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ROLE OF EPIDURAL STEROID INJECTION IN MANAGEMENT OF HERNIATED INTERVERTEBRAL DISC WITH RADICULOPATHY

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ABSRACT

•**Backgroung:** Epidural steroid injection is an important modality in the conservative management of herniated intervertebral disc with radiculopathy. Epidural steroid injections (ESI) have been used since the 1950s for treatment of back pain[1,2], and it was considered from that time till now as a low-risk alternative to surgical intervention in the treatment of intervertebral disc herniation in some patients for whom non-invasive treatment has failed. It has been advocated because it modulates the body's response to inflammatory stimuli such as those related to a disc herniation. However, controversy still persists regarding their effectiveness in reducing the pain and improving the function with literature both supporting and opposing them are available. •**Objective:** The aim of the study is to assess the efficacy of Epidural Steroid Injection (ESI) in managing radicular pain due to herniated intervertebral disc. •**Patients and Methods:** This follow up prospective study was planned to know the results of epidural injections with corticosteroids in managing of symptomatic patients with intervertebral disc herniation, a total of one hundred sixty-six (166) patients aged from 25 years to 80 years were enrolled in the study of both sexes, of two affected spine regions : lumbar and cervical with different levels of disc herniation associated with radiculopathy. After failure of conservative treatment for at least 6 weeks, those patients were managed in Baquba's Pain Management Center by epidural steroid injection (ESI) at the same affected disc level and entrapped nerve root. All the patients were evaluated before and after the ESI using Visual Analogue Score (VAS) and the Oswestry Disability Index (ODI). •**Results:** Patients sample was 166 cases included 92 (55%) male and 74 (44%) female, a total of 227

ESI were given for those patients in lumbar and cervical regions by caudal, interlaminar and transforaminal techniques. Pre-procedural VAS scores for lumbar and cervical patients were 7.93, 8.18 respectively. 137 (82.5%) cases responded very well to ESI (patients developed ≥ 50% pain relief within 2 weeks after first injection) from those lumbar cases were 120 (72.2%) and cervical were 17(10.2%). The number of unresponded cases was 29 (17.4%): 24(14.4%) lumbar and cervical were 5 (3%). •**Conclusion:** Epidural Steroid Injection (ESI) is an effective, simple, minimally invasive and safe method in treating symptomatic herniated intervertebral disc and it could avoid the patient surgical interventional option.

KEYWORDS: epidural steroid injection, herniated intervertebral disc, radiculopathy.

INTRODUCTION

Epidural steroid injections (ESI) have been used for decades for the treatment of spinal pain, particularly for radicular symptoms and radiculopathy. Chronic low back pain with or without sciatica due to prolapsed intervertebral disc is a common problem faced by the orthopaedic surgeons.[3,4] It causes considerable disability and loss of work resulting in significant individual, social and economic burden worldwide. Low back pain is a major public health problem and is beginning to exhibit epidemic proportion.[5]

It is the second leading symptomatic cause of visit to a physician in the United States.[6] In approximately 5% of the adult population, low backache becomes a persistently disabling condition.[7] It affects men and women equally, with onset most often between ages of 30-50 years. Low backache is the most common cause of work related disability in terms of worker's compensation and medical expenses. Risk factors include heavy weight lifting, twisting, obesity and poor postures etc.[8] All kind of conservative and surgical treatments have been used with varying success. Non-surgical treatment of chronic low back pain covers a wide range of alternatives including conventional physiotherapy, manipulations and other manual methods of traction. These conservative methods throw a considerable burden on general practitioners, surgeons and hospital outpatient department.[9,10] Surgical treatment in the form of excision has it's own disadvantages like persistence of back pain, infection, postoperative adhesions and mechanical instability. Solberg et al., in their study, reported a 4% risk of worsening of symptoms after a lumbar discectomy.[11] Clinical research has shown that epidural steroid injections can, in many cases, provide significant long-term relief of pain due to nerve root irritation.[12,13] and reduce the chances of needing surgery for disc herniation

with radiculopathy[14, 15] Other studies have shown pain relief on the order of weeks or months. This is often enough time to allow patients to progress through a rehabilitation program and improve their level of function and ability to work.

