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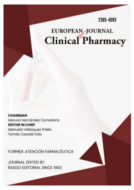

Article

Effect of Preoperative Spinal Injection Timing on Postoperative Outcomes Following Lumbar Decompression Surgery

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Abstract: *Background: Lumbar decompression surgery is commonly performed for patients with degenerative lumbar spine disorders who do not respond to conservative treatment. Objective: This study aimed to evaluate the effect of preoperative spinal injection timing on postoperative outcomes following lumbar decompression surgery. Methods: This retrospective observational study included 287 patients who underwent lumbar decompression surgery at a tertiary care hospital. Patients were categorized based on the timing of their last spinal injection before surgery into three groups: less than one month, one to three months, and more than three months before surgery. Demographic characteristics, clinical data, and postoperative outcomes including surgical site infection, wound complications, hospital length of stay, and neurological recovery were analyzed. Results: Among the 287 patients, the mean age was 54.8 ± 12.6 years and males accounted for 56.4% of the study population. Lumbar spinal stenosis was the most common diagnosis (59.6%). Spinal injections were performed within one month in 27.2% of patients, between one and three months in 41.5%, and more than three months before surgery in 31.4%. Patients who received injections within one month had higher rates of surgical site infection (11.5%) compared with those receiving injections one to three months (5.9%) and more than three months before surgery (3.3%). The early injection group also had a longer mean hospital stay (5.6 ± 2.1 days) compared with the one to three month group (4.7 ± 1.8 days) and the more than three month group (4.1 ± 1.5 days). Postoperative pain improvement was observed in 78.0% of patients and neurological recovery in 70.0%. Conclusion: Preoperative spinal injection timing appears to influence postoperative outcomes following lumbar decompression surgery. Shorter intervals between injection and surgery were associated with higher complication rates and longer hospital stays.*

Keywords: Lumbar decompression surgery, spinal injections, epidural steroid injection, postoperative complications

INTRODUCTION

One of the most prevalent causes of the chronic low back pain and neurological disability in the world is lumbar degenerative spine disorders [1]. Lumbar spinal stenosis, herniated intervertebral discs, and degenerative spondylosis often causes compression of the spinal nerves, which cause such symptoms as radicular pain, numbness, functional impairment, and motor weakness in the day-to-day activities. These disorders are a significant source of disability and health care usage especially among the aging demographics [2]. With more and more people living longer and more inactive, lumbar spine degeneration is on the increase causing a major burden to the healthcare systems and the society. Lumbar decompression is the long-standing treatment of patients with severe symptoms that cannot be eliminated with conservative management [3]. Laminectomy, laminotomy, and microdiscectomy are surgical interventions that are implemented in order to take off the pressure on the compressed neural structures by excising part of the bone, ligament, or disc tissue. The intention of these procedures is to relieve nerve compression, pain, and neurological recovery. It has been established by several studies that lumbar decompression surgery will be able to make a considerable improvement on the level of pain, walking function, and the quality of life among patients with severe lumbar spinal stenosis or disc herniation [4]. Nevertheless, even though these procedures are effective, surgical interventions are not free of risks as they can lead to infection, bleeding, dural tears, nerve damage, and postoperative complications which can impact the recovery. Before surgical treatment, the majority of patients are treated by conservative therapies aimed at decreasing the pain and enhancing the function [5]. Such non-surgery treatments usually involve physical therapy, non-steroidal anti-inflammatory medications, analgesics, lifestyle change and spinal injection treatments. These treatment modalities are considered to be quite effective in providing localized effects of anti-inflammatory practices and transient pain relief with epidural steroid injections and other spinal injections becoming commonly used [6]. These injections are used to inject corticosteroids and local anesthetics around the area of the damaged nerve roots or epidural cavity, which decreases inflammation and nerve irritation of degenerative conditions of the spine. The spinal injections may be done through different methods, which include the interlaminar epidural injections, the transforaminal epidural injections, the facet joint injections, and the selective nerve root block. These are procedures that are usually applied as a diagnostic and therapeutic modality to patients with lumbar radiculopathy or spinal stenosis [7]. Spinal injections in most instances enable patients to continue with waiting until surgery or contain symptoms pending assessment of surgical options. Injections are also able to give some people adequate symptom relief and prevent surgery. Nevertheless, in cases where the symptoms have not disappeared even after repeated injections and additional conservative measures have been administered, surgical decomposition has been advised as the treatment of choice [8]. In general, spinal injections are thought to be safe and minimally invasive, however, the issues related to the effect of these injections on the postoperative outcomes have been raised when it comes to the administration of these injections shortly prior to lumbar spine surgery [9]. One of the main groups of spinal injections, corticosteroids, possess immunosuppressive and anti-inflammatory activity that could affect the capacity of the body to respond to the traumas of the surgeries and infection [10]. Theoretical assumption is that the presence of steroids in the tissues around the surgical site could hamper wound healing, weaken the local immune response and predispose to postoperative infection. Moreover, recurring injections can cause changes in local tissue properties, which might have an impact on the dissection in surgery, and tissue recovery [11].

