Journal of Back and Musculoskeletal Rehabilitation 26 (2013) 85–91
DOI 10.3233/BMR-2012-00354
IOS Press

Fluoroscopy guided cervical interlaminar steroid injections in patients with cervical pain syndromes: A retrospective study

Serbülent Gökhan Beyaz[a,*] and Ali Eman[b]
[a]*Anesthesiology and Pain Management Center, Sakarya University Medical School, Sakarya, Turkey*
[b]*Ipekyolu State Hospital of Van, Anesthesiology, Van, Turkey*

Abstract.
OBJECTIVE: The objective of this retrospective study was to examine the efficacy of fluoroscopically guided cervical interlaminar epidural steroid injections (CILESI).
MATERIALS AND METHODS: Sixty-five patients who received their first fluoroscopically guided CILESI over a 12 month interval were retrospectively identified. Patients who had failed conservative non-surgical management and patients who were otherwise candidates of surgery were included in this trial of CILESI. The verbal numerical rating scales (VNRS) before the treatment, within one hour after the treatment, and upon follow-up, were analyzed.
RESULTS: The most preferred intervention level of CILESI was C5-C6. There was a statistically significant improvement in the VNRS scores from before the injection to immediately after the injection, and upon follow-up. Fifty-one patients (80%) had perfect/good scores. No major complications were encountered after CILESI, but one patient (1.54%) had a vasovagal reaction and another patient (1.54%) had a transient increase of pain after injection.
CONCLUSION: Fluoroscopy guided CILESI is a safe and an effective treatment for patients with cervical pain syndromes. The success rates show that a large percentage of the patients may obtain relief from radicular symptoms and avoid surgery for the follow-up period up to 12 months.

Keywords: Cervical, epidural, steroid, injection, interlaminar, complication

1. Introduction

Cervical epidural steroid injections are usually used to treat acute and chronic pain conditions involving the head, neck, and upper extremities [1,2]. The most common causes are spinal nerve compression secondary to stenosis with spondylosis or herniation of the nucleus pulposus. There are a diversity of conservative therapy options to treat this type of pain, including physical therapy, analgesia, and injections. Despite these conservative treatment options, pain may still persist [3]. There are prospective studies documenting a significant reduction in extremity pain following cervical epidural steroid injections [4,5].

Despite the ongoing debate on the long-term outcome following epidural corticosteroid injections [6, 7], prolonged pain relief may depend on the underlying structural and psychological pathology.

Two main approaches exist for the delivery of drugs into the cervical epidural space: interlaminar and transforaminal. The choice of which approach to use is commonly made by evaluating the patient's structural pathology, one's skill in performing each procedure, and then weighing the advantages versus the risks associated the particular technique. When multilevel pathology is present, the interlaminar route may facilitate multilevel spread [7].

*Corresponding author; Dr. Serbülent Gökhan Beyaz, Associate Professor, Anesthesiology and Pain Management Center, Sakarya University Medical School, Sakarya, Turkey. Mobile: +90 5322879490; Fax: +90 2642552105; E-mail: sgbeyaz@gmail.com.

ISSN 1053-8127/13/$27.50

In clinical practice, the most commonly used technique for identifying the epidural space is the loss of resistance to air or saline technique. The loss of resistance technique (without fluoroscopy guidance) may be inadequate for identifying the epidural space [1]. There has also been a report on the incidence of discontinuity in the ligamentum flavum in the cervical region [8]. The use of fluoroscopy can diminish these risks.

The purpose of our study was to assess the outcomes following cervical interlaminar epidural steroid injections (CILESI) for all etiologies of cervical pain syndromes in terms of the short-term effect.

2. Materials and methods

After the ethical committee approval of the university, 65 CILESI patients were retrospectively enrolled and evaluated in this study. All patients were treated between February 2010 and February 2011 in Ordu University Training and Research Hospital's pain management centre. Written and oral informed consent was obtained from all patients.

