ORIGINAL ARTICLE

Preemptive caudal anesthesia on back pain after lumbar discectomy: a randomized and controlled study

Anestesia caudal preventiva en dolor de espalda después de discectomía lumbar: estudio controlado aleatorizado

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Abstract

Objective: *In this randomized and prospective research, we aimed to relieve surgical and muscle-related pain early after lumbar disc operations with caudal preemptive analgesia.* **Materials and methods:** *A total of 120 patients with single-level lumbar disc herniation were included in this study. The caudal epidural injection was performed for all patients 20 min before surgery. The patients were divided into three groups. Non-steroidal anti-inflammatory drugs or tramadol use were recorded. Pre-operative and post-operative pain was interpreted through a visual analog scale.* **Results:** *There was a difference between the groups in all post-operative measurements ($p < 0.05$), between Group 1 and Group 3, and between Group 2 and Group 3. A statistical significance has been achieved between the groups at the 1st h, 2nd h, 4th h, and 24th h ($p < 0.05$). The difference between the pain intensities of the patients at the 24th h and the 1st week was statistically significant in Groups 1 and 2 ($p < 0.05$). Evaluation of the effects of medical treatments reduced the severity of back pain and foot pain.* **Conclusion:** *The preemptive bupivacaine or in combination with methylprednisolone caudal injection is an effective and safe method to reduce post-operative pain and ameliorate functional capacity for the treatment of lumbar disc herniation.*

Keywords: *Preemptive analgesia. Caudal injection. Lumbar disc hernia. Post-operative pain. Visual analog scale.*

Resumen

Objetivo: *En esta investigación prospectiva aleatorizada, nuestro objetivo fue aliviar el dolor quirúrgico y muscular temprano después de las operaciones de disco lumbar con analgesia preventiva caudal.* **Materiales y métodos:** *en este estudio se incluyeron un total de 120 pacientes con hernia de disco lumbar de un solo nivel. La inyección epidural caudal se realizó para todos los pacientes 20 minutos antes de la cirugía. Los pacientes fueron divididos en tres grupos. Se registró el uso de AINE o tramadol. El dolor preoperatorio y postoperatorio se interpretó a través de una escala analógica visual.* **Resultados:** *Hubo diferencia entre los grupos en todas las medidas postoperatorias ($p < 0.05$), entre el grupo 1 y el grupo 3, y entre el grupo 2 y el grupo 3. Se ha logrado una significación estadística entre los grupos a la 1ª hora, 2ª hora, 4 y 24 horas ($p < 0.05$). La diferencia entre las intensidades de dolor de los pacientes a la hora 24 y la primera semana fue estadísticamente significativa en los Grupos 1 y 2 ($p < 0.05$). La evaluación de los efectos de los tratamientos médicos redujo la gravedad del dolor de espalda y de pie.* **Conclusión:** *La bupivacaína preventiva, o en combinación con la inyección caudal de metilprednisolona, es un método eficaz y seguro para reducir el dolor posoperatorio y mejorar la capacidad funcional para el tratamiento de la hernia de disco lumbar.*

***Palabras clave*:** *Analgesia preventiva. Inyección caudal. Hernia discal lumbar. Dolor postoperatorio. Escala visual analógica.*

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Introduction

Pain is defined as "an unpleasant emotional sensation related to one's past experiences, with or without tissue damage originating from a particular part of the body" by the International Study Group on Pain[1] and is a major public health problem. Over 230 million surgical procedures are performed yearly, increasing gradually. Almost 80% of these patients express pain after surgery[2]. Acute post-operative pain is defined as pain that gradually decreases in a patient who has undergone surgery due to a previous disease, surgical intervention, or the healing of tissue that develops due to both[3].

