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ORIGINAL RESEARCH PAIN MANAGEMENT

Effectiveness of epidural dexamethasone vs triamcinolone to relieve neuropathic pain of cervical disc herniation patients; 3-months follow-up

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ABSTRACT

Background & objective: Cervical disc herniation (CDH) is the most common cause of radicular pain; with one-third of the patients suffering for more than six months. Epidural steroid injections (ESI) are widely performed by the pain specialists and the neurosurgeons in this disorder, acute or chronic. We compared triamcinolone and dexamethasone regarding their efficacy to improve neuropathic pain at three months follow-up.

Methodology: This randomized blinded control trial was conducted at Dr. Kariadi Hospital in Semarang, Indonesia, on 42 chronic CDH patients. Patients were divided into two equal groups of 21 each, to receive, interlaminar cervical epidural injections of triamcinolone or dexamethasone under fluoroscopic guidance. The study was conducted from January 2022 to July 2023. Follow-up on the P*ainDETECT* score was carried out before and 3 months after the ESI. Data collected was analyzed by using the Mann-Whitney test ($P < 0.05$).

Results: Forty-two CDH subjects were involved in the study grouped as Dexamethasone group (21) and Triamcinolone group (21). Both groups observed significant pain improvement ($P < 0.001$, and $P = 0.020$). In the Dexamethasone group 16 out of 21 (76.2%) subjects showed improvement at 3 months of follow-up in the neuropathic pain, while in Triamcinolone group 10 out of 21 (47.6%) showed improvement at 3 months of follow-up. The differences in the two groups were significant ($P < 0.001$ vs $P = 0.007$).

Conclusion: The results of this study prove that epidural injection of dexamethasone is more effective than triamcinolone for improving neuropathic pain syndrome associated with chronic cervical disc herniation.

Keywords: Chronic CDH, Neck pain, Epidural steroid injection, Dexamethasone, Triamcinolone, Pain DETECT

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1. INTRODUCTION

Cervical disc herniation (CDH) might present with radiculopathy if the dorsal root ganglion lying inside the neuroforamen compression is compressed.[1] There is inflammation leading to pain that radiates to the arm and fingers. One-third of the population suffers from CDH for at least six months to many years at some stage of their lives,[1] and it could increase with age, and it commonly affects age group among 30s to 50s.[2] The annual incidence reaches 83.2/100,000 population.[3] Thus structural changes detected by magnetic resonance imaging (MRI) are found in 25% of the people younger than 40 y, and 10% to 60% are found in older than 40 y.[4,5]

Mechanical compression that causes pain in CDH, and some biochemical changes promote nerve root sensitivity. The discs gradually degenerate and the nucleus pulposus material might leak into epidural space, and irritate the nerve roots or adjacent pain origin structures. On the other hand, the disc might become too dry, so the strength and elasticity might develop in discogenic pain.[1] Fourteen percent of the patients might continue to have chronic neck pain without significant improvement by conservative treatment. The epidural injection is carried out with a combination of corticosteroids and local anesthetic drugs where the local anesthetics works to reduce pain directly. The injectable corticosteroid used has been approved by the FDA (Food and Drug Administration).[6] To assess changes in pain in patients after an epidural steroid injection, you can use the painDETECT questionnaire. This questionnaire has high sensitivity and specificity for detecting neuropathic pain. The prognosis depends on age, gender, pain scores, radiculopathy findings, or psychological states; the chronic phase refers to poor outcomes.[7] Although ESI are commonly performed safely, but around in 9.6% some sort of complications may occur.[8]

