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FLUOROSCOPY GUIDED TRANSFORAMINAL STEROID INJECTION ON CERVICAL RADICULAR PAIN

SERVİKAL RADİKÜLER AĞRIDA FLOROSKOPİ EŞLİĞİNDE TRANSFORAMİNAL STEROİD ENJEKSİYONU

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SUMMARY:

Purpose: The aim of this study is to evaluate the benefit rate of cervical radicular pain from fluoroscopy guided transforaminal cervical steroid injection.

Materials-Methods: We collected data of 78 patients retrospectively from patient files. Only adults at least 18 years of age with upper extremity pain of at least 1 month duration at C5-6 or C6-7 levels of cervical spine were included. Each patient underwent a standard physical examination and was asked to complete a 100-mm visual analogue scale (VAS) questionnaire before transforaminal cervical steroid injection and 1, 3, 6 and 12 months after procedure.

Results: Mean pre- and post-injection VAS scores at 1st, 3rd, 6th, and 12th months were 8.34 ± 0.68 (7.24-9.64), 3.88 ± 1.45 (2.22-7.35), 3.95 ± 1.29 (2.12-6.87), 4.35 ± 1.12 (2.53-7.12), 4.43 ± 1.10 (2.10-6.15), respectively. The changes in pre- and post-injection VAS scores through follow-ups were statistically significant ($p<0.001$). Post-hoc tests (Wilcoxon signed-ranks test) revealed that the pre-injection VAS levels were significantly higher than the post-injection VAS scores. The changes in VAS scores at 1st, 3rd, 6th, and 12th months when compared to the pre-injection VAS scores were 53.9 %, 52.9 %, 48.1 %, and 47.1 %, respectively.

Conclusion: Fluoroscopy guided transforaminal cervical steroid injection has been postulated to be effective on cervical radicular pain because accurate delivery of medication to the site of pathology is possible.

Key Words: Cervical transforaminal steroid injection, cervical radicular pain, fluoroscopy guided injection

Level of Evidence: Retrospective clinical study, Level III

ÖZET:

Amaç: Bu çalışmanın amacı servikal radiküler ağrının floroskopi eşliğinde transforaminal steroid enjeksiyonundan fayda görme miktarının incelenmesidir.

Materyal-Metod: 78 hastanın verileri retrospektif olarak dosyalardan toplandı. Sadece en az 18 yaşında, 1 aydır devam eden C5-6 veya C6-7 seviye kaynaklı üst ekstremite radiküler ağrısı olan hastalar çalışmaya dâhil edildi. Her hasta standart fizik muayeneden geçti ve 100mm'lik vizüel analog skala skorları prosedür öncesi ve prosedürden 1,3,6 ve 12 ay sonra hesaplandı.

Sonuçlar: İşlem öncesi ve sonrası 1, 3, 6 ve 12. aylardaki ortalama VAS değerleri 8.34 ± 0.68 (7.24-9.64), 3.88 ± 1.45 (2.22-7.35), 3.95 ± 1.29 (2.12-6.87), 4.35 ± 1.12 (2.53-7.12), 4.43 ± 1.10 (2.10-6.15) olarak hesaplanmıştır. İşlem öncesi ve sonrası değerler arasında istatistiksel olarak anlamlı değişim bulunmuştur ($p<0.001$). Post-hoc testi (Wilcoxon signed-ranks test) işlem öncesi değerlerin işlem sonrasına göre anlamlı derecede yüksek olduğunu göstermiştir. İşlem sonrası 1., 3., 6. ve 12. aylardaki VAS skorlarının işlem öncesi değerler arasındaki değişim oranı ise % 53.9, % 52.9, % 48.1 ve % 47.1 olarak hesaplanmıştır.

Çıkarım: Servikal radikülopati ağrısında floroskopi eşliğinde yapılan transforaminal steroid enjeksiyonu etkilidir çünkü ilacı patolojinin olduğu yere uygulamak mümkündür.

Anahtar Kelimeler: Servikal transforaminal steroid enjeksiyonu, servikal radiküler ağrı, floroskopi eşliğinde enjeksiyon

Kanıt Düzeyi: Retrospektif klinik çalışma, Düzey III

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INTRODUCTION:

Neck and cervical radiculitis pain have been shown to be caused by intervertebral discopaties, cervical muscles, facet joints, ligaments, and nerve root dura which are capable of transmitting pain[13]. Cervical disc herniation is one of the most common indications for surgical interventions in the spine. Cervical radiculitis affects approximately 83 per 100,000 population per year[27].