The intensity of post-operative pain can be influenced by several factors, including the location and type of surgery, duration of the procedure, size and type of incision, patient's pain perception and coping mechanisms, pre-operative physical and mental health status, pre-operative pain management, and type of anesthesia administered, as well as the efficacy of pain management strategies employed before and after surgery. In addition, the presence of pre-operative pain and previous experiences with pain may also contribute to the overall level of post-operative pain experienced by the patient[4]. The frequency of adverse outcomes is influenced by factors such as the quality of post-operative management. Inadequate treatment of post-operative pain is a significant concern, particularly among specific patient populations such as pregnant women, children, the elderly, individuals with limited verbal communication abilities, and those with drug dependency[5].

The advancement of knowledge concerning pain, including its mechanisms and physiopathology, has played a significant role in the emergence of numerous drugs and techniques aimed at minimizing pain. In addition, this has led to the recognition of pain as the fifth vital sign and its utilization to follow patients in the majority of health-care facilities. While pain can serve as a valuable indicator of tissue damage and facilitate immobility during the healing process, the stress response that arises in the post-operative period can have deleterious effects on all physiological systems[6].

Preemptive analgesia refers to the strategy of utilizing pain management techniques before a surgical procedure to reduce the potential for the development of more severe and persistent pain, both during and following the operation. The pre-operative administration of antinociceptive therapy before the surgical incision is the most notable characteristic. Preemptive analgesia has the potential to prevent hypersensitization and exacerbation of post-operative pain by lowering changes that may arise during the transmission of afferent impulses[7]. Subsequent research has indicated that the cessation of the nociceptive afferent block induced by the pre-incision pain treatment approach can result in the reactivation of central sensitization in response to stimuli originating from the wound site. This implies that central sensitization can be initiated by factors other than surgical incisions[8]. Pre-operative pain of the patient, noxious inputs occurring during the operation, inflammatory process due to peripheral-central neuromodulators, and ectopic neural activity cause central sensitization and, thus, both exacerbation and long-term acute pain. The mechanism-oriented analgesia method, which aims to reduce the nociceptive effect caused by all pre-operative, intraoperative, and/or post-operative warnings rather than when the analgesic treatment is applied, is called preventive analgesia[9].

The efficacy of preventive analgesia is attributed to its prolonged duration of action beyond initial expectations. The extended duration of the drug's efficacy can be attributed to its analgesic properties and its ability to impede the pathophysiological mechanisms involved in pain perception and transmission, specifically by halting the initiation of central sensitization. Multimodal analgesia, which aims to address various stages involved in the formation and processing of pain impulses, has been found to offer superior analgesic outcomes compared to interventions that solely target a single level[10].

The objective of this prospective and randomized study was to alleviate post-operative pain associated with lumbar disc surgeries, particularly those related to surgical and muscular factors, in a timely manner. Preemptive analgesia was administered before the arrival of pain mediators in the brain through the spinal canal. The visual analog scale (VAS) score for leg pain is indicative of the surgical outcome's quality. Stated differently, it is anticipated that the VAS score for leg pain will improve following surgical intervention aimed at correcting the herniated disc. During the initial phase, it is crucial to ascertain the specific agent that effectively alleviates VAS-associated back pain. The findings of this study will provide guidance to surgical teams regarding the management of post-operative pain and the avoidance of unnecessary medication.

Materials and methods

A total of 120 patients who applied to our clinic between 2020 and 2022 and operated for single-level

lumbar disc herniation were included in this prospective and randomized research. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

Patients with single-level lumbar disc herniation diagnosed through magnetic resource imaging were included in the study. On the other hand, individuals with multi-level disc herniation, spondylolisthesis, degenerative disc disease, rheumatic diseases, and immunosuppression were excluded from the study. The caudal epidural injection was performed for all patients 20 min before the surgical incision. The patients were systematically randomized and divided into three groups. The first group was given 10 ml of bupivacaine (0.5%, 50 mg) and 40 mg of methylprednisolone (in 2 ml of saline), and 8 ml of normal saline (NS) was added to complete 20 ml. The second group was administered 10 ml of SF and 10 ml of bupivacaine (0.5%, 50 mg). The third group was assigned as the control group, and 20 ml of NS was applied to the patients from the caudal epidural area. A single surgeon performed the operations as a single-level microscopic microsurgery. During the operation, the patient was withdrawn in case of neural injury or cerebrospinal fluid fistula complications.