2. METHODOLOGY

This is a randomized single-blinded control trial study designed, with a control and treatment group pre-post test design. Forty-two subjects suffered from chronic neck pain due to CDH randomly divided into: Triamcinolone and Dexamethasone Groups as 21 subjects each. Neuropathic pain findings were examined by Pain DETECT initially, then 3 months after interlaminar cervical epidural steroid injection (ICESI). This study compared the improvement in pain in both groups with Pain DETECT. This study was carried out at the Dr. Kariadi Hospital Semarang, during the period January 2022 to July 2023. Subjects have been managing ICESI under fluoroscopy guidance in operation theater by experienced and well-trained pain physicians. All procedures were performed under local anesthesia so that we could monitor patient safety during surgery. Triamcinolone 20 mg was administrated in 2 mL of 2% lidocaine. Dexamethasone 5 mg was administrated in dilution with 2 mL of 2% Lidocaine. After steroid injections 2 mL of NaCl 0.9% injected to flush drug evenly distributed and to disperse collected volume. The total volume was not more than 4 mL, so had not promote intracranial pressure increased.

3. RESULTS

Subjects involved in the study were 21 for each Dexamethasone and Triamcinolone groups. Initially, 3 subjects suffered from nociceptic pain, 9 with non-specific pain, and 9 with neuropathic pain in Dexamethasone group. In Triamcinolone group one subject reported with non-specific pain, and 20 with neuropathic pain. There was no significant difference of genders in both groups ($P = 0.747$). Regarding the age there was no significant difference in both groups ($P = 0.77$). So both groups were comparable. Gender and age might not be significant confounding factors in the relationship of pain improvement according to ICESI procedures ($P > 0.05$).

In the Dexamethasone group, 15 patients had nociceptic pain syndromes, and 6 subjects with non-specific

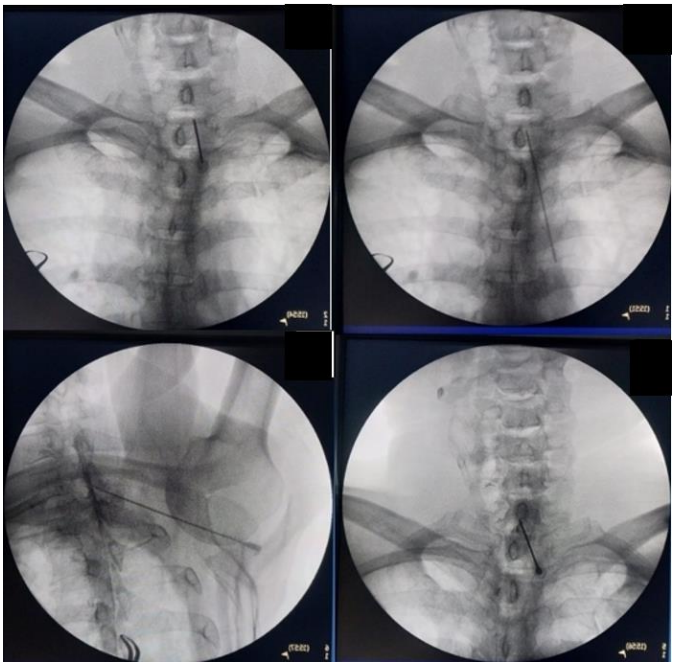

Figure 1: Cervical interlaminar epidural steroid injection. Epidural Tuohy needle inserted towards the intervertebral space C7-T1.

pain at 3 months of follow-up. While in the Triamcinolone group subjects with nociceptic, 5 with non-specific pain, and 11 subjects complained of neuropathic pain syndromes at 3 months follow-up. There was a significant difference before and after dexamethasone injection (P < 0.001) (Table 2). Whereas in the Triamcinolone group there were 2 subjects with non-specific pain. Meanwhile, of the 19 subjects that initially presented with the neuropathic pain syndromes, 4 transformed to nociceptive, 5 to unclear, and 10 continued with the same neuropathic pain syndromes. The results showed significant difference (P = 0.007) by injecting epidural triamcinolone (Table 2).

