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Clinical Research Article

Current practices of cervical epidural block for cervical radicular pain: a multicenter survey conducted by the Korean Pain Society

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ABSTRACT

Background: Cervical epidural block (CEB) is an effective intervention for managing cervical radicular pain. This study aimed to investigate the current status of performing CEB in South Korea.

Methods: Pain physicians affiliated with the Korean Pain Society were asked to complete anonymous questionnaires regarding CEB between September and October 2022. The questionnaire consisted of 24 questions assessing the current status and methods of CEB in detail.

Results: Of the 198 surveys collected, 171 physicians (86.4%) reported performing CEB. Among those, the majority (94.7%) used fluoroscopy during the procedure. The paramedian interlaminar (IL) approach was the most preferred method (50.3%). Respondents performing fluoroscopic-guided IL CEB were categorized into two groups based on clinical experience: those with ≤10 years of experience (≤10-year group, n = 91) and those with >10 years of experience (>10-year group, n = 71). The proportion of physicians obtaining informed consent in the ≤10-year group and >10-year group was 50.5% and 56.3%, respectively. When entering the epidural space during IL CEB, the contralateral oblique view was the second most frequently used in both groups (≤10-year group, 42.9%; >10-year group, 29.6%). In targeting the upper cervical lesions (C3–4), the proportion of respondents who used an IL space higher than C6–7 was 17.6% in the ≤10-year group and 29.5% in the >10-year experience group.

Conclusions: This study demonstrated variability in the CEB technique used by pain physicians in South Korea. The findings highlight the need for education on informed consent and techniques to enhance safety.

Keywords: Cervical Vertebrae; Chronic Pain; Epidural Injection; Fluoroscopy; Neck; Neck Pain; Radiculopathy; Surveys and Questionnaires.

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INTRODUCTION

Cervical epidural block (CEB) is frequently performed on patients with cervical radicular pain unresponsive to conservative treatments, including exercise therapy and medication [1]. CEB can be performed by using an interlaminar (IL) or transforaminal approach [2], with the IL approach being most commonly used due to the risk of major neurologic complications associated with the transforaminal approach [1]. CEB can be performed using either landmark-based or fluoroscopic guidance, with fluoroscopic guidance being the standard method. Recently, an ultrasound-guided approach for transforaminal CEB has been suggested [3].

The efficacy of CEB, including IL and transforaminal CEB, was evaluated in a previous systematic review and guidelines, which provided evidence supporting its efficacy [2,4]. Complications associated with CEB are usually minor, but rare major complications such as spinal cord injury, inadvertent intrathecal injection, or anterior spinal artery syndrome can occur [5]. Therefore, conducting the procedure with the utmost safety is critical. Recently, techniques such as the contralateral oblique (CLO) view have been introduced to enhance the safety of CEB [6–8], accompanied by the publication of updated safety guidelines [9].

Despite the accumulating evidence to enhance the safety of CEB, no reports exist on the current status of CEB performance by pain physicians in South Korea. Therefore, this study aimed to investigate the actual performance status of CEB in South Korea.

MATERIALS AND METHODS

The requirement for ethical approval for this study was waived by the Institutional Review Board of Wonkwang University Hospital (IRB ID number: WKUH 2022-09-004-001). The survey was conducted by the Training & Education Committee of the Korean Pain Society between September and October 2022. Based on the results of this anonymous survey, this manuscript was drafted in 2024.

The survey questionnaire was distributed *via* email to 5,479 pain physicians who are members of the Korean Pain Society. The questionnaire consisted of 24 questions assessing the current methods and status of CEB in detail.

The survey assessed the demographic characteristics of the physicians and whether they performed CEB. For physicians who reported performing CEB, the authors inquired about their preferred methods of guidance (landmark, fluoroscopic, or ultrasound guidance) and approach (IL, transforaminal). Additionally, physicians who reported performing fluoroscopic IL CEB were further questioned about procedural characteristics and complications related to the procedure. The current status of using the CLO view in fluoroscopic IL CEB was investigated.

1. Statistical analysis

Categorical variables were represented as frequencies (percentages). All respondents were divided into two groups: the CEB performer group and the non-performer group. Demographic data were compared between the two groups. A subgroup analysis was performed on respondents who reported conducting fluoroscopic IL CEB. Given that the CLO view was first reported approximately 10 years ago, respondents were categorized into two groups based on their years of clinical experience: those with more than 10 years of experience (the >10-year group) and those with 10 years of experience or less (the ≤10-year group). Between-group comparisons were evaluated with the chi-squared test or Fisher's exact test for categorical variables, as appropriate. Fisher's exact test was used when expected cell counts of less than 5 comprised 25% or more of a table. Data were analyzed using SPSS version 21.0 (SPSS Inc.).