Patients and methods

This study was conducted in the Baqua's Pain Management Center of Baquba Teaching Hospital. It was a follow up prospective study that was planned to know the results of epidural injections with depot corticosteroids in management of intervertebral disc herniation with radiculopathy from Feberuary 2015 to March 2017 in our city (Diyala province). A total of one hundred sixty-six (166) patients aged from 25 years to 80 years (mean 52.5)*(Table 1)* were enrolled in the study of both sexes, of two most affected spine regions: lumbar and cervical with different levels disc herniation including multiple levels and post-surgery radiculopathy. Those patients either consulted Baquba's Pain Management Center or referred to the center by a neurosurgeon, a neurophyscian, an orthopedic or a rheumatologist. A detailed clinical examination was done for all patients, they had symptomatic disc herniation: complaining of backache or neck pain with radiculopathy for more than 6 weeks duration with a positive SLR (straight leg raising) test and not responding to the conventional treatment for at least 6 weeks. Investigations included complete blood count with ESR, coagulation profile, Blood sugar, X-Ray Spine (AP and lateral view) along with Magnatic Resonance Imaging (MRI) that confirmed the diagnosis and identified the spine region that was affected and which disc level that was herniated *(Table 2)*.

Exclusion Criteria

Motor deficit and bladder/bowel involvement, bleeding disorder, local sepsis at the site of injection and spinal deformity. Informed written consent was taken from all patients.

Epidural steroid injection (ESI) was given (1) for cervical spine by interlaminar approach only, because transforaminal method was omitted in the cervical region due to complications. (2) for lumbar spine ESI was given either by caudal, transforaminal or interlaminar route following standard protocols. Under aseptic measures, skin was prepared and anaesthetized.

During all procedures, peripheral venous access was secured in all the patients with 20 G intravenous cannula on the dorsum of hand. Patients were connected to the patient monitor for monitoring ECG, heart rate, non-invasive blood pressure (NIBP) and pulse oximetry. Cleaning and draping of the procedure site was done under complete aseptic technique.

Interventional procedures

Caudal epidural injection: The patient was laid prone on the table and the sacral cornua were identified as two bony prominences on either side of midline of fourth sacral vertebrae. The gap between them indicates the position of sacral hiatus. After cleaning the area and superficial sterilization of the skin and subcutaneous tissue over the hiatus, the patient was injected with 3 to 5 mL of 1% lignocaine to produce local anaesthesia. Touhy needle G 18, 3.5 inch length was then thirsted in just below the hiatus with an angulation of 45 degree to the surface until it reached the bone. It was then slightly withdrawn and made parallel to the surface and advanced further to enter the sacral canal. The position of the tip of needle in the canal was confirmed fluoroscopically by an image intensifier. The stylet was then withdrawn and care was taken that neither the cerebrospinal fluid nor blood escaped, then 1 to 2 mL of non-ionic contrast (iohexol 300%) was injected to confirm the needle placement in the caudal epidural space. Solution was injected at the rate of 5 to 10 mL/min. If blood vessel was punctured, the needle was withdrawn few mm and then the solution was injected. Injected medications were composed of 2 mL 80 mg of methylprednisolone acetate (Depo-Medrol) plus 2 ml of 0.5% bupivacaine plus 2 ml hyaluronidase 1500 I.U. diluted to 12 ml by normal saline. As the solution runs in, most patients feel some lower sacral aching, sometimes referred to back of both thighs. A sufferer of lumbosciatic syndrome nearly always states that the pain in the limb is reproduced first in the buttocks then in the thigh and leg. If the dural puncture occurred, the needle was withdrawn and the procedure was postponed for the next day. This type was done for post-surgery radiculopathy and for multiple levels (L4 and below) and if there was disc herniation above and below L4 vertebra we did management by transforaminal injection for the level above L4 and caudal for the below.

