Physical Medicine and Rehabilitation - International

Open Access

Austin Publishing Group

Review Article

Prognostic Factors Affecting Ultrasound Guided Caudal Epidural Injection in Sciatica Patients

Hussein N[1]* and Dwary M[2]

[1]Professor of PM&R, Alexandria University, Egypt

[2]Clinical Assistant at Alexandria medical pc, USA

***Corresponding author:** Naglaa Hussein, Assistant Professor of PM&R, Albert Einstein College of Medicine, CEO Alexandria Medical pc, Bronx, NY, Professor of PM&R, Alexandria University, Egypt

Received: November 06, 2020; **Accepted:** December 03, 2020; **Published:** December 10, 2020

Abstract

Objective: Evaluate factors affecting outcome of ultrasound guided caudal epidural injection in sciatica patients.

Design: Prospective study.

Setting: Outpatient setting.

Participants: 320 patients with chronic back pain with sciatica more than 3 months, exclusion; severe motor weakness, previous back surgery, infection at site of injection.

Intervention: All patients had detailed history taking, Body Mass Index (BMI), neurological & musckelo-skeletal examination, MRI lumbosacral spine, Nerve conduction-electromyography. (NCS-EMG) Followed by ultrasound guided caudal epidural injection. Main outcome measure: BMI, back pain by Visual Analogue Scale (VAS), Oswestry Disability Index before and 4 weeks after injection

Results: Mean age 56.2±12.74, 116 male (36.3%), 204 female (63.7%). Mean BMI 34.3±8.01, obese 45.3%, overweight 37.5%, normal BMI 17.2%. Positive history of diabetes in 24.1%. Pain duration <1 year 22.5%, 1-3 year 29.7%, 4-10 y 35.6%, >10 y 12.2%. Side of sciatica; Right 60.9%, left 29.4%, bilateral 9.7%. Objective sensory exam positive in 65.3%, objective motor exam positive in 21.9%. MRI findings; L3-4 disc 20%, L4-5 disc 25.1%, L5-S1 23.4%, facet arthropathy, 7.8%, spinal stenosis16.3%. MRI with one disc 64.1%, two disc 27.7%, three or more 11.3%. EMG findings; chronic radiculopathy; L4; 10.3%, L5; 45.9%, S1; 48.4%, bilateral radiculopathy 17.2%, axonal polyneuropathy 4.7%. Mean VAS before injection 8.75±1.36, after injection 4.2±2.34 (p 0.001). Mean Oswestry disability index before injection 77.4±8.9, after injection 40.1±12.2 (p 0.001). Degree of VAS improvement; >75% 20.3%, 50-75% 38.1%, <50%; 25.3%, no change; 16.3%. Oswestry disability index improvement; >75%; 26.6%, 50-75%; 38.8%, <50%; 22.5%, no change 12.2%. Number of injections: one (78.8%), two 14.4%, three 1.3%, four 5%, six 0.6%. Mean duration between injection; 2.82±2.01 months. Factors significantly affect VAS improvement; Age p=0.013, BMI p=0.022, diabetes p=0.003, objective sensory & motor exam p=0.046, 0.04 respectively, presence of more than one -disc p=0.0021, spinal stenosis p=0.003

Conclusion: Ultrasound guided epidural injection is a significantly effective in sciatica patients and is negatively influenced by age, BMI, Diabetes, neurologic deficit and multiple disc and spinal stenosis.

Introduction

Sciatica results from spinal nerve root compression and produces pain in a dermatomal distribution. The pain is often lancinating shooting sharp in quality. It is frequently accompanied by numbness and tingling and may be associated with sensory or motor deficits. This should be differentiated from non -neurogenic sclerotomal pain [1].

The most common cause of sciatica is herniated intervertebral disc [2]. The herniated disc can cause nerve root impingement that leads to lumbosacral radiculopathy [2]. This is considered the mechanical component of sciatica. While there is in addition a biologic chemical component, including inflammation, vascular invasion, immune responses and an array of cytokines [2].

