Impact of Local Anesthetic Volume on Temperature Increase in the Upper Extremity During Ultrasound-guided SGB

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Background: In most previous studies, only the spread of the injectate was measured or subjective indices such as pain reduction or occurrence of Horner's sign were used to determine the effect of Stellate Ganglion Block (SGB). But it is not appropriate if we want to check the exact effect of the SGB on the upper limb. Rather, measuring the temperature in the upper extremity will be the most suitable indicator for changes in upper limb. We evaluated the temperature in the arm, face, and axillary fold using infrared thermometer as an objective indicator of successful US guided SGB. Methods: A total of 102 patients who were diagnosed with chronic neuropathic pain at upper extremity or face were randomly assigned to either the group A (SGB with 4 mL of 1.0% lidocaine), group B (SGB with 6ml of 1.0% lidocaine), or group C (SGB with 8ml of 1.0% lidocaine). The temperature of the face, hand, and axilla were measured before SGB, 10, 20, and 30 minutes after SGB. The severity of pain and ptosis, and side effects of the local anesthetic agent were all documented. Results: The temperature changes on the ipsilateral hand occurring in each group 30 minutes after SGB, were 1.56°C ± 1.77°C, 1.84°C ± 1.47°C, and 2.00°C ± 1.40°C, respectively and it the temperature changes between the 3 groups 30 minutes after SGB showed no significant difference (p = 0.514). The non-inferiority of 4ml volume of local anesthetic for increasing upper limb temperature in the US guided SGB was not proved. But when we analyzed the result in only temperature increase group, we can expect the similar temperature increase in only 4ml volume group with 6ml or 8ml volume group. The adverse effects were only seen in Group C, and the incidence of adverse effects differ significantly between 3 groups (p=0.043). Conclusions: The temperature increase between 3 different volume groups after SGB did not differ significantly. But 4ml of local anesthetic might be sufficient volume in US guided SGB with upper limb pathology in responders with US guided SGB.

The anatomical neurovascular study for the radiofrequency ablation of knee for patients with chronic osteoarthritis

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Background and Objectives: Since Choi et al described radiofrequency ablation of articular branch innervating anterior knee capsule, it has been studied as a possible alternative treatment of surgery for degenerative arthritis. During the procedure, precise nerve targeting and avoiding blood vessels are needed to increase effectiveness and reduce complications. However, the neurovascular distribution of the anterior knee capsule is still unclear.

Materials and Methods: Twenty formalin-embalmed cadaveric specimens donated to Korea University Medical School were used in this study (14 men and 6 women, from 32 to 92 years). We dissected one leg of each specimens. Six nerves and four arteries, known to be responsible for the anterior innervation of the knee (infrapatellar br. of saphenous n. (IP), nerve to vastus medialis (VM), nerve to vastus intermedius (VI), nerve to vastus lateralis (VL), recurrent peroneal n. (RPN), lateral retinacular n. (LRN); superior medial genicular a. (SMGA), superior lateral genicular a. (SLGA), inferior medial genicular a. (IMGA), inferior lateral genicular a. (ILGA) were dissected) from adductor canal through the distal femur to the knee. After wiring each structure, anteroposterior and lateral view was obtained using C-arm. The distances between visible nerve endings and the conventional ablation points of RFA (areas connecting the shaft to the epicondyle) were measured. We also measured the probability of genicular arteries being present at the conventional ablation points.

Results: Mean distance from visible nerve ending to the conventional ablation point was 12.7 ± SD 18.5 (mm), 29.8 mm ± SD 21.3 (mm) and 15.2 ± SD 25.7 (mm) for VM, VI and VL at AP view, respectively. In lateral view, it was 27.3 ± SD 27.9 (mm), 23.8 ± SD 24.2 (mm) and 22.5 ± SD 33.2 (mm) for VM, VI, and VL, respectively. Results of existence probability at ablation point was as 85% (17 of 20 cadaver), 80% (16 of 20 cadaver), 70% (14 of 20 cadaver) for SMGA, SLGA and IMGA, respectively.

Conclusions: According to the result of this study, the existence probability of visible nerve endings were low in spite of high presence of genicular arteries at classical ablation points. Therefore, it would be more appropriate to target more proximal points during the RFA.
Ultrasound-guided versus blind temporomandibular joint injections: a pilot cadaveric evaluation

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Temporomandibular disorders are painful conditions that require precise injection therapy in selected patients. This pilot cadaveric study was undertaken to compare the accuracy of temporomandibular joint (TMJ) injection between the anatomical landmark-based (blind) technique and an ultrasound-guided technique. TMJ injections using the blind technique or the ultrasound-guided technique were performed in 10 non-embalmed cadavers. After dissection, the accuracy of the TMJ injections was found to be significantly greater for the ultrasound-guided injections than for the blind technique (blind 55% vs. ultrasound 95%, P = 0.008). For injections into the upper joint space of the TMJ, the success rate of the injection was comparable for the two techniques (blind 80% vs. ultrasound 100%, P = 0.474). However, ultrasound-guided injections into the lower joint space had a much higher success rate than the blind technique (blind 30% vs. ultrasound 90%, P = 0.020). The blind technique was associated with a considerable proportion of failed or inappropriate injections, especially for lower joint space injections. Ultrasound-guided TMJ injections were accomplished with a higher accuracy than the conventional blind technique, especially in the case of injections targeting the lower joint space of the TMJ.