During the pre-operative phase, patients were primarily administered diclofenac sodium, a non-steroidal anti-inflammatory drug (NSAID), for the purpose of pain relief. As the initial treatment was deemed ineffective, the administration of tramadol was continued for the patients. At the same time, those who required additional analgesics after the operation were given diclofenac sodium and tramadol intramuscularly. Tramadol was administered as an alternative in the absence of any observed impacts. The administration of medications before surgery and the requirement for supplementary medication after surgery was documented.

Pre-operative and post-operative pain at 0, 1, 2, 4, 6, 12, 18, and 24 h was interpreted thorugh a VAS. Whether the patients needed additional anesthesia, ambulation time, hospital stay, and side effects were recorded every hour. The VAS was readministered at post-operative 1st and 6th week.

Study groups were assigned as follows

– Group 1: 10 ml Bupivacaine (50 mg) + 2 ml methylprednisolone (40 mg) + 8 ml NS
– Group 2: 10 ml Bupivacaine (50 mg) + 10 ml NS
– Group 3: 20 ml NS

Caudal epidural injection procedure

The patient was placed in a prone position under general anesthesia before the lumbar disc operation. The sacral hiatus was detected under fluoroscopy. After cleaning the area to be injected, sterilization procedures were followed, and a total of 20 cc injection was administered if no blood flow was detected by entering the epidural area with a 22 G 90 mm spinal needle.

Statistical analysis

Data were analyzed using the Statistics Package for the Social Science (SPSS 23.0-IBM. NY. USA). Characteristics of patients, as n (percent) or mean ± standard deviation (SD) for categorical and continuous variables, were compared among treatment groups using Chi-square or Mann–Whitney U and Kruskal–Wallis H tests. The Wilcoxon signed-rank test was used to compare the median of two dependent groups. The p-value was set at < 0.05 for statistical significance.

Results

Within the research scope, 120 patients, 49.2% (n = 59) female and 50.8% (n = 61) male, were randomized in this prospective study. The ages of the patients ranged from 21 to 71, with a mean age of 50. Patients were divided into three groups according to the procedures applied. Group 1; 10 ml Bupivacaine (50 mg) + 2 ml methylprednisolone (40 mg) + 8 ml NS, Group 2; 10 ml bupivacaine (50 mg) + 10 ml NS and Group 3; 20 ml NS.

The distribution of demographic and clinical findings by treatment groups is denoted in table 1. When the table was examined, it was determined that there was a statistically significant difference between the groups regarding the rate of additional painkiller use, ambulation time, and hospital stay ($p < 0.05$).

The distribution of VAS back and leg pain severity before and after the operation according to the treatment groups is elaborated in table 2. When the table is examined, while there was no statistically significant difference in the pre-operative VAS back pain severity between the groups, it was determined that there was a difference between the groups in all measurements