RESULTS

1. Demographics of survey respondents

A total of 198 pain physicians completed the questionnaire. The demographic characteristics of the survey respondents are summarized in **Table 1**. Of all respondents, 171 physicians (86.4%) indicated that they performed CEBs, while the remaining 27 physicians (13.6%) reported that they did not. Among the demographic variables, only age was significantly different between the CEB performer group and the non-performer group ($P = 0.046$). In the CEB performer group, the age group most frequently performing cervical blocks was 30–39.

2. Procedural characteristics of respondents according to clinical experience

Among the 171 CEB performers, the paramedian IL approach was the most preferred (paramedian IL, 86, 50.3%; midline IL, 74, 43.3%; transforaminal, 11, 6.4%). Most physicians performed CEB under fluoroscopic guidance

Table 1. Demographic data of the survey respondents

Variables	CEB performer (n = 171)	Non performer (n = 27)	*P* value
Age group (yr)			0.046
20–29	42 (24.6)	7 (25.9)	
30–39	85 (49.7)	7 (25.9)	
40–49	29 (17.0)	8 (29.6)	
50–59	13 (7.6)	3 (11.1)	
≥60	2 (1.2)	2 (7.4)	
Sex			
Male	143 (83.6)	25 (92.6)	0.384
Female	28 (16.4)	2 (7.4)	
Workplace			
Primary clinic	93 (54.4)	20 (74.1)	0.126
Secondary hospital	29 (17.0)	5 (18.5)	
Tertiary hospital	48 (28.1)	2 (7.4)	
Other	1 (0.6)	0 (0)	
Experience (yr)			
<1	8 (4.7)	1 (3.7)	0.993
≥1 to <5	41 (24.0)	7 (25.9)	
≥5 to <10	44 (25.7)	7 (25.9)	
≥10	78 (45.6)	12 (44.4)	

Values are presented as number (%).
CEB: cervical epidural block.

(162, 94.7%), and all of them employed fluoroscopic-guided IL CEB.

The procedural characteristics in the subgroup analysis of respondents who reported performing fluoroscopic-guided IL CEB were divided according to their years of clinical experience in **Table 2**. The percentage of physicians always obtaining informed consent in the ≤10-year group and the >10-year group was 50.5% and 56.3%, respectively. Patient position, LOR technique, and needle type significantly differed between the >10-year group and the ≤10-year group (patient position, $P = 0.001$; LOR technique, $P = 0.008$; needle type, $P = 0.033$). In both groups, the prone position (lowering the arm to the body, raising the arm to the head) was the most frequently used in both the ≤10-year group (94.5%) and the >10-year group (73.3%).

Table 2. Procedural characteristics of respondents according to clinical experience when performing the fluoroscopic-guided cervical interlaminar epidural block

Variables	≤10-year experience (n = 91)	>10-year experience (n = 71)	*P* value
Informed consent			0.346
Always	46 (50.5)	40 (56.3)	
Sometimes	10 (11.0)	11 (15.5)	
No	35 (38.5)	20 (28.2)	
Patient position			0.001
Lowering arm to body	78 (85.7)	44 (62.0)	
Raising arm to head	8 (8.8)	8 (11.3)	
Sitting	5 (5.5)	18 (25.4)	
Other[a]	0 (0)	1 (1.4)	
Midline gap of LF			0.137
Know	80 (87.9)	68 (95.8)	
Do not know	11 (12.1)	3 (4.2)	
Detecting epidural space			0.209
LOR with air	18 (19.8)	23 (32.4)	
LOR with saline	36 (39.6)	22 (31.0)	
LOR with air and saline	30 (33.0)	17 (23.9)	
LOR with contrast dye	5 (5.5)	5 (7.0)	
Hanging drop method	2 (2.2)	4 (5.6)	
LOR technique			0.008
Intermittent	55 (60.4)	56 (78.9)	
Continuous pressure	36 (39.6)	14 (19.7)	
Both	0 (0)	1 (1.4)	
Needle type			0.033
Tuohy 24 gauge	0 (0)	1 (1.4)	
Tuohy 22 gauge	46 (50.5)	50 (70.4)	
Tuohy 20 gauge	35 (38.5)	15 (21.1)	
Tuohy 18 gauge	8 (8.8)	3 (4.2)	
Other[b]	2 (2.2)	2 (2.8)	
Use of epidural catheter			0.362
Yes	22 (24.2)	20 (28.2)	
Sometimes	18 (19.8)	19 (26.8)	
No	51 (56.0)	32 (45.1)	

Values are presented as number (%).
LF: ligamentum flavum, LOR: loss of resistance.
[a]Other includes the swimmer's position and the lateral decubitus position. [b]Other include spinal needles (Quincke) and blunt needles.