Interlaminar epidural injection

(1) *in the cervical region*: ESI was given in sitting or prone position, Tuohy needle G 16, 3.5 inch length was inserted between C7 T1 level under fluoroscopic guidance with contrast, we obtained the epidural space either by suction drop or loss of resistance, catheter was introduced through Touhy needle to reach the herniated disc level confirmed by contrast material injection then through the catheter we gave the medication which was composed of methylprednisolone 40 mg + hyaluronidase 1500 I.U.+ 2 ml 0.5% bupivacaine diluted to 5 ml. (2) *in lumbar region*: ESI was done at the same affected level in sitting, lateral, or prone position and could be without fluoroscopy or contrast just by loss of resistance method. Spinous processes of the superior and inferior lumbar vertebrae were identified and the

Tuohy needle G 18, 3.5 inch length was advanced perpendicular to skin through the ligaments, with the opening facing laterally. Confirmation of the space was made by the loss of resistance sign followed by confirmation by contrast medium injection. While injecting the solution, the needle was rotated through 90 degree either upwards or downwards depending on the area to be blocked. This method was done if there was single level disc herniation with mild stenosis of neural foramen and not obstructed on MRI view. Injected dose consisted of 2 ml 80 mg methylprednisolone + 2 ml 0.5% bupivacaine + 1500 I.U. hyaluronidase diluted to 12 ml.

Transforaminal Epidural Steroid Injection (TFESI): were performed under C-arm fluoroscopic guidance. Initial anteroposterior (AP)images were obtained to identify the level and interlaminar space in a prone position with a 10 cm high pillow placed under the abdomen to decrease lumbar lordosis. a 22 gauge blunt curved needle was used. The target point was accessed by the subpedicular safe triangle[16,17] approach in the oblique position. In all of the TFESI applications, a mixture of 40 mg of methylprednisolone acetate in 2 ml of 0.5% bupivacaine + hyaluronidase 1500 I.U. diluted up to 5 mL was used. After placing the needle into the target point, 0.5 to 2 mL nonionic contrast material (Iohexol 300%) was injected to determine whether vascular leakage or intrathecal distribution occurred. After the accurate anterior epidural flow pattern was observed on oblique, anteroposterior, and lateral images, 5 mL of the mixture was injected if TFESI was performed for a single level. If TFESI was performed for more than one level, the same mixture per each level was injected, but the total steroid dose was maintained constant; for example, a total of 2 mL of 80 mg methylprednisolone acetate in 0.5% bupivacaine mixture was administered for all levels. In the case of vascular leakage, the needle site was slightly repositioned and recontrolled by contrast material. If vascular leakage persisted, the procedure was canceled for that level. If the intervention was performed for more than one level, the erroneous injection of the residual mixture into the subsequent level was avoided by flushing the needle with sterile isotonic after each level.

The patients were monitered by vital signs and any neurological deficit in post-injectioin room for at least 2 hours before discharge, every 10 minutes for 1st half hour then every 30 minutes for the next 1.5 hours.

All the patients were evaluated before and after the ESI with follow up for one year duration. The patients were first reviewed after two weeks, and then further follow up was carried out

at one month, three months, six months & one year after the epidural steroid injection. During follow up, the Oswestry Disability Index (ODI) and (VAS) were used to evaluate the response of treatment. The ODI was employed to quantitate the level of functional disability. It consists of ten questions, each with six alternative scores 0–5.[18-20] The sum of the scores was expressed as a percentage. A change of more than 10 points or a change of a minimum of 20% was considered a significant clinical improvement. VAS score was used for assessment of current low backache, neck, upper and lower extremity pain, ranging from 0 (no pain) to 10 (worst pain possible). If a patient subjectively reported a 50% decrease in pain within two weeks after a single injection, no more injections were administered, to be seen after further 2 weeks. If the patient didn't have improvement within a two weeks, a second injection was performed. Patients with neck, low back, upper or lower limb radicular pain not responding to second dose of ESI were considered for surgery. If the patient didn't have subjective improvement (50% pain decrease) even after a second dose of ESI, considered as failure of ESI. The success rate of epidural steroid injection was presented as percentage. The total number of patients who received the epidural steroid injection irrespective of follow up status was considered as denominator. All patients were advised to take mild analgesics (Tab. tenoxicam 20 mg per oral once a day + paracetamol 1 gram 8 to 6 hourly) during the post injection period. No special exercise program or other physical therapy was employed after the injections.