Table 1: Comparative demographic characteristic of the subjects

Parameter	Dexamethasone (n = 21)	Triamcinolone (n = 21)	Total	*p*
Gender				
• Male	8 (38.1)	7 (33.3)	15 (35.7)	0.747*
• Female	13 (61.9)	14 (66.7)	27 (64.3)	
Age				
• < 40 y	1 (4.8)	3 (14.3)	4 (9.5)	0.770^
• 40-50 y	8 (38.1)	6 (28.6)	14 (33.3)	
• 51-60 y	9 (42.9)	10 (47.6)	19 (45.2)	
• > 60 y	3 (14.3)	2 (9.5)	5 (11.9)	

*Data presented as n (%); * chi square, ^ fisher exact*

Table 2: Comparative pain improvement comparison after epidural steroid injection

Drugs	Observation	Type of pain			P-value
		Nociceptic	Non-specific	Neuropathic	
Dexamethasone	Before injection	3 (14)	9 (43)	9 (43)	
	3 months after ESI	15 (72)	6 (28)	0 (0)	< 0.001
Triamcinolone	Before injection	0 (0)	1 (4.8)	20 (95.2)	
	3 months after ESI	5 (23.8)	5 (23.8)	11 (52.4)	0.007

Data presented as n (%); P < 0.05 considered significant.

The neuropathic pain syndromes showed improvement at 3 months in 16 (76.2%) subjects in Dexamethasone group, compared to 10 (47.6%) patients in Triamcinolone group. Fixed neuropathic pain syndromes were demonstrated by 4 patients in the Dexamethasone group and 10 in the Triamcinolone group. Whereas the worsening status was found in one patient each in both groups. The Fisher Exact test showed no difference in changes in the neuropathic pain scales of both (P = 0.140) (Table 3).

4. DISCUSSION

ESI have been shown to be effective for treating pain related to spinal disc herniation. Steroids being used may be either non-particulate type, e.g., dexamethasone, prednisolone etc. or particulate type, e.g., betamethasone, triamcinolone and methylprednisolone etc..[9-12] Triamcinolone 20 mg when administered epidurally, has been shown to improve inflammatory pain without suppressing the hypothalamus-pituitary axis.[9] There is no difference in outcomes between low and high doses to reduce pain. Females suffer the most from chronic neck pain due to CDH in this study (around 66%), which seems in similarity to a recent study (64.3%).[13] The incidence among females in various age groups varies from 50-58%.[14] It might be linked to menopause stages which promote bone density reduction, as the estrogen levels decrease the pain perception might advance.[15] Subjects age in this study were in the range of 51 to 60 y (45.2%). The prevalence might increase gradually with the age.[13] The degeneration process in the intervertebral

Table 3. Comparison of pain improvement between dexamethasone and triamcinolone

Drugs	Pain DETECT changes			*p*
	Improved	No change	Worsened	
Dexamethasone	16 (76)	4 (19)	1 (5)	0.140
Triamcinolone	10 (47.5)	10 (47.5)	1 (5)	

Data presented as n (%); P < 0.05 considered significant.

discs starts with small fissures on the annulus layers. Then gradually advanced so the nucleus pulposus materials is protruded to the outside through the lesion sites. Meanwhile, traumatic events, body posture stress, or hypermobility are the underlying mechanisms found in patients aged lower than 40-years old.

Both steroid drugs might be effective for managing chronic pain due to CDH. Even though there was no significant difference in the improvement in pain between both of the drugs; both dexamethasone and triamcinolone resulted in significant pain improvement ($P < 0.001$, and $P = 0.020$). Steroids might improve pain through inhibiting process of phospholipase A2 (PLA2). It is an inflammatory enzyme with high concentrations in human intervertebral discs that contributes to the pathogenesis of the back pain. PLA2 is responsible for the conversion of phospholipids into arachidonic acid which plays a role in controlling pathways involving cyclooxygenase and lipoxygenase which play a role in the synthesis of prostaglandins and thromboxanes as well as hyperalgesics and leukotrienes which cause inflammation and pain stimuli.[18]