OBJECTIVE

This study aimed to evaluate the effect of preoperative spinal injection timing on postoperative outcomes following lumbar decompression surgery.

METHODOLOGY

This was a retrospective observational study conducted at Hayathabad medical complex hospital Peshawar from June 2024 to June 2025. A total of 287 patients who underwent lumbar decompression surgery for degenerative lumbar spine conditions were included in the study. Patients were selected using a non-probability consecutive sampling technique. They included patients aged 18 years and above who had previously undergone lumbar decompression surgery as a result of degenerative lumbar spine degenerations like lumbar spinal stenosis or lumbar disc herniation. Patients who had a documented history of preoperative spinal injections (epidural steroid injection, facet joint injection or selective nerve root block), as well as patients possessing complete perioperative and follow-up clinical data were included too. Patients who experienced lumbar fusion surgery, revision spine surgery surgery, spinal trauma surgery, tumor surgery, infection surgery and congenital spinal deformity surgery were not excluded. Incomplete medical records or the lack of postoperative follow-up data were also excluded in order to secure reliability of the analysis.

DATA COLLECTION

A structured data collection form was used to gain clinical and demographic information based on hospital electronic medical records. The data used were age, gender, body mass index, presence of comorbidities like diabetes mellitus and hypertension, diagnosis, type of spinal injection administered, when the spinal injection was administered prior to the surgery, and the type of surgery done. The patients were classified based on when their last preoperative spinal injection was done before surgery. The period between the injection and lumbar decompression surgery was also noted and the subjects were classified under time intervals that were established as less than one month, one to three months and over three months before surgery. Surgical site infection, wound complication, postoperative pain levels, hospital stay, readmission rate and neurological improvement were also recorded. The main research findings were the correlation between the time of the preoperative spinal injections with a postoperative complication after the lumbar decompression surgery. The second outcome was the postoperative recovery indices (reduced pain symptoms, neurological recovery and length of hospital stay).

STATISTICAL ANALYSIS

Data were analyzed using the Statistical Package for Social Sciences (SPSS) v26.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Comparisons between study groups were performed using chi-square tests for categorical variables and independent sample t-tests or analysis of variance for continuous variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Data were collected from 278 patients, mean age of the participants was 54.8 ± 12.6 years. The largest proportion of patients belonged to the 40–59 year age group, accounting for 138 (48.1%) cases, followed by those aged ≥60 years with 97 (33.8%) patients, while 52 (18.1%) were between 18–39 years. Male patients constituted 162 (56.4%) of the study population, whereas females accounted for 125 (43.6%). The mean body mass index was 27.3 ± 4.1 kg/m². Regarding comorbidities, diabetes mellitus was present in 78 (27.2%) patients, while 209 (72.8%) had no diabetes. Hypertension was reported in 96 (33.4%) patients and absent in 191 (66.6%). In terms of primary diagnosis, lumbar spinal stenosis was the most common indication for surgery, affecting 171 (59.6%) patients, while lumbar disc herniation was observed in 116 (40.4%).