3. Identification of epidural space under fluoroscopic guidance

When entering the epidural space during a fluoroscopic-guided IL CEB, the lateral view was the most frequently used in both groups (≤10-year group, 46.2%; >10-year group, 52.1%), with the CLO view being the second most frequently used in both groups (≤10-year group, 42.9%; >10-year group, 29.6%) (**Table 3**). The proportion of physicians familiar with the CLO view was significantly higher in the ≤10-year group compared to that in the >10-year group ($P = 0.036$). The proportion of physicians us-

Table 3. Fluoroscopic views that respondents use when advancing the needle to identify the epidural space during cervical interlaminar epidural block according to clinical experience

Variables	≤10-year experience (n = 91)	>10-year experience (n = 71)	*P* value
Fluoroscopic view			0.158
CLO	39 (42.9)	21 (29.6)	
Lateral	42 (46.2)	37 (52.1)	
AP	7 (7.7)	12 (16.9)	
CLO and lateral	1 (1.1)	0 (0)	
AP and lateral	1 (1.1)	1 (1.4)	
CLO, AP, and lateral	1 (1.1)	0 (0)	
Whether know CLO view			0.036
Yes	86 (94.5)	59 (83.1)	
No	5 (5.5)	12 (16.9)	
Use CLO			0.065
Yes	41 (45.1)	21 (29.6)	
No	50 (54.9)	50 (70.4)	
Reasons not to use CLO			0.150
Lack of knowledge	3 (6.0)	9 (18.0)	
Lack of experience	18 (36.0)	20 (40.0)	
No training CLO view	9 (18.0)	6 (12.0)	
Not necessary	11 (22.0)	12 (24.0)	
Limitation to use CLO	9 (18.0)	3 (6.0)	

Values are presented as number (%).
AP: anteroposterior, CLO: contralateral oblique.

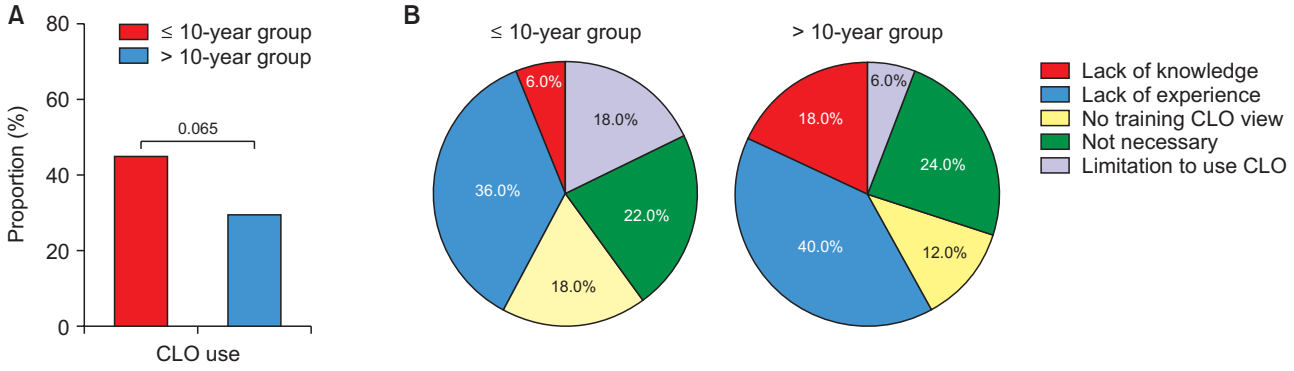

Fig. 1. Proportion of physicians using the contralateral oblique (CLO) view (A) and reasons not to use CLO (B) according to clinical experience.

ing the CLO view was higher in the ≤10-year group, albeit not statistically significant (≤10-year group, 45.1%; >10-year group, 29.6%; $P = 0.065$; **Fig. 1A**). In both groups, the primary reason for not using the CLO view was a lack of experience (≤10-year group, 36.0%; >10-year group, 40.0%; **Fig. 1B**).