Dexamethasone might have better results than triamcinolone for reducing neuropathic pain syndromes due to CDH (Table 2, 3). This could be associated with smaller particle size of dexamethasone than triamcinolone, so it is easily absorbed.[19,20] In addition dexamethasone is a potent anti-inflammatory and immunosuppressant drug, so it might also inhibit fibrovascular tissue formation, reduce inflammatory cell infiltration and thermal hyperalgesia, and induce anti-allodynia effect.[21]

Particulate molecules of triamcinolone might have a risk of aggregation inside the epidural space or at the lesion sites.[22] Administrated into epidural space, triamcinolone could be collected in epidural fast tissues. It may be released slowly with the possibility of adverse events, such as: hypothalamus pituitary adrenal (HPA) axis imbalance, neurological problems, or it can keep the nerves excitability intact and the pain persists.[23] Side effects regarding HPA axis disorders can be avoided, if the dose of both steroids is kept low and only a single administration is performed.[24]

5. LIMITATIONS

The pain questionnaire needs to be subjectively answered by the patients as a limitation of this study. It could be used as another objective parameter to evaluate the improvement, such are neurophysiology examination or inflammatory mediators levels. Besides, the sample size and the duration of the study can be longer, for example, six months or more.

6. CONCLUSION

Dexamethasone might be used for treating chronic neck pain due to cervical disc herniation, being more effective than triamcinolone, even though classified as a short-duration steroid. Besides, it is a non-particulate drug with minimal side effects when used into the epidural space.

7. Data availability

The numerical data generated during this research is available with the authors.

8. Acknowledgments

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9. Competing interests

The authors declare no conflicts of interest in this study. This research did not receive any third-party or commercial sponsorship or financial support.

10. Author Contributions

TB concepted the study and did the ICESI in Operation Theater; RA followed up the subjects; EK and AH did the statistical analysis together with RA, HH; and S evaluated the clinical regulations needed. All authors approve this manuscript for publishing.

11. REFERENCES

1. Sluijter ME. Cervicobrachialgia. In: Sluijter ME, editor. Radiofrequency, Part 2. Meggen (Switzerland): Flivopress; 2003. p. 9-22.
2. Misailidou V, Malliou P, Beneka A, Karagiannidis A, Godolias G. Assessment of patients with neck pain: a review of definitions, selection criteria, and measurement tools. J Chiropr Med. 2010;9(2):49-59. [PubMed] DOI: 10.1016/j.jcm.2010.03.002
3. Swart E, Floyd RT, Cendima M. Cervical spine functional anatomy and the biomechanics of injury due to compressive loading. J Athl Train. 2005;40(3):155-61. [PubMed]
4. Bogduk N, Mercer S. Biomechanics of the cervical spine I: normal kinematics. Clin Biomech. 2000;15:633-48. [PubMed] DOI: 10.1016/s0268-0033(00)00034-6
5. Anderst W, Baillargeon E, Donaldson W, Lee J, Kang J. Motion path of the instant center of rotation in the cervical spine during in vivo dynamic flexion-extension: implications for artificial disc design and evaluation of motion quality after arthrodesis. Spine. 2013;38(10):E594-601. [PubMed] DOI: 10.1097/BRS.0b013e31828ca5c7
6. Carassiti M, Pascarella G, Strumia A, Russo F, Papalia GF, Cataldo R, et al. Epidural steroid injections for low back pain: a narrative review. Int J Environ Res Public Health. 2022;19(1):231. [PubMed] DOI: 10.3390/ijerph19010231