The pathogenesis of cervical radicular pain is associated with multiple chemicals including nitric oxide, metalloproteinase, prostaglandin E2 and interleukin-6 of which are irritants of the spinal nerves causing inflammation[12]. Corticosteroids have anti-inflammatory affect and also stabilize nerve membranes inhibiting ectopic impulses, inhibits ion conductance, hyperpolarizes spinal neurons, and inhibits C fiber transmission[7,10].

Initial treatment of cervical radiculitis usually consists of activity modification, medical and physical therapy. Narcotic analgesics and analgesic adjuvant may be needed when pain is not adequately controlled. A cervical orthosis may provide comfort for some patients in the acute phase. If there is no improvement in 3–4 weeks of conservative treatment, cervical transforaminal steroid injections (CTSI) may be performed before suggestion of surgery.

Fluoroscopy allowed the development of injection procedures. CTSI have the advantage of being able to place medication directly around the dorsal root ganglion pathologically involved in causing a patient's radicular pain. We investigated 78 patients whom treated with CTSI for cervical radicular pain with the follow-up 1., 3., 6. and 12. months.

MATERIALS AND METHOD:

We collected data of 78 patients retrospectively from Maltepe University Department of Algology patient files. Only adults at least 18 years of age with upper extremity pain of at least 1 months duration at C5-6 or C6-7 levels of cervical spine were included. All patients had been evaluated with magnetic resonance imaging (MRI). Furthermore inclusion criteria were patients must have failed previous pharmacotherapy and physical therapy, MRI reports do not include sequestrated cervical disc herniations but bulging and protrusion at one side. Exclusion criteria were neurological deficit, pregnancy, coagulation disorders and have had an operation for cervical spine. CTSI procedure had been performed for all patients.

Transforaminal Injection Tecnique:

The patient is placed in the supine-oblique position on the fluoroscopy table. A towel is placed under the head to keep the neck parallel to the table. The patient is rolled into the correct position with the foramen perpendicular to the radiographic imager. A bolster is then placed behind the patient to support this position. The patient is prepped in a sterile fashion and sterile technique is utilized throughout the procedure.

Once correctly positioned, a skin wheal is raised with 10:1 mixture of 1% lidocaine and 8.4 % bicarbonate. A 22 gauge 1.5–2.5 inch (5 cm) spinal needle (10 cm in obesity) is advanced parallel to the radiographic beam to abut upon the mid-portion near the anterior edge of the superior articular process to gauge depth. The needle is slightly withdrawn and then redirected into the posterior aspect of the foramen 1–2 mm. The position is checked in the AP plane, the needle tip should be slightly beyond the lateral border of the cervical pillar. The needle is then advanced 1–2 mm in the AP plane. If nerve is contacted, the patient typically experiences pain or paraesthesia into the scapula or upper extremity. The needle should be slightly withdrawn off the nerve. The needle should not be advanced beyond the mid-sagittal line of the lateral mass.

Oblique and lateral views are checked to ensure the needle is in the posterior aspect of the foramen (Figure-1, 2). A 1cc syringe containing non-ionic contrast (Isovue or Omnipaque) is connected to low volume extension tubing and flushed with contrast. The extension tubing is then connected to the spinal needle hub after first providing a drop of contrast into the spinal needle to flush out any air. The extension tubing minimizes the chance of needle movement with attaching and detaching the various syringes. Furthermore, the tubing keeps the interventionalist's hand away from the fluoroscopic beam. Contrast 0.5–1.0 cc is then infused under live fluoroscopy carefully evaluating not only for outline of the nerve root but also for any vascular flow.

