



Turkish Journal of Geriatrics
DOI: 10.29400/tjgeri.2023.352
2023; 26(3):258–266

- Ali GÜLER¹ ID
- Yiğit CAN ŞENOL¹ ID
- Afşin Emre AKPINAR¹ ID
- Halis Emre ÇİFTÇİ¹ ID
- Mert YİĞİT¹ ID
- Zeynep GENÇE ÖZ¹ ID
- Elif ORHUN¹ ID
- Ali DALGIÇ² ID

CORRESPONDANCE

¹Ali GÜLER

Phone : +905054007629
e-mail : glerali@yahoo.com

Received : Jul 28, 2023
Accepted : Aug 10, 2023

¹ Ministry of Health Ankara City Hospital,
Neurosurgery, Ankara, Turkey

² Ankara Medica International Hospital,
Neurosurgery, Ankara, Turkey

ORIGINAL ARTICLE

EFFECTIVENESS OF ULTRASONOGRAPHY- GUIDED CAUDAL EPIDURAL STEROID INJECTION IN IMPROVING PAIN AND FUNCTIONAL STATUS OF GERIATRIC PATIENTS WITH SPINAL PAIN

ABSTRACT

Introduction: Treatment of lumbar spinal pain in geriatric patients is challenging. This study retrospectively investigated the effects of an ultrasonography-guided caudal epidural steroid injection on pain and functional recovery in geriatric patients (age ≥ 65 years).

Materials and Methods: Fifty-eight patients who received ultrasonography-guided caudal epidural steroid injection between December 2019 and March 2023 were retrospectively evaluated. Pain levels were evaluated using the Visual Analog Scale, and functional recovery was assessed using Oswestry Disability Index. The time points for evaluation were preoperative, immediately post-procedure, and at three weeks and three months post-procedure.

Results: The main underlying conditions in this cohort were lumbar spondylosis, lumbar disc herniation, and lumbar spondylolisthesis. Thirty patients had multiple-level lumbar canal narrowing, 13 had L4-5 and L5-S1 disc herniation, and five had lumbar spondylolisthesis. Ten patients had a history of lumbar spinal surgery. Fourteen patients had at least three comorbid conditions (cardiovascular disease, morbid obesity, renal disease, etc.), and six had four comorbid conditions. Pain Visual Analog Scale scores in the immediate postoperative period and at three weeks and three months were significantly lower than the preoperative score ($p < 0.001$). Oswestry Disability Index scores at three weeks and three months postoperatively were significantly better than the pre-procedure scores ($p < 0.001$).

Conclusions: Ultrasonography-guided caudal epidural steroid injection is an excellent pain management modality in the treatment of spinal pain, especially in the geriatric age group.

Keywords: Pain; Steroid; Ultrasonography; Comorbidity.



INTRODUCTION

Aging is characterized by biological, physiological, emotional, and functional changes. Individuals aged ≥ 65 years account for approximately 10% of the global population. This percentage is projected to exceed 16% by 2050, accounting for approximately 1.6 billion people (1). The progressive population aging has led to increased incidence and prevalence of chronic pain and related diseases in this age group (2). Degenerative sagittal imbalance is associated with back pain and poor quality of life in the geriatric population (3).

Lumbar disc herniation, lumbar spinal stenosis (LSS), degenerative spondylolisthesis, and previous lumbar operations are among the most common causes of chronic pain syndromes, affecting the quality of life (4). Approximately 70% of people aged ≥ 60 years are affected by lumbar low back pain (5). Lower back pain is the leading cause of activity restriction and workplace absenteeism, placing a high economic burden on the affected individuals and society (6). Over half of geriatric patients aged ≥ 65 years have three or more diseases (such as diabetes, heart disease, and hypertension); therefore, polypharmacy is a common problem in this age group. In addition, geriatric patients typically have reduced physiological reserves of vital organs. Consumption of additional medication or undergoing surgery or physical therapy to treat spinal pain may cause problems (7).

