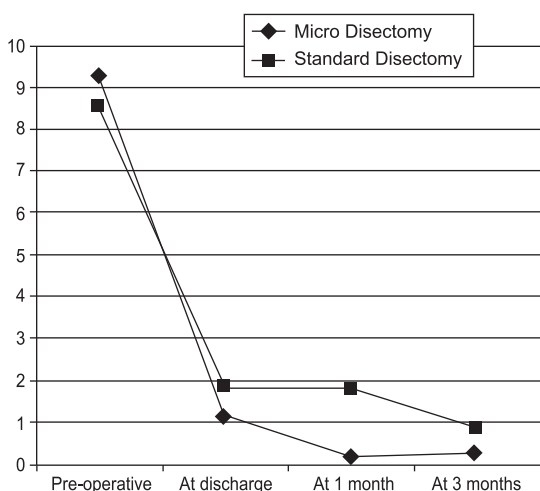
**Table-III**

*Showing outcome according to Macnab's classification in Microdiscectomy and Standard discectomy*

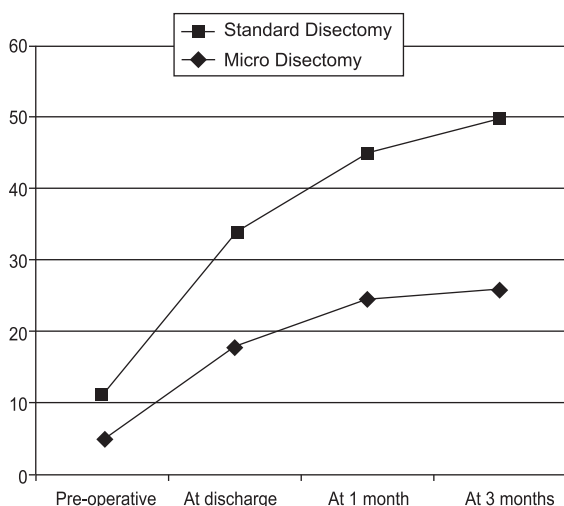
Outcome	Microdiscectomy	Standard discectomy
Excellent	12 (60%)	06 (30%)
Good	07 (35%)	11 (55%)
Fair	01 (5%)	03 (15%)
Poor	None	None



**Fig.-1:** VAS for lumbar pain between Microdiscectomy and Standard discectomy



**Fig.-2:** VAS for sciatica between Microdiscectomy and Standard discectomy



**Fig.-3:** JOA score between Microdiscectomy and Standard discectomy

## Discussion:

Standard discectomy, first reported by Love in 1939, is a very well known surgical procedure for lumbar disc herniation, which has success rates ranging from 70% to 95%. Microdiscectomy procedure has been performed by surgeons since its introduction by Yasargil and Caspar in 1977. Although the evaluation methods and follow-up periods in the subsequent studies differed, excellent or good outcomes were obtained in 85% to 92% of patients.<sup>4</sup>

Compared with the standard discectomy, microdiscectomy has the advantage of being less invasive because the skin incision is small and dissection is performed with clear visualization of structures under microscope. Some authors have claimed greater long and short term success with microsurgery while others have reported no difference in long term results, but advantages in the short term outcome (shorter postoperative hospital stay and quicker return to normal work) with microdiscectomy.<sup>4</sup>

This was prospective study of the surgical outcome of the microdiscectomy and standard discectomy. We focused on comparison of the skin incision size, operative duration, postoperative hospital stay, condition of postoperative scar, intraoperative and postoperative complications, time of return to normal work and surgical outcome and compared our results with those in the literature.