This study included patients who had 6 month duration of symptoms of neck pain and unilateral or bilateral arm pain that had shown no positive responses to medical or physical therapy. Medical therapies included NSAIDs, muscle relaxants, and in some cases, opioids. Physical therapies were used if there was no pain relief after two weeks of medical therapies. All patients had significant clinical symptoms of cervical spinal pathologies. An experienced radiologist detected cervical pathologic levels using magnetic resonance image (MRI). The exclusion criteria were coagulopathy, pregnancy, sepsis, and an allergy to the contrast material/drug to be used. Patients who did not accept intervention, or who had previous cervical epidural injections, or who had previous cervical spine surgery, or who had neurological deficits, were also excluded.

All patients were examined and imaging studies were reviewed by the first author prior to the injection. All injections were performed in the same way, as follows. If routine hemograms, biochemical and coagulation parameters were within normal limits and confirmed, patients were taken into OR. Starvation protocol was 6–8 hours on the injection day. At the fluoroscopy table, standard anesthesia monitorization (non invasive blood pressure, pulse oxymeter, ECG) was performed. Saline solution (NaCl 0.9%) infusion was started intravenously. The intervention site was cleaned with an iodine based antiseptic solution, and covered with caution using sterile drapes. 1–2 mg midazolam and 25–50 micrograms of fentanyl were administered intravenously and conscious sedation was performed. All cervical injections were performed using C-armed fluoroscopy. The intervention site was locally anesthetized with 0.5 ml of 2% prilocaine which was injected into skin and subcutaneous tissue. The injection level was determined after clinical evaluation and MRI. The needle was inserted in the closest point to the pathology. If there were multiple levels of pathologies, one middle point was selected for insertion considering cephalade and caudal dissemination.

The cervical interlaminar epidural steroid injections (CILESI) approach took place after the all patients were placed prone on the fluoroscopy table. Each CILESI was given at the same institution using the interlaminar technique at the level of the pathology. The position of the interspaces was confirmed with palpation using a rocking motion in the superior and inferior planes. After the midline of selected interspaces was identified by palpation and fluoroscopy, a 22 gauge $2\frac{1}{2}$-inch tuohy needle was advanced directly perpendicular to the skin. At posterior to anterior direction, the loss-of-resistance to air technique was used in order to identify the epidural space. After negative aspiration for cerebrospinal fluid or blood, 0.5 ml of non-ionic contrast material was injected in order to document appropriate contrast spread into the epidural space. Next, a combination of a total of 5 ml of 80 mg of triamcinolone acetonide with 3 ml bupivacaine 0.25% was injected into the epidural space. Diabetic patients with unstable blood glucose levels received 40 mg of triamcinolone acetate (the decreased dose).

After intervention, patients rested on the intervention table for 5 minutes. Then, they were transported to the recovery room. They stayed there for 2 hours, if no complication developed. All of the complications that occurred during the procedure were recorded. Patients were asked to sit, stand and walk before rating their pain score using the Verbal Numerical Rating Scale (VNRS, 0–10 scale). All the data obtained from the patients was recorded on the patient's charts. The patients were then discharged from the hospital and asked to return immediately to our pain clinic if unexpected events developed. At the follow-up (1, 3, 6, 9 and 12 months after the injection), the patients were asked for probable therapeutic effects, VNRS or complications. The obtained findings were recorded on the patients' charts for post-interventional follow-up. Moreover, their age, gender and MRI findings were also collected.

The patients' charts were then reviewed one year after the initial procedure for confirmation purposes.

Table 1
Modified North American Spine Society patient satisfactory score

Score	
Bad	No change of complaints; even worse.
Moderate	Epidural steroid helped me but I won't let this procedure again.
Good	Most of the complaints are relieved and I would again let this procedure if my complaints reappear.
Perfect	Epidural steroid satisfied me and fulfilled my expectations.