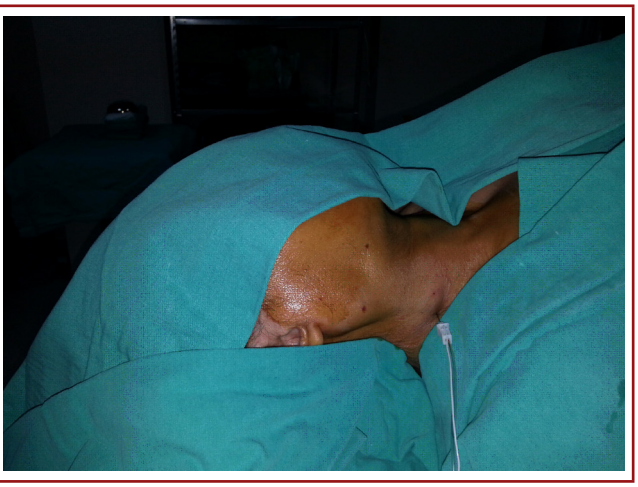

Figure-1. Position of the patient and the needle

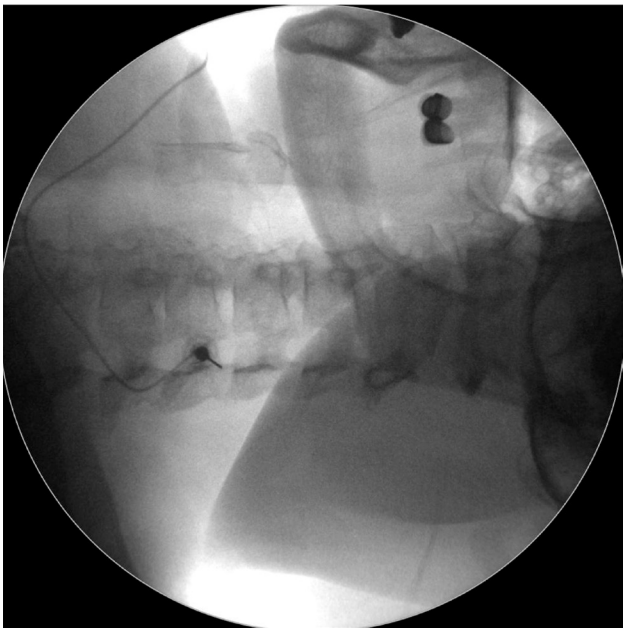

Figure-2. Oblique fluoroscopical view of the needle

Multi-planar fluoroscopic imaging of needle placement is performed before infusion of contrast (Figure-1, 2). Contrast should outline the nerve root with epidural flow and no vascular pattern. Preservative free 1% xylocaine 0.5–1.0 cc is then instilled under live fluoroscopy carefully watching for any vascular flow. After 90s, the patient is queried about peri-oral numbness, metallic taste, tinnitus, light-headedness, shortness of breath, and agitation. The patient is asked to move the fingers and toes, and pin-prick is tested on the hands and lower legs or feet. If there are no untoward effects, 1.5–2 cc dexamethasone may then be infused slowly. Before injecting, imaging is performed to ensure the needle position has not changed.

Follow-up:

Each patient underwent a standard physical examination and was asked to complete a 100-mm visual analogue scale (VAS) questionnaire, in which 0 mm represented no pain and 100 mm the worst imaginable pain, for upper extremity radiculopathic pain symptoms on movement during activities of daily living, before CTSI and 1, 3, 6 and 12 months after procedure.

Statistical Analysis:

Descriptive data of VAS scores were presented as mean, standard deviation, minimum and maximum. The categorical variables gender, level, and side were presented as frequency and percent. The comparisons between independent two groups were conducted by Mann-Whitney U test. The changes during the follow-ups were compared by using Friedman test, and when a statistically significant difference was observed, post-hoc analyses were performed by Wilcoxon test. SPSS software version 21 (IBM Inc., USA) was used for the statistical analyses. Statistical significance level was considered as 0.05 in the analyses of this study.

RESULTS:

Mean age of the patients was 58.15 ± 15.02 (27-79) years. 42 patients were female (53.8%), and 36 were male (46.2%). Mean age of the females and males were 63.21 ± 13.05 years and 52.25 ± 15.53 years, respectively (p=0.050, Mann-Whitney U test). 42 patients (53.8%) had injections at C5-6 level, 36 patients (46.2%) at C6-7 level, 30 patients (38.5%) on right side, and 48 (61.5%) on left side.