RESULTS

In this our prospective study a total number of patients was one hundard sixty-six (166), 92 (55%) were male and 74 (44%) were female, their weights ranged from 50 to 150 kilograms with mean (61.9 ± 34.3), their heights mean was (161.2 ± 4.6 cm) a total number of given ESI were 227, included 3 types of interventional techniques: caudal 36 (15.8%), interlaminar 84 (37%), and transforaminal 107 (47.1%). Pain duration was from 3 weeks to 2 years *(Table 1)*.

The most affected regions of spinal column was lumbar 144 patients (86.7%) and cervical 22 patients (13.2%) and the most affected disc level in the lumbar region was L4L5 86 patients (76,7%) and the 2nd one was L5S1 23 patients (20.5%) while in cervical was C5C6 11 patients (61.1%) and the 2nd one was C4C5 and C6C7 3 patients (16.6%). Patients with affected multiple levels in lumbar region was 20 (13.8%) but in cervical was 3 (13.6%), postsurgical patients in lumbar was 12 (8.3%) and in cervical just 1 (4.5%) *(Table 2)*.

A total number responded cases (those who had experienced > 50% symptoms relief) was 137 (82.5%): 120 lumbar patients (72.2%) of total, (83.3%) of lumbar cases and 17 cervical patients (10.2%) of total, (77.2%) of cervical cases *(Table 3)*. The mean pre-procedural Visual Analogue Score (VAS) for lumbar and cervical was 7.93, 8.18 respectively. Lumbar cases' post-procedural 2nd week, 1st month, 3rd month, 6th month and 12th month mean VAS scores were: 3.21, 2.87, 3.15, 3.35, 3.25 respectively while for cervical cases VAS scores were: 2.98, 3.33, 3.50, 3.65, 3.67 respectively (Fig. 1).

The total number of unresponded patients (those who hadn't reached 50% symptoms relief although they recieved 2 successive ESI injections with 2 weeks interval) and considered failed ESI, was 29 (17.4%): 24 lumbar cases (14.4%) of total, (16.6%) of lumbar cases and just 5 cervical cases (3%) of total, (22.7%) of cervical patients.

No catastrophic complications were recorded in all three interventional procedures but minor complications were observed in 29 patients (17.4%), 6 (3.6%) of them had dural puncture, 4 patients were managed with rest, hydration and caffeine-containing analgesia and another 2 (1.2%) were treated by epidural blood patch to relief the post-duralpuncture headache due to unresponsiveness. 10 (6%) patients developed transient paresthesia that recovered completely within 3 hours. 4 (2.4%) cases developed transient increased pain that responded to simple analgesia and subsided within 24 hours post-injection. 5 (3%) cases experienced vasovagal reaction that was managed with atropine 0.5 mg I.V. and crystalloid solution *(Table 4)*.