The treatment of spinal pain in geriatric patients usually includes modification of activities, various exercise modalities, oral analgesics, neuropathic medications, physical therapy, manual manipulations, epidural steroid injections (ESI), and in some cases, surgical interventions. ESI, a less invasive, safe, and cost-effective treatment option in geriatric patients, has become popular in recent years, as pain medications, anti-inflammatory agents, and surgery pose multiple risks for elderly patients with comorbidities. ESI has been shown to reduce pain and improve functional status in

patients with low back and radicular pain due to spinal pathology. Lumbar ESI improves objective physical capacity parameters and pain scores compared to drug therapy in elderly patients with symptomatic lumbar spinal stenosis (8).

Epidural injections can be administered via interlaminar, transforaminal, and caudal approaches by injecting local anesthetic solutions, steroids, or a combination. These are usually administered to relieve pain and improve function and mobility. The caudal approach is easy to apply and is associated with a lower risk of iatrogenic dural puncture. The procedure can be performed with a blind technique or under fluoroscopy or ultrasonography guidance (9).

This study aimed to investigate pain and functional improvement in geriatric patients who underwent ultrasound-guided caudal epidural steroid injection (CESI) and to emphasize the USG-guided CESI application as one of the treatment options.

MATERIALS AND METHODS

This retrospective case-control study was approved by the institutional review board of the Ankara Bilkent City Hospital and complies with the Declaration of Helsinki (Protocol number: E1-23-3450; Dated 10/05/2023).

Patient selection

The inclusion criteria for the study were: 1) Patients aged ≥ 65 years who received CESI for persistent low back and/or leg pain due to lumbar spinal pathology (as assessed by lumbar MRI at the time of admission); 2) visual analog scale (VAS) pain score of ≥ 6 ; 3) patients not considered for surgical treatment due to high comorbidity or did not respond to conservative treatment. All patients were referred for CESI by neurosurgeons from Ankara Bilkent City Hospital.

The exclusion criteria were: Patients aged <65 years. A research worker (YCS) retrospectively collected patient data and screened their data against inclusion/exclusion criteria. The first author (AG), who performed the procedures, conducted the examination in detail with potential patients with exclusion/inclusion criteria and obtained written informed consent from participants.

A total of 58 patients treated between December 2019 and March 2023 qualified for the inclusion criteria and were included in this study.

Interventions

All CESI procedures were performed by the first author in an operating room environment and under sterile conditions. No needle site local anesthetic was used. After penetrating the sacrococcygeal ligament with an 18-gauge spinal needle under ultrasonography guidance (Toshiba, Tokyo, Japan), before drug induction, a single-shot image was taken with fluoroscopy (Figure 1), and the localization of the needle placed under ultrasound guidance was confirmed. After confirmation, a mixture of 1 mL betamethasone (Celestone®, MSD, USA) and 5 mL bupivacaine (Marcaine®, AstraZeneca, Turkey) 0.5% solution for injection was diluted in 5 mL of 0.9% NaCl and

injected (total of 11 mL). Contrast material agents were not used during the procedures. In patients using anticoagulants, procedures were performed without discontinuing these drugs.

The pain levels of the patients were evaluated using VAS scores. Functional recovery was evaluated using Oswestry Disability Index (ODI) scores. These scores were compared retrospectively before injection, immediately after injection, three weeks after injection, and three months after injection. The presence of comorbidities (diabetes mellitus [DM], heart disease, hypertension, morbid obesity, COAH, renal disease, thyroid disease, etc.), chronic drug use, and anticoagulant drug use was noted.

Outcome Measures

The Oswestry Disability Index (ODI) is derived from the Oswestry Low Back Pain Questionnaire used by clinicians and researchers to quantify disability caused by back pain (10). The self-completed questionnaire contains ten topics concerning the intensity of pain, lifting, ability to care for oneself, ability to walk, ability to sit, sexual function, ability to stand, social life, sleep quality, and ability to travel. The scores for all questions answered are summed, then multiplied by two to obtain the index (range 0–100). Zero equals no disability, and 100 is the maximum disability possible.



Figure 1. Lateral fluoroscopic view confirming the placement of the spinal needle in the sacral space after insertion into the sacrococcygeal ligament under ultrasound guidance.



The visual analog scale (VAS) is a subjective measure of pain (11). It consists of a 10 cm line with two end-points representing “no pain” and “worst pain imaginable,” respectively. Patients are asked to rate their pain by placing a mark on the line corresponding to their pain level. The distance along the line from the “no pain” marker is then measured with a ruler giving a pain score out of 10.