Mean pre- and post-injection VAS scores at 1st, 3rd, 6th, and 12th months were 8.34 ± 0.68 (7.24-9.64), 3.88 ± 1.45 (2.22-7.35), 3.95 ± 1.29 (2.12-6.87), 4.35 ± 1.12 (2.53-7.12), 4.43 ± 1.10 (2.10-6.15), respectively (Table-1). The changes in pre- and post-injection VAS scores through follow-ups were statistically significant (p<0.001). Post-hoc tests (Wilcoxon signed-ranks test) revealed that the pre-injection VAS levels were significantly higher than the post-injection VAS scores.

The changes in VAS scores at 1st, 3rd, 6th, and 12th months when compared to the pre-injection VAS scores were 53.9%, 52.9%, 48.1%, and 47.1%, respectively.

The comparisons of pre- and post-injection VAS scores according to gender are presented in Table-2, according to level in Table-3, and according to side in Table-4. The analyses revealed that all VAS scores were similar between males and females, C5-6 and C6-7, and left and right sides (p>0.05 for all).

Table-1. Pre- and post-injection VAS levels through follow-ups

	Mean	SD	Min	Max	p
Preinjection VAS	8,34	0,68	7,24	9,64	<0.001
1.month VAS	3,88	1,45	2,22	7,35	
3.month VAS	3,95	1,29	2,12	6,87	
6.month VAS	4,35	1,12	2,53	7,12	
12.moth VAS	4,43	1,10	2,10	6,15	

Table-2. Pre- and post-injection VAS levels according to gender

	Gender								p
	Female				Male				
	Mean	SD	Min	Max	Mean	SD	Min	Max	
Preinjection VAS	8,38	,76	7,24	9,64	8,29	,60	7,45	9,24	0,738
1.month VAS	4,09	1,59	2,24	7,35	3,62	1,29	2,22	7,15	0,571
3.month VAS	4,05	1,45	2,12	6,87	3,84	1,12	2,29	6,54	0,877
6.month VAS	4,39	1,37	2,53	7,12	4,30	,79	3,14	5,12	0,817
12.moth VAS	4,60	1,19	2,10	6,15	4,24	1,00	2,53	6,12	0,280

Table-3. Pre- and post-injection VAS levels according to level

	Level								p
	C5-6				C6-7				
	Mean	SD	Min	Max	Mean	SD	Min	Max	
Preinjection VAS	8,14	,68	7,24	9,64	8,56	,63	7,45	9,24	0,089
1.month VAS	4,13	1,44	2,45	7,35	3,58	1,47	2,22	7,15	0,165
3.month VAS	4,11	1,38	2,12	6,87	3,78	1,20	2,29	6,54	0,662
6.month VAS	4,55	1,28	2,53	7,12	4,11	,89	3,12	5,76	0,367
12.moth VAS	4,31	1,25	2,10	6,15	4,58	,92	3,18	6,12	0,554

Table-4. Pre- and post-injection VAS levels according to side

	Side								p
	Right				Left				
	Mean	SD	Min	Max	Mean	SD	Min	Max	
Preinjection VAS	8,59	,64	7,79	9,64	8,18	,68	7,24	9,24	0,170
1.month VAS	4,30	1,60	3,14	7,35	3,61	1,33	2,22	6,39	0,126
3.month VAS	4,26	1,44	2,43	6,87	3,76	1,19	2,12	6,02	0,429
6.month VAS	4,61	1,07	3,25	7,12	4,18	1,14	2,53	6,12	0,444
12.moth VAS	4,73	1,02	2,53	6,12	4,25	1,14	2,10	6,15	0,429

DISCUSSION

The aging process in conjunction with the influence of various mechanical stress factors or injuries to the cervical spine typically results in degenerative changes of the cervical spine. Cervical radicular pain is defined as pain perceived as arising in the upper limb with a sharp, shooting, lancing quality caused by ectopic activation of the nerve roots or other neuropathic mechanisms[14]. Radicular pain follows a segmental-specific pattern. Cervical spine MRI can determine the cause of radicular pain, herniated disk or cervical foraminal stenosis. If not diagnostic, further testing may be required like electrodiagnostic studies, diagnostic selective nerve root injections and brachial plexus MRI[2,11,25].

