



ORIGINAL ARTICLE

Intravascular escape during lumbar transforaminal anterior epidural steroid injection: A retrospective study

Lomber transforaminal anterior epidural steroid enjeksiyonu sırasında intravasküler kaçak: Retrospektif çalışma

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Summary

Objectives: Demonstrate of accidental intravascular injection during lumbar transforaminal anterior epidural steroid injection (TAESI) performed with three-dimensional imaging angiography (3DIA) and fluoroscopy.

Methods: We assessed 20 (9 males and 11 females) patients (with a total of 40 levels) whose images were received with simultaneously 3DIA and fluoroscopy-guided TAEI between January 2016 and September 2016 as retrospective. Injections were carried out in the lumbar fourth intervertebral space bilaterally and performed in the same way all of the cases.

Results: The mean age and body mass index of the patients were 47.9±2.72 years and 26.95±1.21, respectively. There were 10 patients with disc herniation, seven patients with spinal stenosis, and three patients with failed back surgery syndrome. In 3D imaging, vascular escape was detected in the 7 levels (17.5%) which were thought to be no escape in the fluoroscopy imaging.

Conclusion: In chronic lumbar radiculopathy patients, intravascular escapes may occur during the fluoroscopic TAEI procedure. To avoid intravascular injections during TAEI procedure, it may be appropriate to use different imaging methods that can give more detailed results such as 3D angiography.

Keywords: Fluoroscopy; three-dimensional imaging angiography; transforaminal anterior epidural steroid injection.

Özet

Amaç: Üç boyutlu anjiyografi (3BA) ve floroskopi ile yapılan lomber transforaminal anterior epidural steroid enjeksiyonu (TAE-SI) sırasında istenmeyen intravasküler enjeksiyonun gösterilmesi.

Gereç ve Yöntem: Ocak 2016 ile Eylül 2016 tarihleri arasında 20 (9 erkek, 11 kadın) hastaya (toplam 40 seviye) lomber dördüncü intervertebral seviyeden bilateral transforaminal anterior epidural steroid enjeksiyonu (TAE-SI) işlemi yapıldı. TAE-SI işlemi sırasında eş zamanlı olarak çekilen, 3BA ve fluroskopik görüntüleri retrospektif olarak değerlendirildi.

Bulgular: Hastaların ortalama yaş ve vücut kitle indeksi sırasıyla 47.9±2.72 yıl ve 26.95±1.21 idi. Hastaların onunda lomber disk hernisi, yedisinde spinal dar kanal,ve üçünde başarısız bel cerrahisi sendromuna bağlı şikayetleri vardı. Yedi seviyede (%17.5), floroskopik görüntülemeye vasküler kaçış görülmemesine rağmen, 3BA görüntülemeye vasküler kaçış saptandı.

Sonuç: Kronik lomber radikülopati hastalarında floroskopi eşliğinde uygulanan TAE-SI işlemi sırasında farkedilemeyebilen intravasküler kaçışlar olabilmektedir. TAE-SI işlemi sırasında intravasküler enjeksiyonlardan kaçınmak için 3BA gibi daha ayrıntılı sonuçlar verebilen farklı görüntüleme yöntemlerinin kullanılması uygun olabilir.

Anahtar sözcükler: Floroskopi; transforaminal anterior epidural steroid enjeksiyonu; üç boyutlu görüntüleme anjiyografi.

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Introduction

During the application of transforaminal anterior epidural steroid injection (TAESI), which is frequently used in the treatment of chronic and acute radicular pain, it is necessary to use imaging methods. Fluoroscopy-associated application is a classic technique and it is widely used in many algology centers around the world.^[1] It has been reported in previous publications that the drug escape to vascular may be a serious side effect during TAESI in guidance with fluoroscopy. In some publications, the epidural puncture was detected by real-time fluoroscopy or digital subtraction angiography.^[2–5]

In recent years, computerized tomography (CT) has begun to be preferred to TAESI applications with fluoroscopy. It has been shown previously that the superiority of three-dimensional (3D) CT in diagnosing pathological conditions in the carotid and vertebral arteries has been demonstrated.^[6]

In our study, we aimed to investigate concurrently with 3DCT angiography of patients who had chronic lumbar radiculopathy and whether the medical agents given during TAESI administration were escaping to the vasculature.

