

Comparative Outcomes of Lumbar Discectomy with Versus Without Coagulation: A Prospective Study

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Abstract

Background: Discs prolapse in the lumbar region is one of the prevalent causes of low back pain. If conservative management fails, patients may require surgical intervention. During lumbar discectomy, coagulation is necessary to control bleeding. However, prolonged exposure to high temperatures of the coagulation may lead to injury of the surrounding tissues, causing delayed healing.

Objectives: A study was conducted to assess the surgical and functional outcomes of lumbar discectomy with coagulation and without coagulation.

Methods: The current study was a prospective comparative study conducted in the neurosurgery department of Gajju Khan Medical College (GKMC), Swabi, Pakistan, from October 2022 to October 2025. One hundred and twenty participants suffering from primary lumbar disc prolapse were randomly distributed into two equal groups. The participants in Group A underwent discectomy with coagulation. Participants in Group B underwent discectomy without coagulation by using other means of hemostasis. The parameters that were analyzed included operation time, estimated blood loss, VAS, ODI, length of hospital stay, and post-operative complications.

Results: The operation time was significantly shorter in the discectomy without coagulation group ($p = 0.012$). The post-operative VAS and ODI scores were significantly better in Group B after a period of six months ($p = 0.004$ and $p = 0.001$, respectively). The estimated blood loss, length of hospital stays, and post-operative complications were similar for the two groups.

Conclusion: Discectomy of the lumbar spine without coagulation is a procedure linked with a better recovery and improvement in functional outcomes.

Keywords: Disc prolapses of the lumbar spine; Lumbar discectomy; Coagulation; Hemostasis; VAS; ODI

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INTRODUCTION:

Lumbar disc herniation (LDH), where a disc ruptures into the spinal canal, can cause back pain, radiculopathy and disability. Most lumbar disc herniations are responsive to conservative management. However, a subset of patients develops persistent pain, loss of nerve function, or significant disability. This subset often requires surgery. LDH is increasing globally due to aging and sedentary lifestyles. It often causes disability and consumes healthcare resources.¹ The effectiveness of surgical and non-surgical treatments for LDH is well documented. However, the available literature is often characterized by small study cohorts, heterogenous patient populations and disparate methods of outcome assessment.^{2,4} Minimally invasive techniques, such as endoscopic and microscopic discectomy, are associated with less damage to surrounding tissue, shorter hospital stays, and faster recovery. This is especially relevant for patients with comorbid conditions.^{5,7} Advancements in tools, techniques and optical systems used in surgery, and imaging have enhanced the visualization and safety of surgery.^{8,9} The use of bipolar coagulators is still common practice in many surgical interventions and intraoperative hemostatic measures in lumbar discectomy. Using coagulation may heat and injure nearby tissues, causing postoperative pain and prolonging recovery. There are other methods to stop bleeding during surgery, which raise the question of whether coagulation is needed at all during lumbar discectomy. To answer this question, the study compares outcomes of lumbar disc prolapse surgery with and without coagulation. To see if avoiding coagulation improves surgical and postoperative pain recovery, this study looks at blood loss, recovery function and operation time. This is done to see if avoiding coagulation improves surgical and postoperative pain recovery and if it is done without increasing risks. The objective was to compare the following between lumbar discectomy with and without coagulation for the age group of 20-70 years: operative time, intraoperative blood loss, postoperative pain (measured on a Visual Analogue Scale), and Functional outcome after 6 months (measured on Oswestry Disability Index).