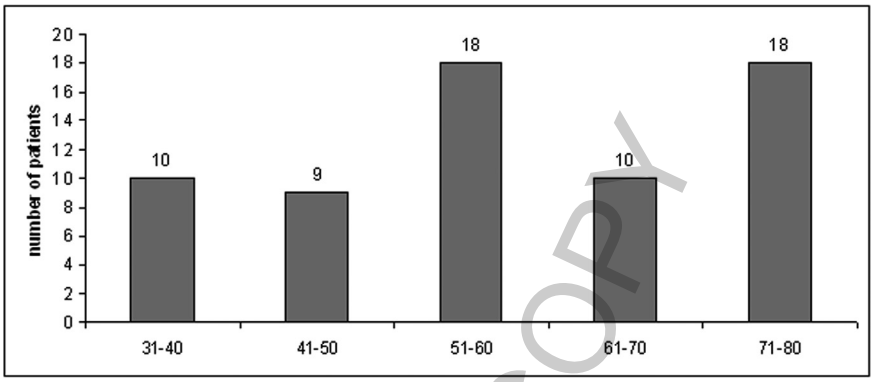

Fig. 1. Patients' age distribution.

Patients were called by telephone and questioned. A modified North American Spine Society (NASS) patient satisfaction score was recorded using a 4-grade scale (Table 1).

3. Statistical analysis

The SPSS (Statistical Package for Social Sciences) for Windows 17.0 software program was used with descriptive statistical methods (frequency analysis, cross table analysis, percentage, mean, standard deviation). The study data was evaluated and a statistical analysis was performed. Initial values and values at 1, 3, 6, 9 and 12 months were analyzed with ANOVA one-way variance analysis. The results were evaluated with a 95% CI (confidence interval). A value of $p < 0.05$ was accepted as significant.

4. Results

A total of 65 patients were included. Demographic features of patients were presented in Table 2. The mean age was 58.7 $\pm$ 13.6 years (range 31–80 years, Fig. 1). The mean weight was 65.8 $\pm$ 10.4 kg. The mean height was 159 $\pm$ 9.5 cm. 49 of them were female and 16 of them were male. The duration of symptoms was 1.8 $\pm$ 0.6 years.

Table 2
Demographic features of patients of CILESI implementation

Age, years	58.7 $\pm$ 13.6
Gender M/F	16/49
Weight, kg	65.8 $\pm$ 10.4
Height, cm	159 $\pm$ 9.5
Duration of symptoms, years	1.8 $\pm$ 0.6

Values are the mean $\pm$ SD and patient number.

On the evaluation of the MRI of patients, disc herniation, spinal degeneration, facet hypertrophy, spinal stenosis and many similar findings were recorded. Disc pathologies were classified into four classes and evaluated accordingly. Bulging, protrusion, extrusion and sequestration were the classes. The most affected site was the level of C5-C6 (Table 3). Bulging was the most encountered problem whereas no sequestrated disc was reported. Twenty-six patients had only discal pathologies. Twenty-two patients had both a discal pathology and some degeneration. Eleven patients had severe degeneration. Nine patients had spinal stenosis. Five patients had facet hypertrophy. The most preferred CILESI intervention site was the C5-C6 level (Fig. 2).

Pre-injection VNRS scores were average at 7.6 $\pm$ 2.2. With the post-injection at 1, 3, 6, 9, and 12 months, VNRS scores dropped significantly ($p < 0.001$, Fig. 3). There were no statistically significant differences between follow-up scores. The satisfaction scores were average 3.3 $\pm$ 0.9. 51 (80%) patients were classified as perfect or good satisfaction (Perfect: 36 patients; good:

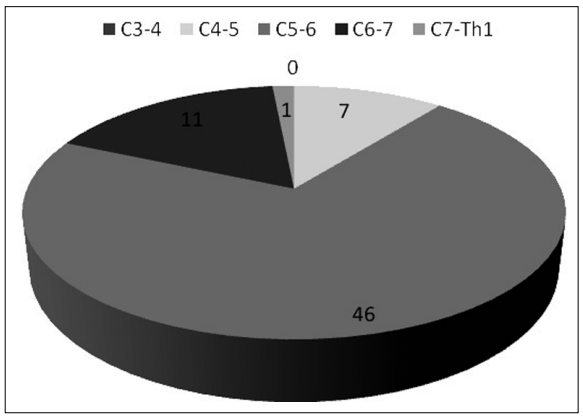

Fig. 2. Levels of CILESI performed. The most preferred CILESI intervention site was the C5-C6 level.