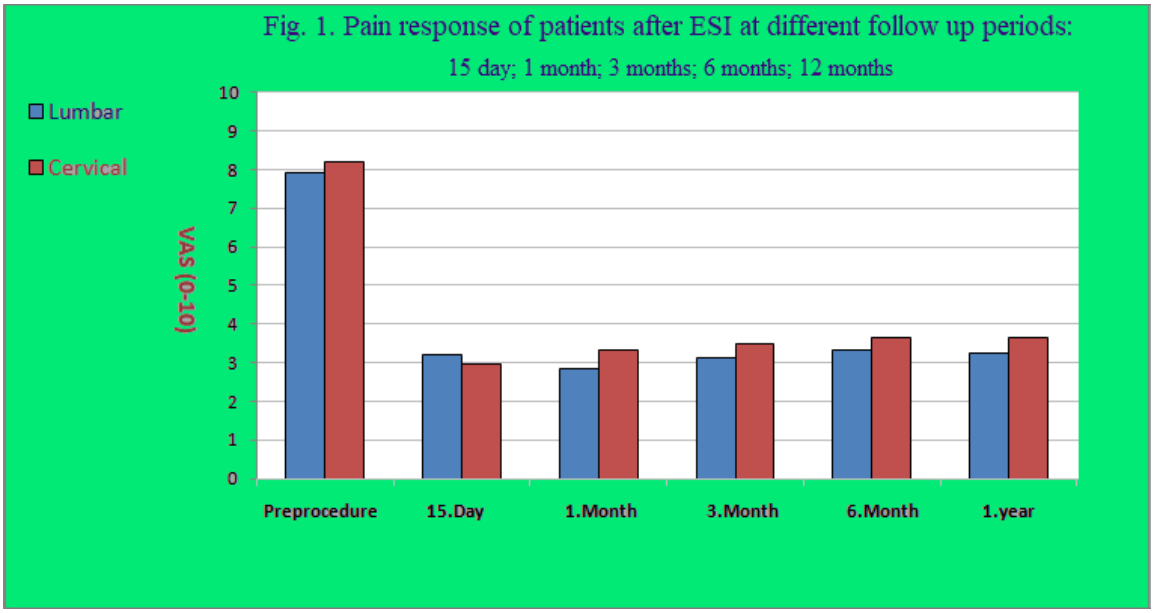
Table (1). Demographic features of Patients.

Age (years) Mean ± SD		52.5 ± 13.1
Gender	Male	92 (55%)
	Female	74 (44%)
Weight (kg) Mean ± SD		61.9 ± 34.3
Height (cm) Mean ± SD		161.2 ± 4.6
Number of injections	Total	227
	caudal	36 (15.8%)
	Interlaminar	84 (37%)
	transforaminal	107 (47.1%)
Pain duration		6 weeks to 2 years

Table (2). Distribution of patients according to affected spinal region and level of herniated discs				
Spine region			Patients NO.(%)	Total NO.(%)
Lumbar	Single level	L2L3	1/112 (0.81%)	112/166 (67.4%)
		L3L4	2/112 (1.7%)	
		L4L5	86/112 (76.7%)	
		L5S1	23/112 (20.5%)	
	Multiple level		20/144 (13.8%)	20/166 (12%)
	Post-surgery		12/144 (8.3%)	12/166 (7.2%)
Cervical	Single level	C3C4	1/18 (5.5%)	18/22 (81.8%) 18/166 (10.8%)
		C4C5	3/18 (16.6%)	
		C5C6	11/18 (61.1%)	
		C6C7	3/18 (16.6%)	
	Multiple level		3/22 (13.6%)	3/166 (1.8%)
	Post-surgery		1/22 (4.5%)	1/166 (0.6%)

Table(3): Distribution of cases according to pain response to ESI

Responded cases	Total NO.(%) 137 (82.5%)	Pre-injection VAS Mean	Post-injection at 15th day VAS Mean	Post-injection at 1st Month VAS Mean	Post-injection at 3rd Month VAS Mean	Post-injection at 6th Month VAS Mean	Post-injection at 12th Month VAS Mean
Lumbar	120 (72.2%)	7.93	3.21	2.87	3.15	3.35	3.25
Cervical	17 (10.2%)	8.18	2.98	3.33	3.50	3.65	3.67



Table(4): Distribution of cases according to complications of ESI	
Complication	**No.(%)**
Dural puncture	6 (3.6%)
Post-dural puncture headache	2 (1.2%)
Subdural block	2 (1.2%)
Transient increased pain	4 (2.4%)
Transient paraesthesia	10 (6%)
Hiccup	1 (0.6%)
Menstrual irregularities	1 (0.6%)
Vasovagal reaction	5 (3%)
Total	**29 (17.4%)**