Material and Methods

In this study, TAESI applications which were made with imaging cooperation with 3DCT angiography (Allura FD20 fluoroscopy system with Clarity, Philips Health Systems, Philips Healthcare, Best, The Netherlands) at Adnan Menderes University Faculty of Medicine, Algology Department between January 2016 and September 2016 have been examined retrospectively. Retrospective planned research was approved by the local ethics committee. All injections were performed by the same expert with 25 years of experience in algology (ONA). Hemogram, coagulation, and routine biochemical tests were normal in the laboratory examinations of the patients studied. The routine application of all injections in our algology clinic can be summarized as follows. All of the injections were performed from the intervertebral space of the lumbar 4-5 (L4-5). Anteroposterior fluoroscopic imaging was performed to detect L4-5 intervertebral space. The C-arm was cranially or caudally directed to make superior and more specifically inferior endplates straight line. Fluoroscopy was placed

at an oblique position 18–20° to visualize neural foramen. TEASI was applied to the safe triangle area just below the pedicle and inferolateral to the pars interarticularis. After the targeted needle entry point has been identified using a Kirschner wire under fluoroscopy, the skin lacquer was infiltrated with 1% lidocaine. Twenty-two gauge, 9 cm Quincke spinal needle was carefully forwarded under intermittent fluoroscopic imaging in the direction of the safety triangle. Anterior-posterior and lateral images were confirmed, with the needle tip located laterally of the pedicle, superolateral to the spinal nerve. An extension line was added to the spinal needle and the negative pressure was used to determine whether the needle was in the vein. After negative aspiration test, 2 mL of nonionic contrast medium was infused under continuously fluoroscopy. Intravascular, intrathecal or soft-tissue injection, and needlepoint location were checked with fluoroscopic imaging. Two minutes after the fluoroscopic image, after adjusting the angiography device, an infusion of 2 mL nonionic contrast medium was infused. During this injection, a real-time image was taken by angiography and an escape to the vascular was investigated. If the escape to the vascular was detected, the needle is repositioned. After anterior epidural spread is achieved, a mixture of 2 mL of 0.5% bupivacaine + 3.5 mg betamethasone was injected for each level. Then, escape to the vascular in these images was investigated by expert radiologist (ÖFKK).

Statistical analysis

The program SPSS 14 was used for data analyses (SPSS Inc., Chicago, IL, USA). Descriptive statistics were reported as mean±standard deviation. The Chi-square test was used in the analysis of qualitative data, and descriptive statistics were given as frequency (%). Differences were accepted as significant when $p < 0.05$.

Results

Twenty-three patients were included in the study, but three patients were excluded from the study because they were unable to access the image records. In total, 20 patients (9 females and 11 males) were evaluated at 40 levels. The study design is shown in the diagram (Fig. 1). The mean age and body mass index of the patients were 47.9 ± 2.72 years and 26.95 ± 1.21 . There were 10 patients with

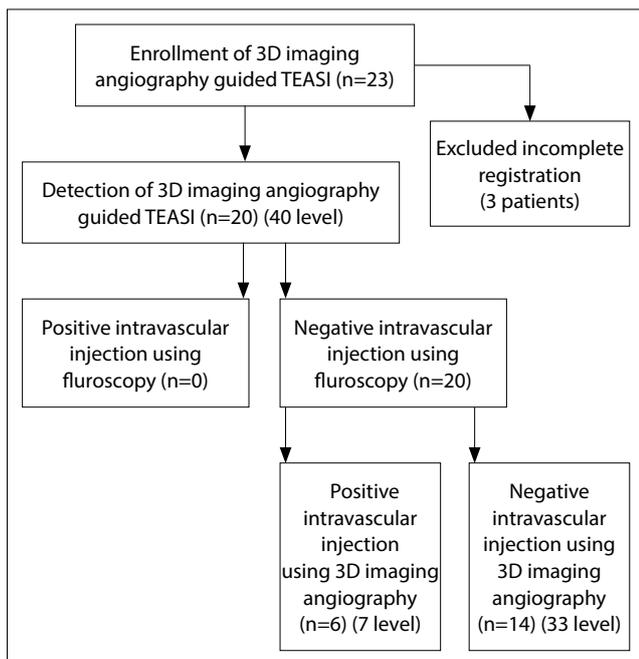


Figure 1. Flow diagram of the study.

disc herniation, seven patients with spinal stenosis, and three patients with failed back surgery syndrome (Table 1). TAESI was performed from L4-L5 spinal levels. In the 3D imaging, vascular escape was detected in the 7 levels (17.5%) which were thought to be no escape in the 2D imaging (Fig. 1–4). The incidence of intravascular injection on each level using 3D imaging angiography (3DIA) is presented in Table 2. It was recorded that all of the drug escapes were vein.