Table 3
Distribution of discal herniation levels

	C3-4	C4-5	C5-6	C6-7	C7-Th1
Bulging	14	21	29	16	0
Protrusion	9	8	18	21	0
Extrusion	0	0	0	0	1
Sequestration	0	0	0	0	0
CILESI*	0	7	46	11	1

*Levels CILESI performed.

16 patients, Fig. 4). Only one patient was then operated on because of intractable pain. Satisfaction scores were decreased with other of the addition of MRI to disc pathologies in patients ($p < 0.05$).

CILESI patients had no major complications (epidural hematoma, subdural complications, dural puncture and post-dural puncture headache, neuropathic symptoms, intracranial hypotension and epidural granuloma, permanent spinal cord injury, intravascular uptake of injectate, pneumocephalus, venous air embolism, cervical epidural abscess, Cushing's syndrome, death) [9]. Minor complications (common complications reported include increased axial neck pain [10, 11], non-positional headache [10], facial flushing [11] and vasovagal episodes [9,10,12,13]) were seen in one patient (1.54%) as vasovagal reaction, and another patient (1.54%) had a transient increase of post-injection pain. No repeated injection was performed on any patient.

5. Discussion

Cervical pain syndromes have a reported incidence of 83 per 100.000 (approximately) [9,14]. The most common cause of cervical pain syndrome was a herniated disc, which accounted for 40% in this study. The initial treatment of these symptoms was conservative, non-interventional management which included bed rest, physiotherapy and medications [15,16]. Cervical steroid injections were often tried for patients whose pain did not relieve despite weeks or months of conservative management [12,17].

The chronic spinal pain syndrome treatment involves epidural steroid injections which are frequently preferred [18,19]. The belief is that the use of corticosteroids has actions other than anti-inflammatory. Corticosteroids stabilize nerve membranes by inhibiting ectopic impulses, inhibiting ion conductance,hyperpolarizing spinal neurons, and inhibiting C fiber transmission. These latter properties of corticosteroids can explain relief symptoms in non-inflammatory states [14].

Cicala et al. [17] reviewed the results of cervical epidural steroid injections in 79 patients with axial neck pain in 1989. At 6 months post injection, they found that 71% (perfect 41.4%, good 29%, poor 29.3%) of the patients had good to perfect relief from their symptoms. Ferrante et al. [12] conducted a retrospective study in 1993 and evaluated 100 patients. 67% of patients relieved after injection. A retrospective study in 1986 by Rowlings and Kirschenbaum [4] evaluated 25 patients over 9 months of follow-up. 75% of patients were relieved after injection. Mangar and Thomas [20] conducted a study on 40 patients who have cervical pathologies. 68% of them were relieved after injection. In a study in 1996 on 68 cervical radiculopathy patients conducted by Bush and Hillier [6], a corticosteroid injection was performed on 64 of them using imaging-techniques. Follow-up was an average of 39 months. If necessary, the injection was repeated (2.5 injections per patients were administered more than once serially for pain relief). They reported that there were no arm (upper extremity) pains in 46 patients (76%). They concluded that repeated epidural steroid injections provide satisfactory results in cervical radiculopathy. Surgery could be postponed or avoided for 39 months.

However, our CILESI study was conducted on potential surgery patients and showed that single-dose CILESI under the guidance of fluoroscopy provided a significant decrease of VNRS scores after injection (during 12 month follow-up). Although VNRS scores gradually increased until the 12th month, this increase was not statistically significant between follow-up scores. Only 5 (7.7%) of the patients reported a satisfaction score as "bad". In other words, 92.3% of the patients were satisfied after intervention. 80% of them were in the perfect/good classification.