DISCUSSION

A number of studies have compared epidural steroid injections (ESI) with control injections for the nonoperative treatment of intervertebral disc herniation. Some investigations, including a number of randomized, prospective and blinded studies in which patients were followed for periods ranging from weeks to one year[21-25], showed epidural steroid injection to be beneficial. However, other comparative randomized and prospective studies of epidural steroid injection demonstrated no substantial effect on the clinical outcome.[26-30] The present study supports the use of epidural steroid injection in patients with continued severe symptoms after six weeks of noninvasive treatment because nearly more than one-half of the patients who received such an injection had a fairly rapid decrease in the symptoms. Epidural steroid injections have been used for decades in the management of low back pain. It is minimally invasive and effective treatment modality in many orthopaedic centres. The first reported use of epidural steroid was in 1952 by Robecchi and Capra[31] and are still an integral part of non-surgical management of low back and radiating pain. They used hydrocortisone in the first sacral root. Later on various researchers were used injection methylprednisolone (Depo-Medrol) and reported better results. Several studies in literature also have shown that ESI is effective in low back pain. In Bogduk series, out of 40 studies more than 4000 patients on lumbar and caudal steroid injections, 36 studies recommended in favour of the use of ESI in lumbosacral pain.[32] Similarly, Koes *et al* review the 12 randomised controlled trials to assess the efficacy of epidural steroid injections for low-back pain and found effective in six studies.[33] Helliwell *et al*. also demonstrated that ESI significantly improved the low back pain.[34] In this study we also used methylprednisolone and demonstrated that it was effective for relieving the symptoms of herniated disc as well as improving the functional status of the patients and it could avoid them surgical option.

The mechanism of pain due to herniated disc is mechanical or chemical stimulation initiates a sequence of events responsible for the generation of back pain and radiculopathy. Mechanical irritation caused by compression, traction and chemical irritation result in intraneural inflammation characterized by ischemia, edema, fibrosis and demyelination. As a result physiologic changes lead to an alteration of nerve function including muscle weakness, sensory deficit and hyperexcitability-pain. The pain due to herniated disc is thought to be arise from the release of arachidonic acid metabolites namely prostaglandin E2, thromboxane, phospholipase A2, tumour necrosis factor, and interleukin from herniated disc cells. The nerve roots, close proximity of herniated disc may sensitize by the above chemical mediator and cause low back and radicular pain.[35,36] Epidural steroids are believed to act by inhibiting the synthesis or release of the inflammatory substances thereby, reducing the intraneural oedema and venous congestion. In this study we used methylprednisolone and bupivacaine for the management of low back and radicular pain and this study showed significant relieve of the symptoms of herniated disc as well as improvement in the functional status of the patients.[37]

Thus our study supports the findings of the studies by Belivesus et al, they also showed that epidural injection of methyl prednisolone was more effective in long standing back pain and sciatica.[38] The various mechanisms have been described to account for the analgesic effect of ESI. Methyl prednisolone is a corticosteroid and is well known for its anti-inflammatory properties[39] and also stabilizes neural membranes, suppress ectopic neural discharges[40] and may have direct anaesthetic effect on small unmyelinated nociceptive C-fibers.[41] Bupivacaine is a local anaesthetic agent, also act as ‘flushing’ agents to dilute the chemical or immunologic agents that promote inflammation. It helps to flush out’ inflammatory mediators from around the area that may be a source of pain and also help to curtail inflammation by inhibiting phagocytosis, decreasing phagocytic oxygen consumption, reducing polymorphonuclear leukocyte lysosomal enzyme release, and diminishing superoxide anion production.[42-44] Additionally, it improves neural blood flow and dysfunction.[45] So our study shows that the combination of methyl prednilolone and bupivacaine more effective for the management of low back pain with radiculoparhy.

CONCLUSION

Carefully administered epidural steroid injection (ESI) is a safe and effective modality in the treatment of intervertebral disc herniation with radiculopathy. It is simple, minimally invasive

and can avoid operative intervention for variable time periods as well as improves the quality of life without surgical intervention. It can be considered to be a good supportive and symptomatic treatment option and can avoid countless days of disability and unnecessary hospital stay. It is not a new technique but deserves a wider use and scientific assessment.

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