All participants were asked to attend the outpatient clinic three weeks and three months after the procedure. Their subjective satisfaction was assessed using the VAS score for pain relief and the ODI for functional improvement. Patients were also asked to report any adverse events.

In the first postoperative month, a researcher (AEA) collected information regarding analgesics, the number of additional CESIs received, spinal surgery, and any side effects through telephonic interviews with all participants. These results were compared with those in the immediate postoperative and 3-week and 3-month periods. The research worker (AEA) gathered all data retrospectively. Until the completion of the study, the statisticians and intervention staff were blinded to data.

Statistical methods

SPSS (Statistical Package for Social Sciences) for Windows 23 program was used for statistical analysis. Continuous variables were presented as mean \pm standard deviation, and categorical variables were presented as frequency (percentage). Measurement results before and after treatment were evaluated using repeated measures analysis of variance. The results were evaluated at the 95% confidence interval, and p values $<$ 0.05 indicated statistical significance.

RESULTS

The study population comprised 58 patients, which included 43 females (74.1%).

The mean age of the patients was 72.7 ± 6.4 (range, 65–87) years. The mean duration of

symptoms was 54.0 ± 52.8 (range, 1–240) months. The mean body mass index was 27.4 ± 3.8 (range 21.9–41.1) kg/m^2 . In the radiological evaluation, 30 patients had multiple-level lumbar canal narrowing, 13 had L4-5 and L5-S1 disc herniation, and 5 had lumbar spondylolisthesis. Ten patients had a

Table 1. Demographic and clinical characteristics of the study population (n = 58)

Variable p	
Age	72.72 \pm 6.43 (65–87)
Body mass index	27.45 \pm 3.82 (21.9–41.1)
Duration	54.00 \pm 52.82 (1–240)
Sex	
Male (%)	15 (25.9)
Female (%)	43 (74.1)
Type of spinal pathology	
Lumbar spondylosis (n)	30
Lumbar disc (n)	13
Lumbar spondylolisthesis(n)	5
Lumbar surgery (n)	10
Affected side	
Right (n)	7
Left (n)	11
Bilateral (n)	40
Comorbidity	4
1 disease	16
2 diseases	18
3 diseases	14
\geq 4 diseases	6
VAS score	
Preoperative (1)	8.39 \pm 1.00
Postoperative 1 st day (2)	4.13 \pm 1.91
Postoperative 3 rd week (3)	4.65 \pm 1.86
Postoperative 3 rd month (4)	4.98 \pm 1.77
ODI	
Preoperative (5)	58.06 \pm 14.45
Postoperative 3 rd week (6)	41.48 \pm 15.43
Postoperative 3 rd month (7)	42.72 \pm 14.10

ODI: Oswestry Disability Index
VAS: Visual Analog Scale

history of lumbar spinal surgery. Five patients were operated on for narrow canals, 2 for disc herniation, and instrumentation was performed in 3 patients. In addition to low back pain in all patients, seven patients had right radicular pain, 11 patients had left radicular pain, and 40 patients had bilateral radicular pain. Table 1 summarizes the study population's primary demographic and clinical characteristics, including the distribution of comorbid diseases and the use of anticoagulant drugs.

The mean preoperative VAS score was 8.39 ± 1.00 . The mean VAS scores on the postoperative first day, third week, and third month are presented in Table 2. The mean VAS scores at all three postoperative time points were significantly lower than the preoperative VAS score ($p < 0.001$) (Figure 2).

The mean preoperative ODI score was 58.06 ± 14.45 . The mean ODI score in the postoperative

Table 2. Changes in VAS and ODI score immediately before, immediately after, at 3 weeks, and 3 months after the procedure.

	p
VAS preop-post op 1 st day (1,2)	<0.001*
VAS preop-postop 3 rd week (1,3)	<0.001*
VAS preop-postop 3 rd month (1,4)	<0.001*
ODI preop-postop 3 rd week (5,6)	<0.001*
ODI preop-postop 3 rd month (5,7)	<0.001*