4. Access level of the epidural space for upper (C3-4) and lower (C6-7) cervical lesions in fluoroscopic-guided IL CEBs

In fluoroscopic-guided IL CEBs, the access level of the epidural space for upper (C3–4) and lower (C6–7) cervical lesions did not significantly differ between the ≤10-year group and the >10-year group (upper cervical lesions, $P = 0.328$; lower cervical lesions, $P = 0.142$; **Table 4**). When performing IL CEB for the upper cervical lesions (C3–4),

Table 4. Access level of epidural space for upper (C3–4) and lower (C6–7) cervical lesions in fluoroscopic-guided interlaminar cervical epidural blocks

Variables	≤10-year experience (n = 91)	> 10-year experience (n = 71)	*P* value
Upper cervical lesions (C3–4)			0.328
Same level (C3–4)	2 (2.2)	4 (5.6)	
One level below (C4–5)	14 (15.4)	17 (23.9)	
C6–7 or C7–T1 with a catheter	17 (18.7)	14 (19.7)	
C6–7 or C7–T1 without a catheter	51 (56.0)	30 (42.3)	
Do not perform IL CEB for C3–4	7 (7.7)	5 (7.0)	
Depends on the case	0 (0)	1 (1.4)	
Lower cervical lesions (C6–7)			0.142
Same level (C6–7)	45 (49.5)	41 (57.7)	
Below C7 without a catheter	40 (44.0)	29 (40.8)	
Below C7 with a catheter	4 (4.4)	0 (0)	
Do not perform IL CEB for C6–7	2 (2.2)	0 (0)	
Depends on the case	0 (0)	1 (1.4)	

Values are presented as number (%).
CEB: cervical epidural block, IL: interlaminar.

Table 5. Fluoroscopic technique to detect intravascular injections during fluoroscopic-guided cervical interlaminar epidural blocks according to clinical experience

Variables	≤10-year experience (n = 91)	>10-year experience (n = 71)	*P* value
			0.437
DSA only	28 (30.8)	13 (18.3)	
Real-time fluoroscopy image only	44 (48.4)	40 (56.3)	
Both	1 (1.1)	2 (2.8)	
One of the two must be checked	4 (4.4)	3 (4.2)	
Depends on the case	14 (15.4)	13 (18.3)	

Values are presented as number (%).
DSA: digital subtraction angiography.

the most frequently used method was C6–7 or C7–T1 IL CEB without a catheter in both groups (≤10-year group, 56.0%; >10-year group, 42.3%). In contrast, the second most frequently used method in the ≤10-year group was C6–7 or C7–T1 IL CEB with a catheter (18.7%), while in the >10-year group, it was one level below IL CEB (C4–5 IL CEB for a C3–4 target level, 23.9%). The proportion of respondents who used an IL space higher than C6–7 was 17.6% in the ≤10-year group and 29.5% in the >10-year group.

5. Fluoroscopic methods for detecting intravascular injection

For detecting intravascular injections during fluoroscopic-guided IL CEB, real-time fluoroscopy imaging was the most frequently used technique in both groups (≤10-year group, 48.4%; >10-year group, 56.3%), with digital subtraction angiography being the second most frequently used technique in both groups (≤10-year group, 30.8%; >10-year group, 18.3%) (**Table 5**).

6. Complications of CEB under fluoroscopic guidance experienced by respondents

The proportion of respondents who experienced any complications was 51.6% in the ≤10-year group and 59.2% in the >10-year group, with no significant difference between the two groups ($P = 0.426$; **Table 6**). Major complications were experienced by 18 (11.1%) of the total respondents (8 [8.8%] of the ≤10-year group and 10 [14.1%] of the >10-year group, $P = 0.321$).

Table 6. Complications experienced by respondents according to clinical experience with the fluoroscopic-guided cervical interlaminar epidural block (multiple responses)

Variables	≤10-year experience (n = 91)	>10-year experience (n = 71)	*P* value
Any complication			0.426
Did not experience	44 (48.4)	29 (40.8)	
Experienced	47 (51.6)	42 (59.2)	
Major complications	8 (8.8)	10 (14.1)	0.321
Spinal cord injury (paraplegia/quadriplegia)	2 (2.2)	3 (4.2)	0.654
Infection or epidural abscess	2 (2.2)	2 (2.8)	0.801
Epidural hematoma	4 (4.4)	7 (9.9)	0.214

Values are presented as number (%).