Table 1. Distribution of demographic and clinical findings

Variables	Total (n = 120)	Group I (n = 40)	Group II (n = 40)	Group III (n = 40)	p-value
	n (%) or mean ± SD	n (%) or mean ± SD	n (%) or mean ± SD	n (%) or mean ± SD	
Age (years)	50 ± 11	50 ± 12	49 ± 12	50 ± 10	0.880
Gender					0.792
Male	61 (50.8)	20 (50)	19 (47.5)	22 (55)	
Female	59 (49.2)	20 (50)	21 (52.5)	18 (45)	
ASA status					0.065
ASA-I	66 (55)	19 (47.5)	28 (70)	19 (47.5)	
ASA-II	54 (45)	21 (52.5)	12 (30)	21 (52.5)	
Hernia level					0.385
L2-3	9 (7.5)	3 (7.5)	5 (12.5)	1 (2.5)	
L3-4	16 (13.3)	7 (17.5)	5 (12.5)	4 (10)	
L4-5	45 (37.5)	12 (30)	13 (32.5)	20 (50)	
L5-S1	50 (41.7)	18 (45)	17 (42.5)	15 (37.5)	
Side					0.648
Right	58 (48.3)	17 (42.5)	21 (52.5)	20 (50)	
Left	62 (51.7)	23 (57.5)	19 (47.5)	20 (50)	
Pre-operative medication					0.262
None	21 (17.5)	10 (25)	8 (20)	3 (7.5)	
NSAID	84 (70)	24 (60)	28 (70)	32 (80)	
Tramadol	15 (12.5)	6 (15)	4 (10)	5 (12.5)	
Additional rescue analgesic drug	40 (33.3)	**0 (0)**	**0 (0)**	**40 (100)**	**< 0.001**
None	80 (66.7)	**40 (100)**	**40 (100)**	**0 (0)**	
Diclofenac	31 (25.8)	**0 (0)**	**0 (0)**	**31 (77.5)**	
Diclofenac + Tramadol	9 (7.5)	**0 (0)**	**0 (0)**	**9 (22.5)**	
Ambulation (h)	9.6 ± 6	**6 ± 0**	**6 ± 0**	**16.7 ± 5.7**	**< 0.001**
Adverse events	2 (1.7)	0 (0)	0 (0)	2 (5)	0.131
Hospital stay (days)	1 ± 0.2	**1 ± 0**	**1 ± 0**	**1.1 ± 0.3**	**0.047**

Bold values represent statistical differences among groups. NSAID: non-steroidal anti-inflammatory drug; ASA: American Society of Anesthesiologists.

after the operation ($p < 0.05$). The statistical difference in all measurements resulted from the results between Group 1 and Group 3 and between Group 2 and Group 3. No difference in leg pain severity has been observed between the groups before the operation. Still, a statistical significance has been achieved between the groups at the 1st h, 2nd h, 4th h, and 24th h after the operation ($p < 0.05$).

The difference between the pain intensities of the patients at the 24th h, 1st week, and 6th weeks after the operation compared to the pre-operative period according to the treatment groups is presented in table 3. When the table was examined, a statistically significant difference was found in all Group 1 and Group 2 measurements except the pre-operative and post-operative 6th-week measurements ($p < 0.05$).

The results of the evaluation of the differences between the medical treatment groups that the patients received before the operation and the severity of back and leg pain before the operation according to the treatment groups are shown in table 4. When the table is examined, there was no statistically significant difference in pre-operative back pain severity between medical treatment in Group 3. All other measurements showed a statistically significant difference between the medical treatment groups ($p < 0.05$).

Discussion

The appropriate and sufficient management of post-operative pain in individuals who have undergone lumbar disc herniation surgery holds a significant position in the neurological recovery of patients. Inadequate management of acute post-operative pain in patients can result in delayed hospital discharge and prolonged recovery time for normal activities. Various pharmacological and analgesic modalities, including non-steroidal anti-inflammatory drugs (NSAIDs), opioids, central