In this study, the mean operative time for microdiscectomy was  $88.25 \pm 32.12$  minutes while it was  $74 \pm 85$  minutes for standard discectomy. The difference was not statistically significant ( $P > 0.05$ ). Working under the microscope somewhat extended operating time. Surgeons need time to become accustomed to and refined in any operative procedure. The learning curve for microdiscectomy technique is usually longer and more flat than that of traditional standard discectomy as it demands more expertise for working with limited field of view at the operation field. This requires specialized surgical instruments and equipments, which are not readily available always, especially in a developing country like ours and needs skilled maneuvering technique of the instruments, which is not easy also. In the study of Katayama et al.<sup>10</sup>, mean operative time was  $45 \pm 8$  minutes for microdiscectomy and  $40 \pm 12$  minutes for standard discectomy and in the study of Mostafa,<sup>18</sup> mean operative time was  $110 \pm 12$  minutes for microdiscectomy and  $100 \pm 10$  minutes for standard

discectomy. Tureyen<sup>4</sup> found mean operative time  $54 \pm 5.65$  minutes for microdiscectomy and  $25 \pm 7.07$  minutes for standard discectomy while in the study of Barrios et al.<sup>19</sup>, mean operative time was 91 minutes for microdiscectomy and 84 minutes for standard discectomy.

We found the mean amount of blood loss to be  $43.3 \pm 50.85$  ml (2 - 220 ml) and  $101.25 \pm 66.72$  (20 - 300 ml) in microdiscectomy and standard discectomy respectively. The difference was statistically significant ( $P < 0.05$ ). In the study of Barrios(19), it was 89 ml in microdiscectomy and 207 ml in standard discectomy. In the study of Mostafa,<sup>18</sup> the mean amount of blood loss was  $50 \pm 52$  ml and  $307.5 \pm 112$  ml in microdiscectomy and standard discectomy respectively. There was more blood loss in standard discectomy than in microdiscectomy in all the studies as was in our study also.

The mean length of skin incision was  $3.4 \pm 2.607$  cm in microdiscectomy and  $5.4 \pm 1.91$  cm in standard discectomy in our study. The difference was statistically significant ( $P < 0.05$ ). In the study of Tureyen<sup>4</sup>, mean length of skin incision was 4 cm and 6 cm in microdiscectomy and standard discectomy respectively. The incision was longer in the standard discectomy than the microdiscectomy procedure as it needs more exposure for better illumination.

In this study, mean duration of postoperative hospital stay was  $5.05 \pm 2.30$  days and  $8.25 \pm 3.58$  days in microdiscectomy and standard discectomy respectively and the difference was statistically significant ( $P < 0.05$ ). In the study of Tureyen<sup>4</sup>, mean duration of postoperative hospital stay was 3 days in microdiscectomy and 6 days in standard discectomy. Prochet et al.<sup>20</sup>, found postoperative hospital stay to be 2 days in microdiscectomy and 4 days in standard discectomy. In the study of Mostafa<sup>18</sup>, mean duration of postoperative hospital stay was  $8.3 \pm 8$  days and  $8.5 \pm 2.3$  days in microdiscectomy and standard discectomy respectively. The shorter postoperative hospital stay associated with microdiscectomy presumably reflects smaller skin incision, less bone extirpation, less muscle disturbance and nerve root manipulation.

There was no intraoperative complication like dural tear, nerve root injury in microdiscectomy and standard discectomy in our study. Greenberg<sup>21</sup> reported dural tear in 0.3% to 13% of cases in discectomy. In the

study conducted by Mostafa(18), dural tear was 3% in microdiscectomy. Dural tears have been reported as the major intraoperative complication during microdiscectomy.<sup>19</sup>