DISCUSSION

This survey provides a snapshot of the practices of CEB among pain physicians, detailing how these procedures are performed in South Korea. To the best of the authors' knowledge, this is the first study to evaluate this issue.

Clinically informed consent must be obtained before performing invasive medical and surgical procedures [10]. However, this survey revealed that only approximately 50% of physicians always obtained informed consent, while 30–40% never did. CEB is a procedure that can cause rare but catastrophic complications, such as spinal cord injury, epidural abscess, or epidural hematoma. In this survey, more than half of the respondents experienced complications, with over 10% encountering major complications despite their years of clinical experience and utilization of fluoroscopic guidance. Given these risks, it is crucial to emphasize the importance of obtaining informed consent by clearly informing patients of potential risks and ensuring training in safe and accurate procedural techniques.

The CLO view enhances safety when performing an IL CEB. A previous randomized controlled trial reported that when performing an IL CEB, the CLO view showed superiority to the lateral view in terms of needling time, success rate on the first attempt, total number of needle passes, needle tip visualization, and needle tip location [7]. A recent prospective observational study evaluating the safety profile of the CLO view in IL CEB observed that among the 393 patients who received IL CEB with the CLO view, there were no cases of dural puncture or spinal cord injury [8]. Furthermore, all needle tips were visualized during the procedure. Despite the demonstrated superiority of the CLO view, it was utilized by only 45.1% of physicians in the ≤10-year experience group and 29.6% in the >10-year experience group in Korea. The primary reason for not utilizing the CLO view in both groups was a lack of experience. Educational workshops or conferences organized by the related medical society should be enhanced to facilitate the learning process and skill development.

In the present results, the majority of physicians preferred the prone position for patients when performing IL CEB, while those with over ten years of clinical experience favored the sitting position. The sitting position allows the operator to more effectively flex the cervical spine, thereby enlarging the IL space for needle insertion. Additionally, the sitting position tends to be more comfortable for the patient [11]. Furthermore, before the introduction of fluoroscopic-guided CEB, the procedure was performed using landmark-based techniques, typically in the sitting position. This historical practice might have influenced the preference for the sitting position among physicians with more than ten years of clinical experience. The limitation of the sitting position is that it allows only a lateral view, whereas the prone position enables the use of the CLO view, which has a superior safety profile. Moreover, the likelihood of patient movement during needle manipulation can be decreased in the prone position rather than the sitting position. Although an experienced physician may safely and effectively perform the IL CEB in both positions, using the CLO view in the prone position may be more appropriate for novice physicians, given its enhanced safety profile.

In this survey, when performing IL CEB targeting the C3–4 level, C4–5 IL CEB was the third most frequently used method in the ≤10-year group and the second most frequently used method in the >10-year group. Additionally, the proportion of respondents who used an IL space higher than C6–7 was 17.6% in the ≤10-year group and 29.5% in the >10-year group. Ongoing controversy exists regarding the optimal IL level for IL CEB. Recent safety

recommendations published by an expert multidisciplinary working group suggested performing IL CEB at the C7–T1 level, but preferably not higher than the C6–C7 level, due to the wider cervical epidural space at the C6–T1 [9,12]. Conversely, a few authors assert that IL CEB above C6–7 is as safe as IL CEB at C7–T1 and C6–7 [13,14]. Until further evidence is gathered, it may be advisable for novice physicians to perform IL CEB at the C6–7/C7–T1 level, considering the wider epidural space. For targets in the high cervical region, IL CEB at the C6–7 or C7–T1 with an epidural catheter could be recommended.

In this survey, approximately one-third of respondents indicated that the insurance fees for CEB under the Korean National Health Insurance Reimbursement System are insufficient, as they do not adequately reflect the risks associated with CEB. Therefore, future revisions of the reimbursement system need to be adjusted.

This study had several limitations. First, due to its survey-based design, there is potential for social desirability bias, especially when reporting on informed consent or complications. The authors attempted to minimize this bias by conducting an anonymous survey. Second, concerning nonresponse bias, the study results might not fully represent the perspectives of all physicians in South Korea. Demographically, a majority of responding physicians were from primary clinics rather than secondary or tertiary hospitals. Thus, the survey results may predominantly reflect the practices of pain physicians in primary care settings.

In conclusion, the authors' findings identify areas needing improvement in the practice of Korean pain physicians performing CEB. Informed consent must be obtained before performing any procedure, especially those with the potential for catastrophic complications, such as CEB. Given the possibility of rare but serious complications, conducting the procedure with the utmost safety is critical. Techniques for enhancing safety, such as the CLO view, have been introduced recently but are not widely used in South Korea, mainly due to a lack of experience and education. Educational workshops or conferences organized by the related medical society to facilitate the learning process and skill development are needed, along with ongoing surveys to assess the performance status of CEB.