Table 2. Distribution of VAS back and leg scores by treatment groups

VAS	Total (n = 120)	Group I (n = 40)	Group II (n = 40)	Group III (n = 40)	p-value	Difference
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD		
VAS back pain						
Pre-operative	0.1 ± 0.3	1.0 ± 0.0	1.0 ± 0.0	1.1 ± 0.3	0.209	
Post-operative	2.8 ± 2.1	**0.1 ± 0.4**	**0.1 ± 0.3**	**0.0 ± 0.0**	**< 0.001**	**a-c/b-c**
Post-operative (1 h)	2.8 ± 1.9	**1.5 ± 0.5**	**1.4 ± 0.5**	**5.5 ± 1.2**	**< 0.001**	**a-c/b-c**
Post-operative (2 h)	2.8 ± 1.6	**1.6 ± 0.5**	**1.5 ± 0.5**	**5.3 ± 0.8**	**< 0.001**	**a-c/b-c**
Post-operative (4 h)	3.1 ± 1.0	**1.6 ± 0.5**	**1.7 ± 0.5**	**5.0 ± 0.5**	**< 0.001**	**a-c/b-c**
Post-operative (6 h)	2.6 ± 1.2	**2.5 ± 0.5**	**2.5 ± 0.5**	**4.4 ± 0.5**	**< 0.001**	**a-c/b-c**
Post-operative (12 h)	2.5 ± 0.9	**1.8 ± 0.4**	**1.9 ± 0.5**	**4.2 ± 0.6**	**< 0.001**	**a-c/b-c**
Post-operative (18 h)	2.1 ± 0.9	**1.9 ± 0.3**	**2 ± 0.2**	**3.7 ± 0.7**	**< 0.001**	**a-c/b-c**
Post-operative (24 h)	1.8 ± 0.9	**1.6 ± 0.5**	**1.5 ± 0.5**	**3.1 ± 0.7**	**< 0.001**	**a-c/b-c**
Post-operative (1 week)	0.8 ± 0.9	**1.4 ± 0.5**	**1.3 ± 0.5**	**2.9 ± 0.5**	**< 0.001**	**a-c/b-c**
Post-operative (6 weeks)	0.4 ± 0.5	**0.4 ± 0.5**	**0.3 ± 0.5**	**1.9 ± 0.5**	**< 0.001**	**a-c/b-c**
VAS Leg Pain						
Pre-operative	6.8 ± 1.2	6.6 ± 1.3	6.8 ± 1.4	7.0 ± 0.8	0.074	
Post-operative	0.7 ± 0.9	**0.0 ± 0.0**	**0.0 ± 0.0**	**2.0 ± 0.0**	**< 0.001**	**a-c/b-c**
Post-operative (1 h)	0.7 ± 0.9	**0.0 ± 0.0**	**0.0 ± 0.0**	**2.0 ± 0.0**	**< 0.001**	**a-c/b-c**
Post-operative (2 h)	0.7 ± 0.9	**0.0 ± 0.0**	**0.0 ± 0.0**	**2.0 ± 0.0**	**< 0.001**	**a-c/b-c**
Post-operative (4 h)	0.3 ± 0.5	**0.0 ± 0.0**	**0.0 ± 0.0**	**1.0 ± 0.0**	**< 0.001**	**a-c/b-c**
Post-operative (6 h)	0.1 ± 0.3	0.1 ± 0.3	0.1 ± 0.3	0.1 ± 0.3	0.897	
Post-operative (12 h)	0.1 ± 0.3	0.1 ± 0.3	0.1 ± 0.3	0.1 ± 0.3	0.897	
Post-operative (18 h)	0.1 ± 0.3	0.1 ± 0.3	0.1 ± 0.3	0.1 ± 0.3	0.897	
Post-operative (24 h)	0.0 ± 0.2	**0.0 ± 0.0**	**0.0 ± 0.0**	**0.1 ± 0.3**	**0.017**	**a-c/b-c**
Post-operative (1 week)	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	1.000	
Post-operative (6 weeks)	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	1.000	

Bold values represent statistical differences among groups. VAS: visual analog scale. a: Group I; b: Group II; c: Group III.

Table 3. Distribution of pre-operative and post-operative VAS back pain and leg pain scores by treatment groups