Table 1. Demographic and Clinical Characteristics of Patients (n = 287)

Variable	Category	n (%) / Mean ± SD
Age (years)	—	54.8 ± 12.6
Age Group	18–39 years	52 (18.1)
	40–59 years	138 (48.1)
	≥60 years	97 (33.8)
Gender	Male	162 (56.4)
	Female	125 (43.6)
Body Mass Index (kg/m²)	—	27.3 ± 4.1
Diabetes Mellitus	Yes	78 (27.2)
	No	209 (72.8)
Hypertension	Yes	96 (33.4)
	No	191 (66.6)
Primary Diagnosis	Lumbar spinal stenosis	171 (59.6)
	Lumbar disc herniation	116 (40.4)
Timing of Preoperative Spinal Injection	<1 month before surgery	78 (27.2)
	1–3 months before surgery	119 (41.5)
	>3 months before surgery	90 (31.4)

Surgical site infection was highest among patients who received injections within one month before surgery, occurring in 9 (11.5%) patients. In comparison, infections occurred in 7 (5.9%) patients in the 1–3 month group and 3 (3.3%) patients in the >3 month group. Similarly, wound complications were reported in 11 (14.1%) patients in the <1 month group, compared with 10 (8.4%) in the 1–3 month group and 4 (4.4%) in the >3 month group. Readmission rates also followed a similar pattern, with 7 (9.0%) cases in the <1 month group, 6 (5.0%) cases in the 1–3 month group, and 3 (3.3%) cases in the >3 month group.

Table 2. Postoperative Complications According to Injection Timing

Injection Timing	Surgical Site Infection n (%)	Wound Complication n (%)	Readmission n (%)
<1 month	9 (11.5)	11 (14.1)	7 (9.0)
1–3 months	7 (5.9)	10 (8.4)	6 (5.0)
>3 months	3 (3.3)	4 (4.4)	3 (3.3)
p-value	0.041	0.036	0.048

The mean length of hospital stay following lumbar decompression surgery was 4.8 ± 1.9 days. Overall, postoperative pain improvement was observed in 224 (78.0%) patients, whereas 63 (22.0%) patients reported no significant improvement in pain. Neurological recovery was documented in 201 (70.0%) patients, while 86 (30.0%) patients showed no noticeable neurological change following surgery.

Table 3. Postoperative Recovery Outcomes (n = 287)

Outcome	Category	n (%) / Mean ± SD
Length of hospital stay (days)	—	4.8 ± 1.9
Postoperative pain improvement	Improved	224 (78.0)
	No significant improvement	63 (22.0)
Neurological recovery	Improved	201 (70.0)
	No change	86 (30.0)

Patients who received spinal injections within one month prior to surgery had the longest mean hospital stay of 5.6 ± 2.1 days, compared with 4.7 ± 1.8 days in the 1–3 month group and 4.1 ± 1.5 days in the >3 month group. Pain improvement was reported in 55 (70.5%) patients in the <1 month group, 95 (79.8%) patients in the 1–3 month group, and 74 (82.2%)

patients in the >3 month group. Neurological recovery occurred in 50 (64.1%) patients in the <1 month group, 86 (72.3%) patients in the 1–3 month group, and 65 (72.2%) patients in the >3 month group. The proportion of patients with no improvement was highest in the <1 month group with 23 (29.5%) cases, compared with 24 (20.2%) cases in the 1–3 month group and 16 (17.8%) cases in the >3 month group.