Epidural corticosteroid injection is used mostly in subacute (>6 weeks) and chronic low back pain. It had gained popularity and the rationale beyond it that the genesis of radicular pain when a herniated disc impinges on a nerve root, is at least partly related to locally induced inflammation [3,4]. Caudal epidural injection is performed as diagnostic and therapeutic interventions in various lumbosacral pain syndromes. Caudal epidural injections is complicated by variations in sacral anatomy and the risk of inadvertent intravascular injection. Ultrasound guided injection was found to be as effective as fluoroscopic guidance without the risk of radiation exposure. However, the ultrasound-guided techniques are limited by lack of visualization inside the sacral canal thereby limiting the identification

Hussein et al. © All rights reserved

Citation: Hussein N and Dwary M. Prognostic Factors Affecting Ultrasound Guided Caudal Epidural Injection in Sciatica Patients. Phys Med Rehabil Int. 2020; 7(1): 1170.

of epidural spread and vascular spread [5].

Methods and Materials

This study was prospective study conducted at outpatient setting. All the included patients had signed informed consent prior to their participation after explanation of the benefits and risks of caudal epidural injection. The study included 320 patients with chronic back pain with sciatica more than 3 months exclusion criteria: severe motor weakness, previous back surgery, infection at site of injection

Intervention: all patients had detailed history taking, Body Mass Index (BMI), neurological & musckelo-skeletal examination, MRI lumbosacral spine, Nerve conduction-electromyography. Followed by ultrasound guided caudal epidural injection.

Technique of ultrasound guided caudal epidural

The patient was placed in prone position with abdomen resting on a pillow to relax the gluteal muscles, the patient was asked to turn his heels outward. Ethyl chloride was sprayed as local anesthetic for the whole sacral area after the skin overlying the sacrum and sacral hiatus was prepped with antiseptic solution. A curved ultrasound transducer was place over the lower sacrum after the application of a sterile gel. The transducer was placed in a transverse plane and slowly moved caudally until the sacral cornua are visualized. Sacral hiatus and sacrococcygeal ligaments are identified. The transducer then turned longitudinally and moved slowly cephalad until the inferior portion of the ultrasound transducer lies toward the top of the sacral hiatus. A 22-gauge 3-inch needle was inserted through the skin 1 cm below the inferior border of the transducer utilizing in plane approach and advanced with a 45-degree angle to skin through sacrococcygeal ligament in the caudal canal. After a negative aspiration, 40mg of triamcinolone together with 4 ml of lidocaine 1% was injected (l).

Main outcome measure

BMI, back pain by Visual Analogue Scale (VAS), Oswestry Disability Index before and 4weeks after injection [7,8].

Results

The demographic and clinical data of the studied patients. Mean age 56.2±12.74, 116 male (36.3%), 204 female (63.7%). Mean BMI 34.3±8.01, obese category was the highest (Table 1). The duration of pain varies from less than 1 year to more than ten years with the highest number of patients with duration 4-10 y. MRI findings of the studied patients (Table 2). The most frequent findings were L 4-L5 disc. MRI with one disc 64.1%, two disc 27.7%, three or more 11.3%. NCS-EMG finding revealed chronic radiculopathy; L4; 10.3%, L5; 45.9%, S1; 48.4%, bilateral radiculopathy 17.2%, axonal polyneuropathy 4.7%.

The change of VAS and Oswestry disability after caudal epidural injection. Both of them showed significant improvement (p=0.001) (Table 3). The Degree of VAS improvement and Oswestry disability index improvement after injection. Most of the studied patients falls among 50-75% category of improvement (Table 4). The number of injections received Most of the studied patients received only one injection (Table 5). The duration between injection (Table 6). Mean duration between injection; 2.82±2.01 months.

Factors significantly affect VAS improvement; Age p=0.013, BMI p=0.022, diabetes p=0.003, objective positive sensory & motor exam p=0.046, 0.04 respectively, presence of more than one- disc p=0.0021, spinal stenosis p=0.003 (Table 6).

Table 1: Distribution of the studied patients group regarding their demographic and basic clinical data.