Characteristics	Group I (n = 40)		Group II (n = 40)		Group III (n = 40)	
	Mean ± SD	p-value	Mean ± SD	p-value	Mean ± SD	p-value
VAS back pain						
Pre-operative	**1.0 ± 0.0**	**< 0.001**	**1.0 ± 0.0**	**< 0.001**	**1.1 ± 0.3**	**< 0.001**
Post-operative (24 h)	**1.6 ± 0.5**		**1.5 ± 0.5**		**3.1 ± 0.7**	
Pre-operative	**1.0 ± 0.0**	**0.018**	**1.0 ± 0.0**	**0.033**	**1.1 ± 0.3**	**< 0.001**
Post-operative (1 week)	**1.4 ± 0.5**		**1.3 ± 0.5**		**2.9 ± 0.5**	
Pre-operative	1.0 ± 0.0	0.366	1.0 ± 0.0	0.655	1.1 ± 0.3	< 0.001
Post-operative (6 weeks)	0.4 ± 0.5		0.3 ± 0.5		1.9 ± 0.5	
VAS leg pain						
Pre-operative	**6.6 ± 1.3**	**< 0.001**	**6.8 ± 1.4**	**< 0.001**	**7.0 ± 0.8**	**< 0.001**
Post-operative (24 h)	**0.0 ± 0.0**		**0.0 ± 0.0**		**0.1 ± 0.3**	
Pre-operative	**6.6 ± 1.3**	**< 0.001**	**6.8 ± 1.4**	**< 0.001**	**7.0 ± 0.8**	**< 0.001**
Post-operative (1 week)	**0.0 ± 0.0**		**0.0 ± 0.0**		**0.0 ± 0.0**	
Pre-operative	**6.6 ± 1.3**	**< 0.001**	**6.8 ± 1.4**	**< 0.001**	**7.0 ± 0.8**	**< 0.001**
Post-operative (6 weeks)	**0.0 ± 0.0**		**0.0 ± 0.0**		**0.0 ± 0.0**	

Bold values represent statistical differences among groups. VAS: visual analog scale.

nerve blocks, and infiltration techniques, have been employed for the management of post-operative pain following lumbar disc herniation procedures. However, similar to numerous other surgical procedures, the establishment of a universal analgesic approach has proven to be elusive[11].

The utilization of infiltrative, peripheral, and central blocks for the management of acute post-operative pain ought to be regarded as the fundamental element of multimodal analgesia. These applications have the potential to be utilized in conjunction with general anesthesia to provide post-operative analgesia, or alternatively, they

Table 4. Distribution of pre-operative VAS back pain and leg pain scores by pre-operative medication treatment groups

VAS	Pre-operative Medication	Group I (n = 30)		Group II (n = 32)		Group III (n = 37)	
		Mean ± SD	p-value	Mean ± SD	p-value	Mean ± SD	p-value
VAS back pain							
Pre-op	NSAID	**0.0 ± 0.0**	**< 0.001**	**0.0 ± 0.0**	**< 0.001**	0.0 ± 0.0	1.000
	Tramadol	**0.67 ± 0.82**		**0.75 ± 0.50**		0.0 ± 0.0	
VAS leg pain							
Pre-op	NSAID	**6.58 ± 0.65**	**< 0.001**	**6.68 ± 0.94**	**< 0.001**	**6.81 ± 0.40**	**< 0.001**
	Tramadol	**9.0 ± 0.89**		**10.0 ± 0.0**		**8.80 ± 0.84**	

Bold values represent statistical differences among groups. VAS: visual analog scale; NSAID: non-steroidal anti-inflammatory drug; SD: standard deviation.

may be employed as a primary method. Analgesics such as paracetamol, metamizole, non-steroidal anti-inflammatory drugs (NSAIDs), opioids, and adjuvants are commonly employed in the management of pain. Various administration routes can be favored for these medications to offer analgesia after surgery. The administration of these medications is infrequent in isolation or in conjunction, contingent on the extent of post-operative discomfort resulting from the surgical procedure[12].

The caudal injection is a beneficial method for easing post-operative pain due to its ability to access both the dorsal and ventral epidural spaces. Furthermore, it appears safe for the management of post-surgical syndrome. The administration of bupivacaine and tramadol through a single caudal epidural injection as a preemptive analgesic technique has been found to be a secure, uncomplicated, and efficacious approach for the management of post-operative pain[13]. The caudal injection method is often advocated by neurosurgeons due to its high degree of dependability. It has been asserted that a reliable imaging technique is necessary to ensure the accurate positioning of the caudal needle, as the epidural space cannot be reached with a success rate of 25% in caudal injections. According to Klocke et al., the utilization of ultrasound guidance during caudal epidural steroid injection allows for clear visualization of anatomical structures, resulting in effective injection outcomes[14].