7. Virdi G. Cervical myelopathy: pathophysiology, diagnosis and management. Spine Res. 2017;3(2):12. DOI:10.21767/2471-8173.100032
8. Esther M, Benedetti R, Rapipen S, John S, Richard WR, et al. Epidural steroid injections: complications and management. Tech Reg Anesth Pain Manag. 2009;13(4):236-50. DOI: 10.1053/j.trap.2009.06.011
9. Budisulistyo T, Husni A, Pramukarso DT, Pudjonarko D. Effect of caudal epidural adhesiolysis on pain and daily activities among chronic lumbar disc herniation patients. Anaesth Pain Intensive Care. 2022;26(6):198-203. [FreeFullText]
10. Kim BR, Lee JW, Lee E, Kang Y, Ahn JM, Kang HS. Effectiveness of epidural steroid injection in patients with lumbar herniated intervertebral disc under a "wait-and-see" policy. Acta Radiol. 2022;63(1):67-75. [PubMed] DOI: 10.1177/0284185120985500
11. Schneider B, Varghis N, Kennedy DJ. Ideal corticosteroid choice for epidural steroid injections: a review of safety and efficacy. Curr Phys Med Rehabil Rep. 2015;3(2):151-8.
12. Josh L, Nolan G, John C, Lisa H, Jayme K, Kennedy DJ, Matt S, et al. Results of cervical epidural steroid injection based on the physician referral source. Interv Pain Med. 2022;1(3). DOI: 10.1016/j.inpm.2022.100114
13. Sharrak S, Al Khalili Y. Cervical disc herniation. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2023.
14. Kim YK, Kang D, Lee I, Kim SY. Differences in the incidence of symptomatic cervical and lumbar disc herniation according to age, sex and national health insurance eligibility: a pilot study on the disease's association with work. Int J Environ Res Public Health. 2018;15(10):2094. [PubMed] DOI: 10.3390/ijerph15102094
15. Howay SY, Sutarto, Larasati TA. Identification risk factors of herniated nucleus pulposus (HNP). J Agromedicine Unila. 2021;8. [FreeFullText]
16. Raffensperger M. Orthopedic interventions for the cervical spine and temporomandibular joint. In: Orthopedic Interventions for the Physical Therapist Assistant. Philadelphia: F.A. Davis; 2020. p.195.
17. Dietrich TJ, Sutter R, Froehlich JM, Pfirrmann CW. Particulate versus non-particulate steroids for lumbar transforaminal or interlaminar epidural steroid injections: an update. Skeletal Radiol. 2015;44(2):149-55. [PubMed] DOI: 10.1007/s00256-014-2048-6
18. Yeung JT, Johnson JI, Karim AS. Cervical disc herniation presenting with neck pain and contralateral symptoms: a case report. J Med Case Rep. 2012;6:166. [PubMed] DOI: 10.1186/1752-1947-6-166
19. Kang WY, Lee JW, Lee E, Kang Y, Ahn JM, Kang HS. Systemic effects of fluoroscopically guided epidural steroid injection with dexamethasone. Korean J Pain. 2019;32(3):178-86. [PubMed] DOI: 10.3344/kjp.2019.32.3.178
20. Park CH, Lee SH. Effect of lumbar epidural steroid injection on neuropathic pain: a prospective observational study. AIMS Neurosci. 2022;9(1):24-30. [PubMed] DOI: 10.3934/Neuroscience.2022003
21. Bastos LF, Vago JP, Caux TR, Costa BL, Godin AM, Menezes RR, et al. Delay of neuropathic pain sensitization after application of dexamethasone-loaded implant in sciatic nerve-injured rats. Braz J Pharm Sci. 2019;55. [FreeFullText]
22. Wahezi S, Mohamed SE, Lederman A, Beck AP. Aggregation properties of triamcinolone acetonide injection in human serum: considerations when performing epidural steroid injections. J Pain Res. 2019;12:1033-9. [PubMed] DOI: 10.2147/JPR.S181038
23. Lamer TJ, Dickson RR, Gazelka HM, Nicholson WT, Reid JM, Moeschler SM, et al. Serum triamcinolone levels following cervical interlaminar epidural injection. Pain Res Manag. 2018:8474127. [PubMed] DOI: 10.1155/2018/8474127
24. Liu X, Du Y, Cong H, Liu G, Ren Y. Effects of continuous epidural injection of dexamethasone on blood glucose, blood lipids, plasma cortisol and ACTH in patients with neuropathic pain. Front Neurol. 2021;11:564643. [PubMed] DOI: 10.3389/fneur.2020.564643