ODI: Oswestry Disability Index

VAS: Visual Analog Scale

* $p < 0.001$

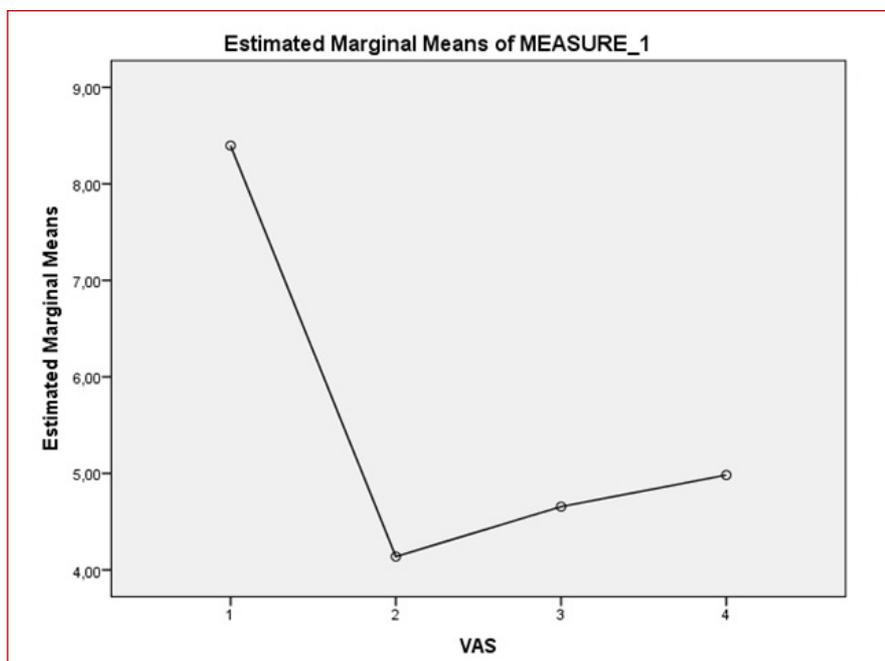


Figure 2. Change in VAS scores at various time-points after the procedure.

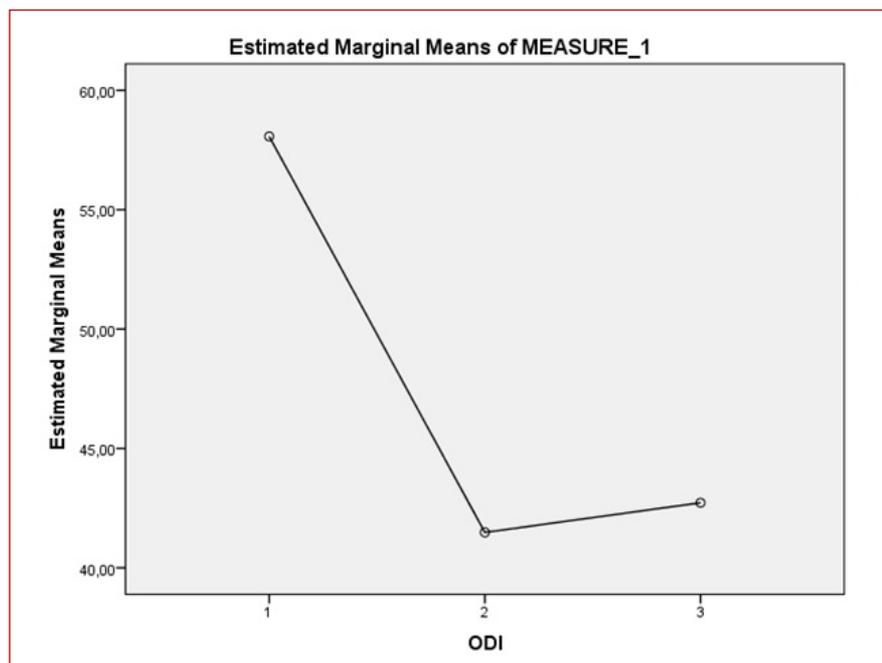


Figure 3. Comparison of improved ODI scores in the groups.

third week and third month were 41.48 ± 15.43 and 42.7 ± 14.10 , respectively (Table 2).

There was a significant change in the ODI values at three weeks and three months postoperatively compared to the pre-procedure ($p < 0.001$) (Figure 3).