Kaygusuz et al. conducted a preemptive study. They reported patient satisfaction as *"very good–excellent"* in the lornoxicam and tramadol groups but "poor–fairly well" in the placebo group[15]. Manchikanti et al. indicated that significant pain reduction (i 50%) was shown in 55-65% of patients with spinal stenosis after using of caudal epidural steroid injection (ESI)[16]. Botwin et al. reported a successful outcome in 65% of patients after 6 weeks, 62% after 6 months, and 54% after 12 months, and a reduction of at least 50% in visual analog pain scores after caudal epidural steroid injection[17]. On the contrary, caudal epidural steroid injection outcomes for chronic low back pain without stenosis are poor[18]. In our study, the distribution of VAS back and leg pain severity before and after the operation, the statistical difference has been obtained between the groups in all measurements in the post-operative period ($p < 0.05$). The statistical difference in all measurements resulted from the results between Group 1 (Bupivacaine + methylprednisolone) and Group 3 (control) and between Group 2 (Bupivacaine) and Group 3 (control). Still, there was statistical significance in the VAS leg scores between the groups after the 1st h, 2nd h, 4th h, and 24th h following the operation. The findings of this study indicate that bupivacaine is a more efficacious treatment option for post-operative low back pain compared to NS, whether administered as an independent therapy or in conjunction with methylprednisolone. The efficacy of the treatment in alleviating leg pain is noted to be limited to the initial 4-h period as compared to NS. The efficacy of lumbar disc surgery was noted to result in a reduction of leg pain during the post-operative phase.

Today, the clinical importance of post-operative pain management is increasing daily. Inadequately treated post-operative pain can lead to important clinical problems that may cause high morbidity, such as hypoxemia, atelectasis, pneumonia, deep vein thrombosis, pulmonary embolism, delayed recovery of bowel functions, myocardial ischemia, and urinary retention in the acute period[19]. The study revealed a statistically significant difference in the VAS back scores between pre-operative and post-operative back pain results in both Group 1 (Bupivacaine + methylprednisolone) and Group 2 (Bupivacaine). However, its efficacy diminishes beyond the 6th-week post-operation, as statistical significance was not observed beyond this period.

On analysis of the additional analgesic requirements of the groups, it was noted that the entirety of the control group necessitated analgesic medication. The administration of additional analgesics proved unnecessary in the remaining two groups. The findings

of this study indicate that preemptive analgesia has the potential to mitigate the necessity for additional medical intervention and potentially enhance its application.

By comparing ambulation times, it was observed that the mobilization time in the control group was determined to be 16.7 h. However, this duration can be reduced to 6 h, consequently protecting patients from potential complications associated with immobilization. Although no significant difference in side effects was detected among the groups, a marginal statistical difference was noted in the duration of hospitalization. It has been suggested that this intervention might reduce the occurrence of nosocomial infections and facilitate expedited rehabilitation of patients into the workforce.

Post-operative pain management should minimize or eliminate the patient's discomfort, facilitate recovery, avoid or effectively prevent side effects, and provide economical treatment. There is no ideal method of post-operative analgesia. There are differences between the advantages and disadvantages of each method, the area where it is effective, and the type of pain[20].

Conclusion

The fluoroscopy-guided caudal epidural injection is an effective and safe method to reduce post-operative pain and ameliorate functional capacity for the treatment of lumbar disc herniation. The use of bupivacaine, or in combination with methylprednisolone during caudal injection in the pre-operative period, leveraged clinical benefit in the management of post-operative pain.

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Conflicts of interest

The authors declare that they have no competing interests.

Ethical disclosures

Protection of human and animal subjects. The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Confidentiality of data. The authors declare they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained approval from the Ethics Committee for analysis and publication of routinely acquired clinical data and informed consent was not required for this retrospective observational study.

Use of artificial intelligence for generating text. The authors declare that they have not used any type of generative artificial intelligence for the writing of this manuscript nor for the creation of images, graphics, tables, or their corresponding captions.

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