Cervical herniated disk specimens have demonstrated increased levels of matrix metalloproteinase activity, nitric oxide, prostaglandin E2 and interleukin-6 [16]. Phospholipase A2 also plays a role in the inflammation of the nerve root and can be neurotoxic[10]. Epidural steroids have been shown to inhibit phospholipase A2 activity, thus reducing symptoms. Corticosteroid mitigates nerve conduction slowing due to inflammation[26]. Corticosteroids also affect cell-mediated activity and cytokines, which may be involved in the pathogenesis of radicular pain. Corticosteroids effects could be counted as anti-inflammatory, inhibiting C fiber transmission, inhibiting ion conductance, stabilization of nerve membranes inhibiting ectopic impulses and hyperpolarizing spinal neurons[7,10,12,15]. The favorable outcome from cervical radiculitis from herniated disk may be due in part to the natural regression of disk herniation over time[22].

Fluoroscopic guided epidural injections advocate utilizing this technique in order to assure that medications reach the appropriate target of foraminal space[5]. Inaccurate needle placement is a common problem encountered with any epidural injection[4]. Cervical spondylotic foraminal stenosis, foraminal and entrance zone disk herniations and epidural fibrosis can potentially block the flow of medication for epidural injection to the involved dorsal root ganglion. MRI or at least multi-planar computed tomography should be obtained before proceeding with spinal interventions to avoid wrong trajectory. The vertebral artery path can be followed to evaluate for a tortuous vertebral artery overlying a foramen that may interfere with a transforaminal injection[1]. If complications develops after CTSI, a preprocedure MRI is very helpful to compare to a new MRI for any changes.

There are two options for cervical steroid injections as transforaminal and interlaminar[17]. The important differences between interlaminar and transforaminal epidural injections include that while interlaminar entry delivers the medication close to the assumed site of pathology and the transforaminal approach is the target-specific modality requiring the smallest volume to reach the primary site of pathology and also leading to the site of pathology ventrally[24]. We used target specific transforaminal trajectory in our study.

Complications reported with CTSI include dural puncture, vertebral artery injury, nausea, neck pain, transient increased radicular pain, vasovagal reaction, non-specific headache, transient lightheadedness, dyspepsia, fluid retention, transient global amnesia, paralysis, cord infarction and cerebellar infarction, and death[21]. Ma et al. reviewed records of 1,036 cervical transforaminal epidural steroid injections in 844 subjects[14]. Immediate complications were recorded by the radiologist performing the procedure. The authors' reported complications occurred in 14 subjects (1.66%). These included headache/dizziness (0.59%), transient pain or weakness (0.71%), hypersensitivity reaction (0.12%), transient global amnesia (0.12%), vasovagal reaction (0.12%), and wrong site injection (0.36%). Huston et al. performed a prospective, controlled study with independent interviewer of lumbar and cervical selective nerve root injections on 151 subjects who received 306 injections. Of the cervical group, there were 89 cervical selective nerve root injections performed on 37 subjects and immediate complications were increased pain at injection site 22.7%, increased radicular pain 18.2%, lightheadedness 13.6%, increased spine pain 9.1%, non-specific headache 4.5%, and nausea 3.4% [14]. Our complications were dural puncture in 2 patients.

Lin et al. retrospectively reported on 70 consecutive subjects that underwent CTSI for radicular pain from a herniated cervical disk[20]. All patients had been offered surgical treatment but given the option of CTSI. Mean follow-up was 13 months (range, 6 months to 4 years) with 65.3 % good to excellent relief with Odom criteria and avoidance of surgery. The authors found more favorable result in those over age 50 and symptom duration less than 100 days. Vallee et al. prospectively evaluated l CTSI performed on 32 consecutive subjects with radicular pain from foraminal stenosis either from spondylosis or disk herniation[30]. At 6 months follow-up greater than 50 % relief occurred in 56% who also resumed full activities. There are comprehensive reviews that reported the effectiveness of CTSI[3,6,8,9,18,23]. Also some studies compared the paticulate and non-particulate CTSI and they reported no significance difference at results but they do not suggest particulate steroids because of serious side effects[19,28]. Our results are supporting the pain relief ratios of the literature and we use non-particulate steroid (dexamethazone) for the procedure.

CTSI have been postulated to be effective because accurate delivery of medication to the site of pathology is possible. CTSI may be recommended to the patients whom have failed previous pharmacotherapy, physical therapy and also not be eligible for surgery.

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