	Number "n= 320"	Percent
Age		
<40	32	10
40-60	145	45.3
60+	143	44.7
Range	23.0-84	
Mean	56.2	
S.D	12.74	
Sex		
Male	116	36.3
Female	204	63.7
BMI		
Normal	55	17.2
Over weight	120	37.5
Obese	145	45.3
Range	21.0-55.3	
Mean	34.3	
S.D	8.01	
History of diabetes	77	24.1
Pain duration		
<1 year	72	22.5
3-Jan	95	29.7
10-Apr	114	35.6
>10	39	12.2
Side of sciatica		
Right	195	60.9
Left	94	29.4
Bilateral	31	9.7
Objective Sensory Exam		
Positive	209	65.3
Negative	111	34.7
Objective Motor Exam		
Positive	70	21.9
Negative	250	87.1

Table 2: MRI findings among the studied patients.

MRI findings	Number "n= 320"	Percent
L3-L4 Disc	64	20.0
L4-L5	80	25.1
L5-S1	75	23.4
Facet	25	7.8
S. Stenosis	52	16.3

Table 3: Comparison between pre and post-injection VAS and Oswestry Disability Index.

	Pre Injection	Post-Injection	t-test	*P* value
VAS				
Range	5.0-10.0	0-10	8.22	0.001*
Mean	8.75	4.20		
S.D	1.36	2.34		
Oswestry Disability Index				
Range	60-93.0	8.0-75.0	5.98	0.001*
Mean	77.4	40.1		
S.D	8.9	12.2		

Discussion

This study was carried out to evaluate the efficacy of ultrasound-guided caudal epidural injection among sciatica patients and the factors that affect the degree of improvement. All the studied patients

Table 4: Distribution of the studied patients regarding the degree of improvement of VAS and Oswestry Disability Index.

Degree of Improvement	Number "n= 320"	Percent
VAS		
>75.0%	65	20.3
50.0-75.0%	122	38.1
<50.0%	81	25.3
No change	52	16.3
Oswestry disability index		
>75.0%	85	26.6
50.0-75.0%	124	38.8
<50.0%	72	22.5
No change	39	12.2

Table 5: Number of injection received among the studied patients group.

Number of injection received	Number "n= 320"	Percent
1	252	78.8
2	46	14.4
3	4	1.3
4	16	5.0
6	2	0.6

Table 6: Duration between each injection received among the studied patients group.

Duration between each injection (months)	Number "n=320"	Percent
1 month	12	3.8
2-3 months	165	51.6
4-5 months	109	34.1
6^{+}	34	10.6
Range	1-9	
Mean	2.82	
S.D	2.01	

presented with sciatica more than three months and had responded significantly to corticosteroid caudal epidural injection with variable degree of improvement of pain score and Qwstery disability index based on the tested variables.

Revising literature regarding the efficacy of caudal epidural injection in the management of sciatica, Watts & Silagy [9] carried a meta-analysis on the efficacy of epidural corticosteroid in the treatment of sciatica and documented that it is very effective in the management of lumbosacral radicular pain [9]. In addition, other authors reported the significant efficacy of caudal epidural in treating sciatica patients [10,11].

Nandi J and Chowdhery A studied 47 patients with sciatica receiving caudal epidural corticosteroid injection, In comparison to placebo, there was significant improvement after 4 weeks but at 12 weeks, there was no difference between groups and they concluded that caudal epidural provide no additional improvement over placebo in long term natural history of lumbosacral sciatica, however it can be an important component of short term management of painful sciatica [12]. In Contradiction to our results, Iversen T et al., concluded in their study that no difference between caudal steroid or saline injection in treating chronic lumbar radiculopathy. Their study compared injection between saline and steroid injection and they found short-term improvement for both groups but on long-term basis after 52 weeks, follow up there was no improvement. Each of the tested patient groups was composed of 41 patient's only [13]. In our study, we had large population sample that can lead to more accurate statistical results and we had measured VAS and Owstery disability index after 4 weeks i.e. short term period as we believe that it is unlikely that the improvement of caudal steroid injection will persist forever so to test the patient after 52 weeks, in our opinion it is very long periods that is unlikely the effect of steroid will be persistent during this whole period.

In this study, the degree of improvement of VAS and Owstery disability index after caudal epidural injection were variable and the highest category falls among 50-75% improvement. In the previous literature, it was documented the improvement of VAS and Owstery index, however the degree of improvement was not listed in the literature [14].