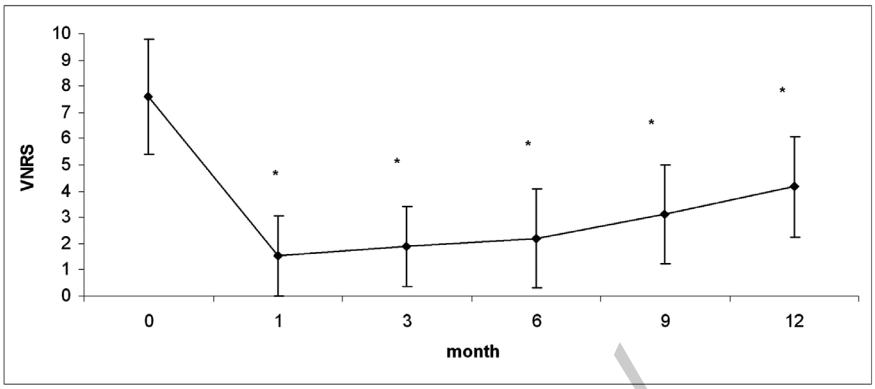

Fig. 3. Distribution of VNRS scores versus months. *Statistically significance differences between baseline VNRS scores and follow-up scores with ANOVA $p < 0.001$.

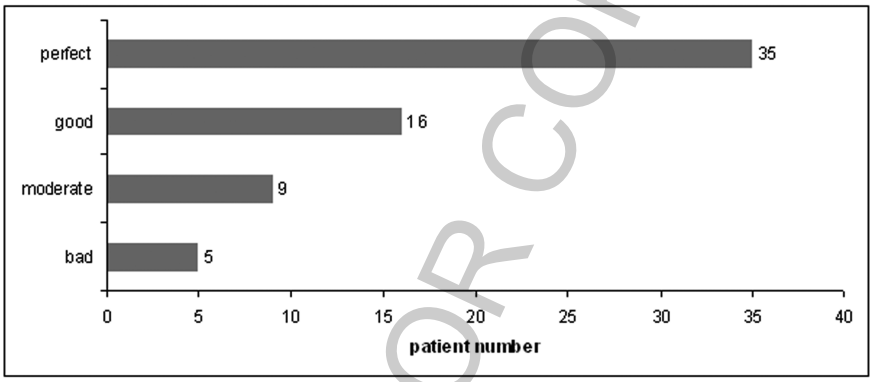

Fig. 4. Satisfaction scores of patients. Data are given as number of patients.

We performed CILESI via the midline interlaminar approach, which was relatively easy. The transforaminal approach offers another route to the epidural space, but this is considered technically difficult and it has catastrophic complications [21]. However, no study has yet compared the clinical effects of the interlaminar and transforaminal approaches.

The complications of CILESI are infrequent and minor [17]. In our series, no serious complications occurred during or after CILESI. Only one patient had increased neck pain and one patient had a vasovagal reaction (total of 2 patients, 3.08%). Catcholove et al. [22] conducted a study on 45 CILESI patients and they reported 6 hypotension, 1 respiratory failure and 1 unidentified unilateral block (complications rate was 17.7%). Waldman [13] conducted a prospective study on 215 patients; 23 of them did not return (23 lost to follow- up), 3 patients had minor complications and 3 patients had major complications (3 patients had vasovagal reactions, 2 had a dural puncture and 1 patient had a superficial abscess with a total complication rate of 3.13%).

On investigation of the relevant reviews in the literature, it is seen that most of the CILESI studies before 2000 were conducted via blind loss of resistance or the hanging drop technique [9,12,13,17,22]. However, this study was conducted via fluoroscopy guidance, therefore our minor complication rate was lower than any other studies. No major complication was seen. Many CILESI studies have been performed without imaging guidance. However, fluoroscopy guided techniques increase the procedure precision and help confirm the correct needle placement. Because fluoroscopy-guided techniques should lead to better results and reduce complication rates, they are now becoming more popular than ever [11,23]. The loss of resistance technique may be inadequate for ensuring accurate needle placement during unguided cervical epidural injections [10]. Besides, the VNRS scores of our patients were also lower at the 12 month follow-up. Satisfaction rates were accordingly higher. These successful results may be as-

sociated with our closer injections to the site of CILESI pathology.