Table 4. Association Between Injection Timing and Postoperative Recovery Indicators (n = 287)

Injection Timing	Length of Hospital Stay (days) Mean ± SD	Pain Improvement n (%)	Neurological Recovery n (%)	No Improvement n (%)
<1 month (n = 78)	5.6 ± 2.1	55 (70.5)	50 (64.1)	23 (29.5)
1–3 months (n = 119)	4.7 ± 1.8	95 (79.8)	86 (72.3)	24 (20.2)
>3 months (n = 90)	4.1 ± 1.5	74 (82.2)	65 (72.2)	16 (17.8)
p-value	0.032	0.041	0.048	0.039

DISCUSSION

Lumbar decompression surgery is a useful intervention on patients who have degenerated lumbar spine disorders and not responding to the conservative management. Nevertheless, the time of the spinal injection in the preoperative period is still a significant clinical factor due to its possible effect on the postoperative results. In the current research, the association between the time of spinal injections and postoperative outcomes was assessed in 287 patients who underwent lumbar decompression surgery. These results proved that patients who were spinal injected at a shorter time before the surgery had higher risks of postoperative complications and a little worse recovery outcome than patients who injected at a later time before surgery [12]. In the current study, it was found that the rate of surgical site infection was higher in patients who were spinal injected withing one month before surgery (11.5) compared to those who were injected with one month (5.9) to more than three months (3.3) before surgery. The same was true with wound complications and hospital readmission. The results of this study indicate that corticosteroid preoperative exposure can increase the risk of postoperative complications. The immunosuppressive effects of corticosteroids are well known and therefore, they can suppress local immune responses and delay wound healing making them more susceptible to infection [13].

The findings of the present study are consistent with the ones that have been reported in past studies that have explored the relationship between spinal injections and surgical complications. It has been postulated in previous studies that epidural steroid injections injected just before lumbar spine surgery can lead to postoperative infection because of the immunosuppression caused by corticosteroids [14]. In order to reduce this possible risk, some studies have suggested that injections should be avoided during a period before surgery of about few weeks. The present research endorses these issues by illustrating the increase in the rate of complications in patients who were injected less than one month prior to surgery [15]. Timing of injecting influenced the postoperative recovery outcomes as well in this study. Mean hospital stay was higher in patients who underwent surgery within one month of receiving spinal injection (5.6±2.1 days) than in patients who receive injections 1-3 months (4.7±1.8 days) before surgery and more than three months (4.1±1.5 days). Also, the rate of patients experiencing improved pain during postoperative period was lower in the early injection group (70.5) than in the other groups (79.8 and 82.2). These results suggest that a postoperative recovery and less time of hospitalization can be related to delaying surgery following spinal injections. The same trend was also observed in terms of neurological recovery among the study groups. It was found that in the current study the neurological improvement was recorded in 64.1% of the patients who were injected less than one month before surgery as compared to about 72% of the patients who were injected more than one month before surgery [16,17]. Even though the difference was not significant, it indicates that a greater time between injection and surgery could enable a better tissue healing process and a decreased presence of inflammatory interference throughout the postoperative healing [18-20]. There were some limitations in this study that one must remember when making an interpretation of the findings. To begin with, the retrospective type can cause selection bias and restricts the possibility to form a causal relationship between the time of preoperative spinal injection and postoperative outcomes. Second, the study was done in only one center and had a sample size of 287 patients, which might not be generalizable to the populations and other healthcare facilities. Third, the nature of spinal injections, dosage of steroids, and methods of injections were not completely standardized, which may affect the results of the postoperative. Also, possible confounding variables like the severity of spinal pathology, experience of the surgeon and differences in perioperative management had not been completely controlled. Lastly, the follow-up duration was more of a short-term postoperative outcome and no consideration was done on long-term surgical outcomes. These findings must be borne out by further multicenter prospective studies involving standardized protocols and the span of follow up.

CONCLUSION

It is concluded that the timing of preoperative spinal injections may influence postoperative outcomes following lumbar decompression surgery. Patients who received spinal injections closer to the time of surgery demonstrated higher rates of postoperative complications and slightly prolonged hospital stays compared with those who had longer intervals between injection and surgery. Allowing a longer interval between spinal injection and surgical intervention may reduce the risk of complications and improve postoperative recovery

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