DISCUSSION

In this study, ultrasonography-guided CESI reduced pain and improved the functional status of geriatric patients with spinal pain during the following three months. The term spinal stenosis (SS) is an anatomical diagnosis. It tends to increase with age and can also be seen in asymptomatic individuals. Most patients aged ≥ 65 years who have undergone lumbar spinal surgery are operated on for SS. Generally, the use of analgesic drugs should be minimized in elderly patients with comorbidities (such as hypertension, diabetes, and cardiovascular disease) due to these drugs' cardiovascular, renal, and gastrointestinal adverse effects. Spinal pain

management in geriatric patients usually includes conservative measures, but surgical intervention may sometimes be required. However, spinal surgery is associated with multiple perioperative risks in older adults (12).

ESI, a less invasive, safe, and cost-effective treatment option for geriatric patients, has become popular recently. Epidural injections usually aim to relieve pain and improve function and mobility. ESI can be performed with interlaminar, transforaminal, and caudal approaches. Fluoroscopy-guided CESI procedure entails radiation exposure and requires the use of contrast material and the application of local anesthesia at the entry site; however, the USG-guided procedure does not require a contrast agent or local anesthetic application at the entry site. This protects the patient from the potential side effects of contrast agents. In recent years, radiation exposure has been eliminated by performing this procedure under ultrasound rather than fluoroscopy (13). Ultrasonographic guidance enables localization of the sacral hiatus

and visualization of the sacrococcygeal ligament. It also detects variations, making injection easy and safe (14).

In a study of 16 patients with lumbar stenosis (age range 68–83 years) conducted by Przkora et al., lumbar ESI application improved objective physical capacity parameters and pain scores compared to drug treatment (8). In our study, most patients had lumbar stenosis and showed a significant improvement in VAS and ODI scores. Similarly, Taşdoğan et al. evaluated the short-term results of ESI in 44 elderly patients with LSS. They found that the ESI application is an effective non-surgical option for pain relief and improving physical function in elderly patients. In their study, additional injections were required in 4 patients, and surgery was required in 2 patients (15). In our study, three patients required a second dose of additional injection, but none in our cohort underwent surgery.

Manchikanti et al. demonstrated the efficacy of caudal epidural injections with or without steroids in treating chronic lower back pain associated with central lumbar stenosis in 100 patients (16). In this study, betamethasone 1 mL was preferred as a steroid, and 0.5% lidocaine 9 mL was preferred as a local anesthetic; however, in our study, we used betamethasone 1 mL and 0.5% bupivacaine 5 mL as a local anesthetic.

In the study by Shabat et al., conservative treatment for LSS was unsuccessful in elderly patients with LSS (17). Anesthesia techniques in orthopedic surgery procedures may affect postoperative results in elderly patients. General anesthesia is associated with the risk of in-hospital mortality, acute respiratory failure, more extended hospital stay, and a higher readmission risk than spinal or regional anesthesia (18).

Surgical decompression is appropriate for people with lumbar spondylosis who do not respond to non-surgical interventions or have neurological problems that severely impair function (19). However, what is generally considered a

minor complication in young adult patients may be associated with more severe outcomes in older patients and can significantly prolong the hospital stay. (20,21)

While planning the geriatric surgery process, the patient's physiological loss, the effect of multiple chronic diseases, drug use, preferences, opinions, and sociocultural characteristics should be respected. Following the principles of quaternary prevention, the patient should be protected from vital risks, ageist attitudes and prejudices, and unnecessary pain and suffering. Therefore, the risks and benefits of an operation should be carefully evaluated in elderly patients with more complex problems that negatively affect their health outcomes.

In a retrospective study evaluating the effect of frailty on postoperative complications in geriatric patients undergoing multi-level lumbar fusion surgery, frailty was associated with higher odds of all perioperative complications, length of stay, and all-payer costs. Fragile patients had significantly higher 90-day and 180-day readmission rates and higher 90-day wound deterioration rates. In the subgroup analysis, minimally invasive surgery was associated with significantly reduced surgical complication rates, especially in frail patients. The results showed that frailty status is an essential determinant of perioperative complications and prolonged readmissions in geriatric patients undergoing multi-level lumbar fusion. Thus, fragile patients should be operated using minimally invasive techniques to minimize the risk of surgical complications (22).