Botwin et al. [10] conducted a prospective study which had the highest minor complication rate in the literature (16.8%). This highest complication rate may be associated with a thick and long needle (18-gauge, 9-mm Tuohy needle). Our CILESI needles were much thinner and shorter (22 gauge, $2^{1}/_{2}$-inch Tuohy needle). Nevertheless, one patient in our study underwent surgery. From this, they hoped to extrapolate the possible benefits of CILESI in preventing decompressive surgery. The data showed that their rates of cervical decompression surgery decreased during the period of CILESI use.

While these studies are being evaluated, it is controversial how to classify these complications. For example, some studies classify a dural puncture as minor complication [13,14,19] whereas some studies classify a dural puncture as a major complication [9,24,25]. Therefore, we believe that this issue should not be ignored while interpreting results.

The strongest feature of this study is that all CILESI were performed by the same first author. Of course, there are also some limitations to our study; for example, being a retrospective review and is not a controlled, blinded and randomized study, as some other studies [26–28]. It is well known that in invasive studies which it is not so easy to design randomized controlled trails because of logistic difficulties and also the typical double-blinded pharmacological trials with the inclusion of a drug against placebo and being able to include a control group. While a sham group that the other part of the procedure could be adjoined as a control group, it would pose further ethical and medico-legal dilemmas. It is very hard to predict the real etiology of pain which appears to have multiple associated pathologies with increasing age in a patient of chronic cervical spinal pain syndrome. That's why we evaluated all the effects of injections as a whole regardless of their etiologies. Our clinical follow-up of 12 months may not be sufficient in defining long-term success for the patients who did experience significant relief. However, we believe it may be equally important in defining significant short-term symptomatic improvement for a relatively benign procedure, particularly in these patient populations.

In conclusion, this presented study of chronic cervical spinal pain showed that fluoroscopy guided CILESI is a safe and effective method of treatment with high patient satisfaction rates and minimum complications. In the literature, there are no other studies which have this low rate of minor complications with no major complication. However, our results suggest that approximately more than 90% of patients with symptomatic cervical spinal syndromes can be treated effectively and avoid surgery for up to 12 months, and possibly longer, with a trial of CILESI.

References

[1] Kim KS, Shin SS, Kim TS, Jeong CY, Yoon MH, Choi JI. Fluoroscopically guided cervical interlaminar epidural injections using the midline approach: an analysis of epidurography contrast patterns. Anesth Analg. 2009;108(5):1658-61.

[2] Lin EL, Lieu V, Halevi L, Shamie AN, Wang JC. Cervical epidural steroid injections for symptomatic disc herniations. J Spinal Disord Tech. 2006;19(3):183-6.

[3] Benny B, Azari P, Briones D. Complications of cervical transforaminal epidural steroid injections. Am J Phys Med Rehabil. 2010;89(7):601-7.

[4] Rowlingson JC, Kirschenbaum LP. Epidural analgesic techniques in the management of cervical pain. Anesth Analg. 1986;65(9):938-42.

[5] Cicala RS, Westbrook L, Angel JJ. Side effects and complications of cervical epidural steroid injections. J Pain Symptom Manage. 1989;4(2):64-6.

[6] Bush K, Hillier S. Outcome of cervical radiculopathy treated with periradicular/epidural corticosteroid injections: A prospective study with independent clinical review. Eur Spine J. 1996;5(5):319-25.

[7] Derby R, Lee SH, Kim BJ, Chen Y, Seo KS. Complications following cervical epidural steroid injections by expert interventionalists in 2003. Pain Physician. 2004;7(4):445-9.

[8] Hogan QH. Epidural anatomy examined by cryomicrotome section. Influence of age, vertebral level, and disease. Reg Anesth. 1996;21(5):395-406.

[9] Abbasi A, Malhotra G, Malanga G, Elovic EP, Kahn S. Complications of interlaminar cervical epidural steroid injections: A review of the literature. Spine (Phila Pa 1976). 1 Sep 2007; 32(19):2144-51.