The infections associated with microdiscectomy are most likely related to positioning of the microscope directly over the wound, although the microscope is draped sterile, parts of it have the potential to contaminate the wound. The limited operating space between the microscope and the wound introduces another potential break in proper surgical technique that can result in wound contamination. This complication should occur in less than 0.5% of lumbar microdiscectomy procedures. This infection rate is minimized by ensuring that surgery is performed in a nutritionally sound patient and by using judicious techniques and intraoperative prophylactic antibiotics, as well as by not touching unsterile parts (eye pieces) of the microscope, which in turn leads to contamination of the field.<sup>4</sup> Regarding postoperative complication, in our series, there was only one case (5%) of discitis in standard discectomy which responded to medical treatment and was cured. There was no discitis following microdiscectomy. There was also no superficial wound infection in any of the patients of the either group. Greenberg<sup>22</sup> reported, incidence of superficial wound infection and discitis to be 0.9% to 5% and 0.2 to 4% respectively in lumbar discectomy. In the study of Mostafa(18), they had an incidence of superficial wound infection of 6% in microdiscectomy. Koebe<sup>3</sup> reported that discitis occurred in 2.3% of cases in lumbar discectomy and incidence of discitis was less than 1.5% in microdiscectomy.

We had no miscounting of the targeted level in microdiscectomy owing to radiographic confirmation of the level by c-arm imaging or X-ray in our series. We had no recurrent cases in our study which may be due to the short period of our follow-up and small numbers of the patients included compared to the other studies. As recovery following lumbar disc surgery occurred to a great extent during the first 2 months, the early post-operative outcome appears to be quite a reliable indicator of the postoperative outcome in 1 year follow-up.<sup>16</sup> The incidence of repeated surgery for recurrence ranges from 1.7% to 8%.(3) Greenberg<sup>23</sup> and Schmid(8) both reported their recurrence rate to be 4%. Recurrence rate was 2.4% in cases of microdiscectomy in Ramani's series.<sup>24</sup>



Outcome of both procedures were assessed through postoperative follow-up examination at the time of discharge, at 1 month and at 3 months. Measurement instruments for outcome were VAS for lumbar pain and sciatica, JOA score, Macnab's classification and time of return to normal work.

In this study, VAS for lumbar pain improved from pre operative  $8.15 \pm 2.68$  to  $0.7 \pm 1.12$  at 3 months follow up in microdiscectomy and from pre operative  $8.45 \pm 2.13$  to  $1.9 \pm 2.02$  at 3 months follow up in standard discectomy. The difference was not statistically significant ( $P > 0.05$ ) at discharge but the differences were statistically significant ( $P < 0.05$ ) at 1 month and at 3 months. VAS for sciatica improved from pre operative  $9.3 \pm 1.30$  to  $0.3 \pm 1.12$  at 3 months follow up in microdiscectomy and from pre operative  $8.65 \pm 1.69$  to  $0.95 \pm 1.19$  at 3 months follow up in standard discectomy. The differences were not statistically significant ( $P > 0.05$ ) at discharge and at 3 months but the difference was statistically significant ( $P < 0.05$ ) at 1 month. These results show less back pain and leg pain in microdiscectomy at 1 month and 3 months follow-up, which helped in early ambulation and early return to their normal daily activities after microdiscectomy than after standard discectomy. In the study conducted by Katayama et al(10), VAS for sciatica improved from  $7.9 \pm 0.6$  to  $1.2 \pm 0.4$  in microdiscectomy and from  $8.1 \pm 0.9$  to  $1.3 \pm 0.5$  in standard discectomy. Tureyen(4) found that, VAS for sciatica improved from 8 to 2.1 in microdiscectomy and from 7.5 to 1.8 in standard discectomy. Mostafa(18) showed that, VAS for lumbar pain improved from  $7.6 \pm 0.9$  to  $1.2 \pm 0.4$  in microdiscectomy and from  $8.5 \pm 0.7$  to  $1.6 \pm 0.7$  in standard discectomy. VAS for sciatica improved from  $7.9 \pm 0.6$  to  $1.2 \pm 0.4$  in microdiscectomy and from  $8.1 \pm 0.9$  to  $1.3 \pm 0.5$  in standard discectomy in his series.