In this study, we had studied the variable factors that can influence the outcome of the caudal epidural injection, namely the presence of DM, BMI, age and presence of objective sensory and motor findings, MRI findings.

As regard the presence of DM. It significantly negatively influenced the degree of improvement of VAS after epidural injection. Although the diabetic patients still showed significant improvement of pain compared to prior injection but the degree of improvement is significantly less compared to non-diabetic patients.

Diabetes mellitus is associated with low back pain and spinal pain, however direct causal link between diabetes and back pain was not established [15]. The association with chronic back pain are more stronger for severe cases of pain.

The association of DM with the severity of pain and the frequency of its chronisation and recurrence has been established. The most likely mechanism of such association is the lesion of intervertebral discs mediated by the accumulation of advanced glycation end products (EGP). In DM the concentration of EGP increases significantly, they initiate ectopic calcification, a decrease in cell density in the end plate and changes in vertebrae. Cells of pulposus nuclei begin to produce pro inflammatory cytokines and chemokines that trigger the process of angio and neurogenesis [16].

Won Ho Kim et al reported significant improvement of pain after epidural injection for diabetic patients using either 20 or 40 mg triamcinolone without significant difference between doses. However, in their study they did not compare the results with none diabetic patients to see the influence of diabetes on the degree of pain improvement [17]. In this study, the majority of the studied patients falls among the obese body mass index. All of the studied patients including the obese category have significant improvement of VA S and Owstery disability index which denotes the effectiveness of ultrasound guided epidural injection even among the obese patients, but when we compared the degree of improvement of VAS between the obese and non- obese patients, we found that obesity inversely affected the degree of improvement.

Conducted a study aiming to find the association between caudal epidural steroid injection and BMI. They concluded that caudal epidural injection improved all body weight and they noted that the limitation of the study was due to small number of obese patients [18].

Table 7: Multivariant analysis of different risk factors, which may affect the degree of improvement by VAS.

	Improvement regarding VAS								Total	*P* value
	>75%		50-75%		<50%		No change			
	No.	%	No.	%	No.	%	No.	%		
Age										
<40	22	68.8	6	18.8	2	6.3	2	6.3	32	0.013*
40-60	32	22.1	63	43.4	50	34.5	0	0.0	145	
60+	11	7.7	53	37.1	29	20.3	50	35.0	143	
BMI										
Normal	32	58.2	18	32.7	3	5.5	2	3.6	55	0.022*
Over weight	20	16.7	69	57.5	15	12.5	16	13.3	120	
Obese	13	9.0	35	24.1	63	43.4	34	23.4	145	
History of diabetes	6	7.8	12	15.6	19	24.7	40	51.9	77	0.003*
Pain duration										
<1 year	45	62.5	12	16.7	10	13.9	5	6.9	72	0.069
1-3 yrs	10	10.5	52	54.7	30	31.6	3	3.2	95	
4-10 yrs	6	5.3	50	43.9	34	29.8	24	21.1	114	
>10 yrs	4	10.3	8	20.5	7	17.9	20	51.3	39	
Objective Sensory Exam										
Positive	2	1.0	20	9.6	62	29.7	209	100.0	209	0.046*
Negative	63	56.8	102	91.9	19	17.1	27	24.3	111	
Objective Motor Exam										
Positive	4	5.7	13	18.6	18	25.7	35	50.0	70	0.040*
Negative	61	24.4	109	43.6	63	25.2	17	6.8	250	
Number of disk										
One	62	30.2	52	25.4	42	20.5	49	23.9	205	0.0021*
Two	3	3.8	52	65.8	23	29.1	1	1.3	79	
Three or more	0	0.0	18	50.0	16	44.4	2	5.6	36	
S. Stenosis	3	5.8	16	30.8	9	17.3	24	46.2	52	0.003*

Excess body weight causes extra stress on the disc. Disc is a soft rubbery pad between the vertebrae, which carries the body weight. When the disc herniates, the nucleus protrudes and presses the nerve through the spinal canal [19].

Baysal and Friends compared the epidural steroid injection between the obese and non-obese patients. They did not experience any difference between the groups [20].