METHODS

This is a prospective, comparative study conducted in the Department of Neurosurgery at Gajju Khan Medical College (GKMC), Swabi, Pakistan. Data was collected for a period of three years from October 2022 to October 2025. A consecutive sampling technique was employed for patient selection. The sample size for the study was set at 120 patients. This was based on the availability of eligible patients within the time frame of the study as well as the sample sizes used in previous similar studies. One hundred and twenty patients with lumbar disc prolapse, who were indicated for surgery, were selected for this study and randomly divided into two groups of equal size. Group A had lumbar discectomy performed with hemostatic coagulation. Group B had lumbar discectomy performed without coagulation; this was achieved using hemostatic pressure, irrigation with normal saline, and the use of absorbable hemostatic agents. Patients of either gender and between the ages of 20-70 years with a primary lumbar disc prolapse, which had not resolved with conservative management, were included in the study. Patients with recurrent lumbar disc prolapse, those with spinal deformities, spinal infections or spinal malignancy, as well as those who had previously undergone lumbar surgery were excluded from the study. All surgeries were performed under general anesthesia by experienced neurosurgeons using a standard microsurgical technique. Data were collected regarding the time taken to perform the surgery, the intraoperative blood loss, the intensity of post-operative pain (VAS), the functional status (Odyssey Disability Scale with 10 items), the length of stay in the hospital post-surgery, and the complications which occurred post-surgery. The patients were followed up at 1 week, 1 month, 3 months and 6 months after the surgery. All collected data were entered and analyzed using SPSS version 26.0. Quantitative variables were expressed as mean $\pm$ standard deviation, while qualitative variables were presented as frequency and percentage. Independent sample t-test and Chi-square test were applied for comparison between groups. A p-value of <0.05 was considered statistically significant. Ethical approval was obtained from the Institutional Review Board (IRB) of Gajju Khan Medical College (GKMC), Swabi, Pakistan. Written informed consent was

obtained from all participants prior to inclusion in the study.

RESULTS:

A total of 120 patients were included in the study. Baseline demographic characteristics, including age and gender distribution, were comparable between the two groups with no statistically significant differences, as shown in Table I.

Table I. Demographic Profile of Study Participants (n = 120)

Variable	Group A (With Coagulation) n = 60	Group B (Without Coagulation) n = 60	p-Value
Age Range (years)	20–70	20–70	—
Mean Age (years)	45.2 ± 10.4	44.5 ± 10.8	0.73
Gender			
Male n (%)	40 (66.7%)	40 (66.7%)	1.00
Female n (%)	20 (33.3%)	20 (33.3%)	1.00

Disc Levels Affected:

The most frequently involved spinal level was L4–L5 58.3%, followed by L5–S1 (41.7%). No significant difference in level distribution was found between the two groups (p = 0.68).

Table II. Distribution of Affected Lumbar Disc Levels

Affected Level	Group A (With Coagulation) n = 60	Group B (Without Coagulation) n = 60	Total n (%)	p-Value
L4–L5	36 (60.0%)	34 (56.7%)	70 (58.3%)	0.68
L5–S1	24 (40.0%)	26 (43.3%)	50 (41.7%)	0.68
Total	60 (100%)	60 (100%)	120 (100%)	

Intraoperative Findings

Mean operative time was significantly shorter in Group B (without coagulation), while mean blood loss was slightly higher though statistically insignificant. Incidence of dural tears was minimal and comparable between groups.

Table III. Intraoperative Parameters

Parameter	Group A (With Coagulation)	Group B (Without Coagulation)	p-Value
Operative Time (min)	84.2 ± 10.8	78.6 ± 9.7	0.012
Blood Loss (ml)	105.4 ± 30.2	112.8 ± 32.1	0.24
Dural Tear n (%)	2 (3.3%)	1 (1.7%)	0.56

- p < 0.05 considered statistically significant

Postoperative Outcomes

Both groups showed substantial postoperative improvement in pain and disability scores. Patients in the non-coagulation group experienced faster pain relief and better functional recovery at 3- and 6-month follow-ups. The rates of minor complications and hospital admissions were the same for all groups.

Table IV. Postoperative Pain, Functional Outcomes, and Complications

Outcome Measure	Group A (With Coagulation)	Group B (Without Coagulation)	p-Value
VAS Score (Pre-op)	8.4 ± 0.8	8.3 ± 0.9	0.65
VAS Score (6 Months)	2.3 ± 0.7	1.8 ± 0.6	0.004
ODI (pre-op)	64.2 ± 7.5	63.5 ± 6.9	0.52
ODI (6 Months)	22.8 ± 5.1	18.9 ± 4.3	0.001
Hospital Stay (days)	3.8 ± 1.0	3.4 ± 0.9	0.058
Wound Infection n (%)	3 (5.0%)	2 (3.3%)	0.65

DISCUSSION:

The current study explored the outcomes of lumbar discectomy with and without coagulation. It examined the efficacy and safety of the procedure (in terms of complications) and the recovery time. The results show that lumbar discectomy without coagulation had a shorter surgery time and a quicker recovery with less pain post operatively and had the same safety profile and complication rate. It may be prudent to not use routine bipolar coagulation to lumbar discectomy in the patients for whom the procedure is required.