In this study, JOA score improved from  $5.3 \pm 3.79$  before surgery to  $26.45 \pm 2.79$  at the 3 months follow-up time in microdiscectomy and from  $5.8 \pm 4.007$  to  $23.70 \pm 4.14$  in standard discectomy. The differences were statistically significant ( $P < 0.05$ ). JOA score improvement rate at the end of 3 months follow-up was 89.53% in microdiscectomy and 76.50% in standard discectomy. The differences were statistically significant ( $P < 0.05$ ). The JOA score and JOA score improvement rate significantly improved in both groups after surgery. Early ambulation and early return to normal daily activities were better after

microdiscectomy than after standard discectomy as reflected by the JOA score improvement rate. In the study of Tureyen(4), JOA score improvement rate was 81% in microdiscectomy and 79% in standard discectomy. In the study of Mostafa<sup>18</sup>, JOA score improved from  $16 \pm 2$  before surgery to  $27 \pm 1$  at last follow-up time.

In this study, patients with microdiscectomy returned to their normal work within  $34 \pm 16.35$  days after operation and patients with standard discectomy returned to their normal work within  $71.25 \pm 22.76$  days after operation. The difference was statistically significant ( $P < 0.05$ ). One patient (5%) in microdiscectomy and 3 patients (15%) in standard discectomy modified their previous work. Microdiscectomy allowed the patients to return to normal work quicker than standard discectomy. In the study conducted by Tureyen<sup>4</sup>, 88.5% of patients returned to normal work within 4 weeks after operation in microdiscectomy and 54% of patients in standard discectomy.

In this study, according to Macnab's classification, excellent or good outcomes were obtained in 95% for microdiscectomy and 85% for standard discectomy. Although outcome of microdiscectomy according to Macnab's classification was better, there was no significant statistical difference ( $P > 0.05$ ) between the outcomes of microdiscectomy and standard discectomy. In the study of Tureyen<sup>4</sup>, excellent or good results were seen in 90% of cases after microdiscectomy and 89% after Standard discectomy. Outcome was excellent or good in 91% and 86% of patients following microdiscectomy, in series of Findlay<sup>6</sup> and Ramani<sup>24</sup> respectively. In the study conducted by Silvers<sup>17</sup> found excellent or good results in 95% after microdiscectomy and 89% after Standard discectomy.

Our results were more or less similar to the results found in the literature. There were no statistically significant difference ( $P > 0.05$ ) between the outcomes of the lumbar microdiscectomy and lumbar standard discectomy in the operation time, complications, postoperative VAS for sciatica, and in the outcome according to Macnab's classification. But there were statistically significant differences ( $P < 0.05$ ) between the surgical outcomes of the microdiscectomy and standard discectomy in the skin incision length, postoperative hospital stay, postoperative VAS for lumbar pain, postoperative JOA score, time of return to normal work.

Microdiscectomy procedure technique offers the benefits of a smaller skin incision, limited tissue trauma, shorter postoperative hospital stay and earlier return to normal work than standard discectomy. Its results are comparable to standard discectomy procedure. Like other new minimally invasive techniques microsurgical discectomy has a learning curve which is related to surgery time, complications, conversion to the open procedure and recurrent disc herniation.

### Conclusion:

For lumbar disc herniation, there were no statistically significant differences between the surgical outcome of the microdiscectomy and standard discectomy in the operation time, complications, postoperative VAS for sciatica, and in the outcome according to Macnab's classification. But there were statistically significant differences between the surgical outcome of the microdiscectomy and standard discectomy in the skin incision length, postoperative hospital stay, postoperative VAS for lumbar pain, postoperative JOA score, time of return to normal work. Lumbar microdiscectomy is a safe and effective procedure for lumbar intervertebral disc herniation. Its results are comparable to standard discectomy procedure. Microdiscectomy procedure technique offers the benefits of a smaller skin incision, limited tissue trauma, shorter postoperative hospital stay and earlier return to normal work than standard discectomy. The microsurgical approach for lumbar discectomy remains the gold standard against which all other procedures must be compared. A large scale study with a longer follow up is needed to come to a better inference on outcome of microlumbar discectomy.

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