DATA AVAILABILITY

The datasets supporting the findings of this study are available from the corresponding author upon reasonable request.

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CONFLICT OF INTEREST

Yeon-Dong Kim and Seong-Soo Choi are section editors of the Korean Journal of Pain; however, they have not been involved in the peer reviewer selection, evaluation, or decision process of this article. No other potential conflict of interest relevant to this article was reported.

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AUTHOR CONTRIBUTIONS

Chan-Sik Kim: Writing/manuscript preparation; Hyun-Jung Kwon: Writing/manuscript preparation; Sugeun Nam: Data curation; Heeyoon Jang: Formal analysis; Yeon-Dong Kim: Supervision; Seong-Soo Choi: Writing/manuscript preparation.

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REFERENCES

1. Peene L, Cohen SP, Brouwer B, James R, Wolff A, Van Boxem K, et al. 2. Cervical radicular pain. Pain Pract 2023; 23: 800-17.
2. Manchikanti L, Knezevic NN, Navani A, Christo PJ, Limerick G, Calodney AK, et al. epidural interventions in the management of chronic spinal pain:

American Society of Interventional Pain Physicians (ASIPP) comprehensive evidence-based guidelines. Pain Physician 2021; 24(S1): S27-208.
3. Zhang X, Shi H, Zhou J, Xu Y, Pu S, Lv Y, et al. The effectiveness of ultrasound-guided cervical transforaminal epidural steroid injections in cervical radiculopathy: a prospective pilot study. J Pain Res 2018; 12: 171-7.
4. Manchikanti L, Nampiaparampil DE, Candido KD, Bakshi S, Grider JS, Falco FJ, et al. Do cervical epidural injections provide long-term relief in neck and upper extremity pain? A systematic review. Pain Physician 2015; 18: 39-60.
5. Kim YD, Moon HS. Review of medical dispute cases in the pain management in Korea: a medical malpractice liability insurance database study. Korean J Pain 2015; 28: 254-64. Erratum in: Korean J Pain 2016; 29: 62.
6. Gill JS, Aner M, Nagda JV, Keel JC, Simopoulos TT. Contralateral oblique view is superior to lateral view for interlaminar cervical and cervicothoracic epidural access. Pain Med 2015; 16: 68-80. Erratum in: Pain Med 2015; 16: 2218.
7. Sim JH, Kwon HJ, Kim CS, Kim EH, Kim DH, Choi SS, et al. Comparison of contralateral oblique view with the lateral view for fluoroscopic-guided cervical epidural steroid injection: a randomized clinical trial. Reg Anesth Pain Med 2022; 47: 171-6.
8. Kwon HJ, Kim CS, Kim J, Kim S, Shin JY, Choi SS, et al. Contralateral oblique view can prevent dural puncture in fluoroscopy-guided cervical epidural access: a prospective observational study. Reg Anesth Pain Med 2023; 48: 588-93.
9. Rathmell JP, Benzon HT, Dreyfuss P, Huntoon M, Wallace M, Baker R, et al. Safeguards to prevent neurologic complications after epidural steroid injections: consensus opinions from a multidisciplinary working group and national organizations. Anesthesiology 2015; 122: 974-84.
10. Schenker Y, Fernandez A, Sudore R, Schillinger D. Interventions to improve patient comprehension in informed consent for medical and surgical procedures: a systematic review. Med Decis Making 2011; 31: 151-73.
11. Goodman B, Petalcorin JS, Mallempati S. Optimizing patient positioning and fluoroscopic imaging for the performance of cervical interlaminar epidural steroid injections. PM R 2010; 2: 783-6.
12. Benzon HT, Huntoon MA, Rathmell JP. Improving the safety of epidural steroid injections. JAMA 2015; 313: 1713-4.
13. Schultz DM, Hagedorn JM, Abd-Elsayed A, Stayner S. Safety of interlaminar cervical epidural injections: experience with 12,168 procedures in a single pain clinic. Pain Physician 2022; 25: 49-58.
14. Manchikanti L, Malla Y, Cash KA, Pampati V. Do the gaps in the ligamentum flavum in the cervical spine translate into dural punctures? An analysis of 4,396 fluoroscopic interlaminar epidural injections. Pain Physician 2015; 18: 259-66.