Recent studies have revealed a relationship between the severity of foraminal stenosis and the analgesic outcome of ESI (23).

In another study, although transforaminal ESI effectively relieves pain regardless of the severity of foraminal stenosis, patients with severe foraminal stenosis reported a significantly smaller decrease in pain scores over time (24). In our study, patients with severe foraminal stenosis showed a lesser change in VAS scores.



Olgun et al. demonstrated ESI's effectiveness in treating low back pain in the elderly. In their study, elderly patients with disc herniation responded better to treatment than those with spinal stenosis and failed back surgery. There was no difference in radiation dose between the interlaminar, transforaminal, and caudal approaches. In the present study, the procedure was performed with a caudal approach under USG guidance, and the patients and surgical team were exposed to very low radiation. In addition, ODI scores for evaluating functional recovery and comorbid diseases were also examined in our study. Moreover, the number of patients with spinal stenosis in our study was higher, and the procedure was considered successful in all groups (25).

Advanced age and comorbidity are risk factors for LSS-related complications. Therefore, ESI is an effective non-surgical pain relief therapy that can be used in a select group of elderly patients. Performing the procedure via the caudal route under ultrasonography guidance significantly reduces the radiation exposure to the patient and the surgical team (13).

Some limitations of this study should be considered while interpreting the results. This was a single-center study, which may have introduced selection bias. The lack of a placebo group was another limitation. A more extensive prospective study is required to draw more robust conclusions.

CONCLUSIONS

USG-guided CESI is an excellent pain management modality in treating spinal pain, especially in the geriatric age group where surgery is not required or is high-risk. It may be the first-choice method in treating spinal pain in the age group.

Acknowledgements

Preparation for publication of this article is partly supported by the Turkish Neurosurgical Society.

Conflicts of Interest

The authors declare that no conflicts of interest are associated with this study.

REFERENCES

1. World Health Organization. World report on ageing and health [e-book] World Health Organization; 2015. [Internet]. Available from: <https://apps.who.int/iris/handle/10665/186463>. Accessed: 09.09.2022.
2. Molton IR, Terrill AL. Overview of persistent pain in older adults. *Am Psychol*. 2014;69(2):197-207 (DOI: 10.1037/a0035794).
3. Cohen L, Pappas E, Refshauge K, et al. Associations between potentially modifiable clinical factors and sagittal balance of the spine in older adults from the general population. *Spine Deform* 2022;10(2):433-441. (DOI: 10.1016/j.jspd.2021.08.003).
4. Manchikanti L, Boswell MV, Singh V, et al. Prevalence of facet joint pain in chronic spinal pain of cervical, thoracic, and lumbar regions. *BMC Musculoskeletal Disord* 2004; 5:1-15. (DOI: 10.1186/1471-2474-5-15).
5. Wong AYL, Karppinen J, Samartzis D. Low back pain in older adults: Risk factors, management options and future directions. *Scoliosis Spinal Disord* 2017; 12:1-14 (DOI: 10.1186/s13013-017-0121-3).
6. Lodato E, Kaplan W. Priority Medicines for Europe and the World "A Public Health Approach to Innovation" Update on the 2004 Background Paper. *Priority medicines for Europe and the world*. 2013;1-22. (DOI: 10.1186/2052-3211-8-s1-k4).
7. Herr K. Pain assessment strategies in older patients. *J Pain* 2011;12(3):3-13. (DOI: 10.1016/j.jpain.2010.11.011).
8. Przkora R, Kinsky MP, Fisher SR, et al. Functional improvements utilizing the short physical performance battery (SPPB) in the elderly after epidural steroid injections. *Curr Pain Headache Rep* 2019;23(2):14. (DOI: 10.1007/s11916-019-0748-2).
9. Chen CP, Wong AM, Hsu CC, et al. Ultrasound as a screening tool for proceeding with caudal epidural injections. *Arch Phys Med Rehabil* 2010;91(3):358-363. (DOI: 10.1016/j.apmr.2009.11.019).
10. Fairbank JCT, Pynsent PB. The Oswestry Disability Index. *Spine* 2000;25(22):2940-2952. (DOI: 10.1097/00007632-200011150-00017).