Discussion

It was noted in 1998^[7] that lumbar transforaminal epidural steroid injections administered with fluoroscopy were very effective on pain and it continues to be used as widely as every day. 3DCT angiography device is now an advanced device that provides detailed information about the diagnosis of many diseases and the progression of the disease. Early identification and follow-up of brain-related problems,^[8] as well as cardiac problems^[9] and many other system problems, enable us to visualize vessel and lymphatic structures in 3D. In the literature, it is quite surprising that the lumbar TAESI application is very rarely performed with this device providing such detailed information. Therefore, the results of our study are very important in terms of whether the firstly fluoroscopic TAESI goes to the right target, or where it spreads, and simultaneously presents the recorded data with 3DCT angiography device.



Figure 2. Anterior-posterior fluoroscopy image of one of the participating patients during TAESI procedure.



Figure 3. Rotational angiography oblique image of one of the participating patients during TAESI procedure.



Figure 4. Cone beam CT reconstruction image and vascular escape image during TAESI operation of one of the participating patients.

Table 1. Demographic and clinical findings of patients

Variables	Values
Age (year)	47.9±2.72
BMI (kg/m ²)	26.95±1.21
Female/male	9/11
Diagnosis	
Disc herniation	10
Spinal stenosis	7
Failed back surgery syndrome	3

BMI: Body mass index.

Table 2. Incidence of intravascular injection during TAESI according to level

Level	Number of injections	Number of intravascular injection on 3D imaging angiography
L4-5 right level	20	4
L4-5 left level	20	3

TAESI: Transforaminal anterior epidural steroid injection.

TAESI is one of the most effective methods for controlling radicular pain. Corticosteroids inhibit the synthesis of various pro-inflammatory mediators. Therefore, TAESI can reduce nerve root inflammation induced by mechanical compression at the narrowed foramen. Furthermore, decreased inflammation can reduce the edema on the nerve root or tissues around the nerve root resulting from inflammation. Besides, corticosteroids inhibit neural transmission within the nociceptive C-fibers.^[10,11]

This method, which has very good results in the literature, has been shown to be effective in reducing pain even after 1 year in patients with spinal stenosis, patients with chronic radicular pain such as disc herniation and previous back surgery.^[11,12] In our study, patients with disc herniation, spinal stenosis, and failed back surgery syndrome were included and a total of 40 levels were evaluated. We think that examining this much is enough to show vascular escape.

Fluoroscopic TAESI is widely used worldwide and is well tolerated by patients. However, there may also be serious catastrophic side effects. According to the previous reports, it seems to be a method that could

have very dangerous consequences. Serious complications such as spinal cord ischemia,^[13] monoplegia/paraplegia,^[14] and death^[15] have been reported.

In addition, in 2012 has been reported that a case report using digital subtraction angiography could not prevent paraplegia in a patient with TAESI.^[16] In a study published nowadays, patients undergoing transforaminal epidural steroid injection with cervical vertebrae were compared with those with fluoroscopic and digital subtraction angiography and reported no significant differences.^[17] Contrary to the reported publication, in our study was performed by TAESI fluoroscopy controlled by 3DCT, and it was noted that the escape from the 40 levels to the 7 levels was performed. About 17.5% of undetectable vascular escape in fluoroscopy images was detected in 3DCT images.

This difference was significant. This could have been catastrophic, although it did not cause serious problems in any of our patients. In our opinion, even a complication that may develop in a patient can have catastrophic consequences. Therefore, we can say that 3DCT angiography permits more controlled, safer, and more detailed application of TAESI than fluoroscopy.

In a recent study, it was emphasized that CT-guided epidural steroid injection is safe even in elderly patients and the application time is shorter than other applications.^[18] One of the disadvantages of this application is that the radiation content of the TAESI using 3DCT is excessive. DSA was reported to increase the effective radiation dose incurred by 2.3–4.3-fold for TFEI compared to conventional fluoroscopy.^[19] But does radiation receive more or is it likely to be exposed to lethal complications? The answer to these questions is an issue that we should not think much about.

The limitation of this study was the small number of patients. However, when records of patients were examined retrospectively, it was considered to be a very important data to see steroid vascular escape even in one patient in fluoroscopic application. In future studies, the number of patients can be increased in studies that planning the escape frequency of the drug to the vascular structure.

As a result, TAESI with fluoroscopy applied to patients with chronic lumbar radiculopathy may not be reliable due to vascular escape. TAESI with 3DIA ap-

plied to patients with chronic lumbar radiculopathy may be a safer application that gives more detailed results than fluoroscopy practice. There is a need for studies comparing TAESIs reliability with different imaging methods used in practice.

Ethics Committee Approval: The Adnan Menderes University Clinical Research Ethics Committee granted approval for this study (date: 08.09.2016, number: 2016/979).

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