The results suggest the hypothesis that if bipolar coagulation is reduced to lessen the injury to the surgical site, the recovery will improve and the risk will not be increased. The patients who did not receive bipolar coagulation had lower VAS and ODI scores at six months post operation, indicating improved recovery.

The results of this study are similar to multiple studies that suggest excessive use of bipolar coagulation may result in injury to the neural and muscular tissues around the surgical site and lead to pain and discomfort.^{10,11} Rabin et al. (2025) demonstrated similar results in the study with 2,180 patients and found the same results in that there were no complications, and the recovery of pain post operation and functionality greatly improved if coagulation was omitted post-surgery.¹⁰

In this study the time taken for surgery was significantly less in the group who received no coagulation. This has been reported by Hajilo et al (2023). They demonstrated that using electrocautery prolonged the duration of surgery and increased edema of the tissue.¹¹ Avoiding excessive thermal coagulation was also seen to improve visualization and significantly decrease the duration of the procedure.¹²

While blood loss was higher in the non-coagulation group, it was not statistically significant. Kang et al. (2020) published similar results, reporting that in endoscopic lumbar discectomy, total blood loss does not increase when hemostasis is achieved using irrigation and mechanical compression.¹³

Postoperative pain and functional recovery results revealed significantly lower VAS and ODI scores, respectively, in the non-coagulation group at 6 months. Zhu et al. (2025) and Guo et al. (2025) reported similar results in that the injuries caused by heat are minimized by using tissue preservation, decreasing postoperative edema/inflammation, and ultimately expediting the overall rehabilitation.^{14,15}

CONCLUSION:

This study of lumbar discectomy showed that discectomy without coagulation was as safe and had better post-operative results compared to discectomy with coagulation. Less time was spent in the operating room. The time to the relief of postoperative pain was shorter. Incorporation of postoperative functional recovery was rapid. The mean blood loss for each technique and postoperative

The results do not differ from what was obtained in minimally invasive surgery protocols augmented by the ERAS where the restoration of recovery is achieved as a result of preserved microvascular integrity.

Local and regional immediate evidence supports these findings. Minimal use of electrocautery in intervention resulted in minimal post-intervention pain and shorter hospital stay in studies conducted at tertiary sites in Lahore and Karachi, Pakistan, and from other studies conducted in the spine surgery literature in Pakistan. Based on these findings, the external validity of our study is strengthened as it targets resource optimization and a decrease in hospital burden in our healthcare system.

The present study observed that complication rates were low and largely equivalent for both groups, providing evidence that the omission of coagulation does not present a safety risk for surgery. In a more recent review, Le Huec et al. (2022) indicated that modern mechanical hemostatic methods and absorbable agents can substitute routine coagulation in spinal surgeries and reduce the risk of thermal injury and dural irritation.¹⁸ In agreement, Li et al. (2024) reported that excessive radiofrequency thermocoagulation should be avoided as it can delay the recovery of neural function.¹⁹

Old studies favoring routine coagulation were largely focused on open surgical methods that made visualization and control of surgical bleeding more complicated. However, with the recent microsurgical and endoscopic innovations, more precise dissection and less surgical bleeding are observed, allowing less reliance on thermal coagulation.²⁰

The authors recommend that more multicentric controlled surgical trials take place to circumvent the limitations of this study, which include a single-center design, short follow-up, and a lack of randomization, which likely resulted in selection bias and reduced generalizability.

complications was statistically similar for each technique.

There are significant disadvantages to the injudicious use of coagulation in lumbar disc removal operations. Coagulation may delay the healing process of the tissue. Coagulation injury to tissue is irreversible. In modern spine and other microsurgical/endoscopic procedures, the use of

hemostatic agents and absorbable agents are an effective combination. They provide a neat, tissue-sparing address to hemostasis with the least thermal injury and protect the microsurgical integrity of the tissues.

Required is multicenter/longitudinal research designed to achieve the outcomes of this study and address the issues of rupture and long-term/functional outcome in the absence of thermal injury.

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