11. Huskisson EC. Measurement of pain. *Lancet*. 1974;2(7889):1127-1131. (DOI: 10.1016/s0140-6736(74)90884-8).
12. Costandi S, Chopko B, Mekhail M, et al. Lumbar spinal stenosis: Therapeutic options review. *Pain Pract*. 2015;15(1):68-81. PMID: 24725422. (DOI: 10.1111/papr.12188).
13. Güler A, Şenol YC, Karadeniz R, et al. Ultrasonography in caudal injections can reduce use of fluoroscopy. *J Turk Spinal Surg* 2023;34(1):18-25. (DOI: 10.4274/jtss.galenos.2022.93695).
14. Yoo SW, Ki MJ, Doo AR, et al. Prediction of successful caudal epidural injection using color Doppler ultrasonography in the paramedian sagittal oblique view of the lumbosacral spine. *Korean J Pain*. 2021;34(3):339-345. (DOI: 10.3344/kjp.2021.34.3.339).
15. Tasdogan AM, Kilic ET. Outcome measurements for pain relief in elderly patients with spinal stenosis undergoing epidural steroid injection: Is conservative approach an option? *Turk Neurosurg*. 2020;30(5):734-738. (DOI: 10.5137/1019-5149.JTN.29251-20.3).
16. Manchikanti L, Cash KA, McManus CD, et al. Results of 2-year follow-up of a randomized, double-blind, controlled trial of fluoroscopic caudal epidural injections in central spinal stenosis. *Pain Phys*. 2012;15(5):371-384. PMID: 22996849. (DOI: 10.36076/ppj.2012/15/371).
17. Shabat S, Folman Y, Leitner Y, et al. Failure of conservative treatment for lumbar spinal stenosis in elderly patients. *Arch Gerontol Geriatr* 2007;44(3):235-241. PMID: 16872695. (DOI: 10.1016/j.archger.2006.05.003).
18. Rodkey DL, Pezzi A, Hymes R. Effects of spinal anesthesia in geriatric hip fracture: A propensity-matched study. *J Orthop Trauma* 2022;36(5):234-238. (DOI: 10.1097/BOT.0000000000002273).
19. Burgstaller JM, Steurer J, Gravestock I, et al. Long-term results after surgical and non-surgical treatment in patients with degenerative lumbar spinal stenosis. *Spine (Phila Pa 1976)*. 2020;45(15):1030-1038. (DOI: 10.1097/brs.0000000000003457).
20. Rajpal S, Lee Nelson E, Villavicencio AT, et al. Medical complications and mortality in octogenarians undergoing elective spinal fusion surgeries. *Acta Neurochir (Wien)*. 2018;160(1):171-179. (DOI: 10.1007/s00701-017-3384-9).
21. Nordseth T, Gulati AM, Nerland US, et al. Surgery for lumbar spinal stenosis in individuals aged 80 and older: A multicenter observational study. *J Am Geriatr Soc*. 2016;64(10):2011-2018. (DOI: 10.1111/jgs.14311).
22. Ton A, Shahrestani S, Saboori N, et al. The impact of frailty on postoperative complications in geriatric patients undergoing multi-level lumbar fusion surgery. *Eur Spine J*. 2022;31(7):1745-1753. PMID: 35552820. (DOI: 10.1007/s00586-022-07237-4).
23. Kim HJ, Ban MG, Rho M, et al. Evaluation of sagittal spinopelvic alignment on analgesic efficacy of lumbar epidural steroid injection in geriatric patients. *Medicina (Kaunas)* 2022;58(10):1383. PMID: 36295544. (DOI: 10.3390/medicina58101383).
24. Chang MC, Lee DG. Outcome of transforaminal epidural steroid injection according to the severity of lumbar foraminal spinal stenosis. *Pain Phys*. 2018;21(1):67-72. (DOI: 10.36076/ppj.1.2018.67).
25. Olgun Y, Sacaklıdır R, Okumuş Y, et al. Efficacy of epidural steroid injection in elderly patients: Does diagnosis affect treatment success? *Turk J Geriatr*. 2023;26(1):20-26. (DOI: 10.29400/tjgeri.2023.327).