[10] Botwin KP, Castellanos R, Rao S, Hanna AF, Torres-Ramos FM, Gruber RD, et al. Complications of fluoroscopically guided interlaminar cervical epidural injections. Arch Phys Med Rehabil. 2003;84(5):627-33.

[11] Kwon JW, Lee JW, Kim SH, Choi JY, Yeom JS, Kim HJ, et al. Cervical interlaminar epidural steroid injection for neck pain and cervical radiculopathy: Effect and prognostic factors. Skeletal Radiol. 2007;36(5):431-6. Epub 2007 Mar 6.

[12] Ferrante FM, Wilson SP, Iacobo C, Orav EJ, Rocco AG, Lipson S. Clinical classification as a predictor of therapeutic outcome after cervical epidural steroid injection. Spine (Phila Pa 1976). 1993;18(6):730-6.

[13] Waldman SD. Complications of cervical epidural nerve blocks with steroids: A prospective study of 790 consecutive blocks. Reg Anesth. 1989;14(3):149-51.

[14] Huston CW. Cervical epidural steroid injections in the management of cervical radiculitis: Interlaminar versus transforaminal. A review. Curr Rev Musculoskelet Med. 2009; 2(1):0-42. Epub 2009 Jan 7.

[15] Wolff MW, Levine LA. Cervical radiculopathies: Conservative approaches to management. Phys Med Rehabil Clin N Am. 2002 Aug;13(3):589-608.

[16] Nawani DP, Agrawal S, Asthana V. Single shot epidural injection for cervical and lumbosaccral radiculopathies: A preliminary study. Korean J Pain. 2010;23(4):254-7. Epub 2010 Dec 1.
[17] Cicala RS, Thoni K, Angel JJ. Long-term results of cervical epidural steroid injections. Clin J Pain. 1989; 5(2):143-5.
[18] Manchikanti L, Cash KA, Pampati V, Wargo BW, Malla Y. Cervical epidural injections in chronic discogenic neck pain without disc herniation or radiculitis: preliminary results of a randomized, double-blind, controlled trial. Pain Physician. 2010;13(4):E265-78.
[19] Abdi S, Datta S, Trescot AM, Schultz DM, Adlaka R, Atluri SL, et al. Epidural steroids in the management of chronic spinal pain: A systematic review. Pain Physician. 2007;10(1):185-212.
[20] Mangar D, Thomas PS. Epidural steroid injections in the treatment of cervical and lumbar pain syndromes. Reg Anesth. 1991;16(4):246.
[21] Malhotra G, Abbasi A, Rhee M. Complications of transforaminal cervical epidural steroid injections. Spine 2009;34:731-739.
[22] Catchlove RF, Braha R. The use of cervical epidural nerve blocks in the management of chronic head and neck pain. Can Anaesth Soc J. 1984;31(2):188-91.
[23] Silbergleit R, Mehta BA, Sanders WP, Talati SJ. Imaging-guided injection techniques with fluoroscopy and CT for spinal pain management. Radiographics. 2001;21(4):927-39; discussion 940-2.
[24] Darvish B, Gupta A, Alahuhta S, Dahl V, Helbo-Hansen S, Thorsteinsson A, et al. Management of accidental dural puncture and post-dural puncture headache after labour: A Nordic survey. Acta Anaesthesiol Scand. 2011;55(1):46-53. doi: 10.1111/j.1399-6576.2010.02335.x
[25] Imarengiaye C, Ekwere I. Postdural puncture headache: A cross-sectional study of incidence and severity in a new obstetric anaesthesia unit. Afr J Med Med Sci. 2006; 35(1):47-51.
[26] Concato J, Shah N, Horwitz RI. Randomized, controlled trials, observational studies, and the hierarchy of research designs. N Engl J Med. 22 Jun 2000;342(25):1887-92.
[27] Benson K, Hartz AJ. A comparison of observational studies and randomized, controlled trials. N Engl J Med. 2000; 342(25):1878-86.
[28] Manchikanti L, Heavner JE, Racz GB, Mekhail N, Schultz DM, Hansen HC et al. Methods for evidence synthesis in interventional pain management. Pain Physician. 2003;6(1):89-111.