Klocke in another study stated that ultrasound guided epidural injection is safe and effective in over weight and obese patients [21]. In this study, the majority of the patients are from 40-60 y old age group. All the studied patients showed significant improvement of VAS and Owstery disability index. However, older age, above 60 y showed significantly less degree of improvement in VAS.

The frequency of disc herniation increases with age. The peak frequency of herniation at L5-S1, L4-L5 levels is between the age of 44 & 50 year with a progressive decline in frequency thereafter [22]. In our study, most of the patients lie within the above-mentioned category of patients i.e. 40-60 y, which goes with the reported literature. However, the explanation why the older age achieved significantly less degree of improvement of pain after caudal epidural was not mentioned. May be because with older age, the pathology of degenerative disc disease become more advanced and long-standing, which can influence the degree of pain relief after epidural injection.

Among the variables, that we studied whether it affects the degree of improvement of VAS after caudal epidural was the presence of sensory and/or motor deficit. We found that the presence of such deficit negatively significantly affected the degree of VAS improvement. The suggested explanation for this that the presence of either sensory and or motor deficit indicate more grave compression on the nerve root with more permanent effect. In contradiction to this result, Billy GG et al., denied the effect of sensory and or deficit on the results of epidural [23].

We disagree with this result because during the natural course of spinal nerve root entrapment, first stage there is only sensory complaint presenting the sciatica with no objective clinical findings, the more the compression on the spinal nerve root is persistent, then fist the sensory fibers of the nerve root become affected manifested clinically as an objective sensory deficit. Further compression will affect the motor component of the nerve root and then will be manifested clinically as motor deficit so this consequence reflects the stages and the degree of nerve root compression so our findings that proves that the presence of sensory and or motor deficit affects the degree of improvement and response to caudal epidural injection although they still got significant improvement compared to their baseline.

In our study we had tried to analyze the degree of improvement of VAS and Owstery disability index after caudal epidural injection with MRI findings, we found that that presence than more than one herniated disc negatively affected the degree of improvement of VAS and Owstery disability index although those group still showed significant improvement compared to their base line. In addition, those patients with spinal stenosis in MRI findings showed less significant improvement compared to patient with only one herniated disc but still they experienced significant improvement of pain and disability score compared to their base line.

Revising the literature for these particular findings, we did not find a study that specifically analyze the degree of improvement after caudal epidural with lumbosacral MRI. But almost all the studies documented the general improvement after caudal epidural

injection as mentioned before. Carried out meta-analysis for efficacy of epidural injections in managing [24].

Chronic spinal pain and reported that the evidence is level II for caudal and lumbar interlaminar epidural injection with level III evidence for lumbar transforaminal epidural for lumbar spinal stenosis. The evidence is level III for axonal or discogenic pain without facet arthropathy [24].

In Conclusion; ultrasound guided caudal epidural injection is very effective and safe tool for short-term pain relief in patients with chronic back pain associated with sciatica without any obvious side effects. The degree of improvement of pain and function is negatively influenced by the age, body mass index, diabetes mellitus, the presence of sensory and or motor deficit as well as the presence of multiple herniated disc and spinal stenosis in lumbosacral MRI. However, patients having those variables still had a significant improvement of their symptoms compared to their base line.

References

1. Dixit RK and Schwab JH. Low back pain and neck pain. In stone JH, editor: A clinician pearl's and myths in rheumatology, New York. Springer. 2009.
2. Jarvik JG and Deyo RA. Diagnostic evaluation of low back pain with emphasis on imaging. Ann Intern Med 2002; 137: 586-597.
3. Carette S, LeClair R, Marcouxs S, Morin F, Blaise GA and St-Pierre A, et al. Epidural corticosteroid injections for sciatica due to herniated nucleus pulposus. N Eng J Med. 1997; 336: 1634-1640.
4. Pinto R, Maher C, Ferreira M, Hancock M, Oliveira VC, Mclachlan AJ, et al. Epidural corticosteroid injection in the management of sciatica. A systemic review and meta-analysis. Ann Intern Med. 2012; 157: 865-877.
5. Vydyanathan A and Narouz S. Ultrasound guided caudal epidural injections and sacroiliac joint injection. Tech Reg Anesth Pain Manag. 2009; 13: 157-160.
6. Waldman S. Ultrasound guided caudal epidural. Chapter 101 in: Comprehensive atlas of ultrasound guided pain management injection techniques. Editor Lippincott Williams & Wilkins, 2014; 710-718.
7. Ackerman WE and Ahmad M. The efficacy of lumbar epidural steroid injections in patients with lumbar disc herniations. Anesthesia Analog. 2007; 104: 1217-1222.
8. Abdi S, Datta S, Trescot AM. Schultz DM, Adlaka R and Atluri SL, et al. Epidural steroids in the management of chronic spinal pain: a systematic review. Pain Physician. 2007; 10: 185-212.
9. Watts RW and Silagy CA. A meta-analysis on the efficacy of epidural corticosteroid in the treatment of sciatica. Anaesth Intensive Care. 1995; 23: 564-569.
10. Sayegh FE, Kenanidis E, Papavasiliou KA, Potoupnis ME, Kirkos JM and Kapetanos GA. Efficacy of steroid and non-steroid caudal epidural injections for low back pain and sciatica: a prospective randomized double- blind clinical trial. Spine. 2009; 34: 1441-1447.
11. Bush K and Hillier S. A controlled study of caudal epidural injections of triamcinolone plus procaine for the management of intractable sciatic. A Spine (Phila Pa 1976). 1991; 16: 572-575.
12. Nandi J and Chowdhery A. A randomized controlled clinical trial to determine the effectiveness of caudal epidural steroid injection in lumbosacral; sciatica. J Clin Diagn Res. 2017; 11: RC04-RC08.
13. Iversen T, Solberg TK, Rommer B, Wilsgaard T, Twisk J and Anke A, et al. Effect of caudal epidural steroid or saline injection in chronic lumbar radiculopathy. Multicenter, blinded randomized controlled trial. BMJ. 2011; 343: d5278.
14. Lee JH, Choi KH, Kang S, Kim DH, Dong HK and Kim BR, et al. Non-surgical treatment for patients with radicular pain from lumbosacral disc herniation. Spine J. 2019; 19: 1478-1489.
15. Possolon D, Ferreira PH, Dario AB, Almeida L, Vesentini G and Harmer AR, et al. Is there an association between diabeters and neck and back pain? A systematic review with meta-analysis. PLos One 2019; 21; 14: eo212030.
16. Iskra DA. Comorbidity of type 2 diabetes mellitus and low back pain. Zhurnal Nevrologii I Psikhiatrii Imeni SS Korsakova. 2018; 118: 126-130.
17. Kim WH, Sim WS, Slin BS, Lee CJ, Jin HS and Lee JY, et al. Effects of two different doses of epidural steroid on blood glucose level and pain control in patients with diabetes mellitus. Pain Physician. 2013; 16: 557-568.
18. Gokcek E, Kilic ET, Kaydu A and Sahin OF. The effects of body mass index on caudal epidural steroid injection. Annals of medical & health sciences Research. 2017; 7: 428-431.
19. Lean MEJ, Han TS and Seidell JC. Impairment of health and quality of life using new US fedral guidelines for the identification of obesity. Arch Intern Med. 1999; 159: 837-843.
20. Baysal PK, Baysal O, Erkiline A, Gurcii ME, Golboyu BE and Ekinci M, et al. Administered epidural steroid injection for back pain bel agrisicin epidural steroid Enjeksiyonu Uygulanan Hastalarda Beden Kitle indeksinin Etkisi.
21. Klocke R, Jenkinson T and Glew D. Sonographically guided epidural steroid injection. J Ultrasound Med. 2003; 22: 1229-1232.
22. Dammers R and Koehler PJ. Lumbar disc herniation: Level increases with age. Surg Neurol. 2002; 58: 209-212.
23. Billy GG, Lin BAJ and Chow MX. Predictive factors of the effectiveness of caudal epidural steoid injections in managing patients with chronic low back pain and radiculopathy. Clin Spine Surg. 2017; 30: E833-E838.
24. Kaye AD, Manchikanti L, Abdi S, Alturi S, Bakshi S and Benyamin R, et al. Efficacy of epidural injection in managing chronic spinal pain: Absent evidence synthesis. Pain Physician. 2015; 18: E939-1004.