Fig. 2. Successful injections when using the ultrasound-guided approach. The two dyes could be identified after removal of (A) the lateral ligament. (B) The red dye was identified in the upper joint space above the disc. (C) the blue dye was identified in the lower joint space below the disc. (D) Schematic diagram.

Table 1. Comparison of the accuracy of temporomandibular joint injections using the blind technique and the ultrasound-guided technique, as confirmed by anatomical dissection.

<table>
<thead>
<tr>
<th></th>
<th>Success/total (%)</th>
<th>95% CI</th>
<th>P-value</th>
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<tbody>
<tr>
<td></td>
<td>Blind technique</td>
<td>US-guided technique</td>
<td></td>
</tr>
<tr>
<td>Upper joint space</td>
<td>8/10 (80%, 0.442–0.964)</td>
<td>10/10 (100%, 0.655–1.000)</td>
<td>0.474</td>
</tr>
<tr>
<td>Lower joint space</td>
<td>3/10 (30%, 0.080–0.646)</td>
<td>9/10 (90%, 0.541–0.994)</td>
<td>0.020</td>
</tr>
<tr>
<td>Total</td>
<td>11/20 (55%, 0.320–0.761)</td>
<td>19/20 (95%, 0.730–0.997)</td>
<td>0.008</td>
</tr>
</tbody>
</table>

CI, confidence interval; US, ultrasound.
US-guided laser lithotripsy for calcific tendinitis of elbow

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Introduction: Calcific tendinitis is one of the very painful and disturbing condition, it may occur around shoulder, elbow, wrist, hip, knee, and many elsewhere. In many clinic, the diagnosis is made based on patient symptom and radiographic finding. However, calcific tendinitis is not easily diagnosed unless the deposit is big enough, hyperdense, ultrasounography or computed tomography examination is done. Physical theraphy(PT), ESWT, prolotherapy, steroid injection are actively used for elbow pain, despite of continuous treatment the results may not be satisfying for those underdiagnosed calcific tendinitis. Purpose is to report two cases of US-guided aser lithotripsy(USLL) in patients with calcific tennisit of elbow who did not respond to many other conservative treatment.

Case Report: Two patients were diagnosed and treated for lateral epicondylits several times in other hospital. 1st patient: A 59-year-old, right handed male had right elbow pain for 1 month. V AS score is 7, pain aggravated by full extension o, pingpong. Tenderness(+), LOM: slight. Radiography was normal, 0.98cm deposit was found during ultrasound examination. Patient had PT, ESWT, PDRN before visiting our hospitl.2nd patient: A 57-year-old, right handed male had right elbow pain for 2 month after golf practice. VAS score is 7, pain aggravated by gripping, golf. Tenderness(+), some LOM existed because of pain. Radiography was normal, 1.28cm calcium deposit was found during ultrasound examination. Patient had PT, ESWT, steroid injection before visiting our hospital. We performed double-needle calcium lithotripsy technique by using ultrasonography and laser(Ho:YAG, 10W, 200-300J)+100ml n/s irrigation+triamcinoloone 10mg with 0.5% Mepivacaine 10ml.

Results: USLL showed dramatic symptomatic improvement. (1 week later: VAS2, VAS2 /2 WEEK LATER: VAS 1, VAS 0 respectively). For the conclusion, 1) ultrasound examinaition is neccessary for patient with constent elbow pain regarding conservative treatment. 2) USLL also showed excellent pain relief in calcific tendinitis of shoulder and elbow.

The Effect of Speed of Normal Saline Injection on Optic Nerve Sheath Diameter in Thoracic Epidural Anesthesia

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**Background:** Intracranial pressure (ICP) is affected after epidural saline or local anesthetic injection. Both ICP and epidural pressures have been shown to reach peak pressure just after epidural injection and begin decline thereafter. Measuring the optic nerve sheath diameter (ONSD) through ultrasonography is one of the non-invasive methods used for ICP assessment. The purpose of this study was to investigate the effect of the speed of epidural saline injection to the ONSD under awake conditions.

**Study design:** Prospective randomized trial.

**Setting:** An interventional pain management practice in South Korea.

**Methods:** This study included 40 patients receiving thoracic epidural catheterization for pain management after upper abdominal or thoracic surgery. Following successful epidural space confirmation, patients were randomized to receive epidural saline infusion with a speed of either 1ml/sec (slow-speed, A group) or 3 ml/sec (rapid-speed, B group) respectively. For the measurement of ONSD, transorbital sonography was performed, and ONSD was measured at 3 mm posterior to the optic nerve head.

**Results:** A and B groups showed significant increases in ONSD according to time. Post-hoc analysis of this result revealed that ONSD at T10 and T30 were significantly increased from baseline values (T0) (* P < 0.05 vs. T0, + P < 0.001 vs. T0). The mean values at any of the time points and degree of changes (T1-T0, T10-T0, and T30-T0) in ONSD between groups A and B did not show any significance.
Factors associated with successful outcome to ganglion impar block: A Retrospective Study

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Background: Coccydynia is defined as pain in and around the coccyx. It has numerous causes and multiple contributing factors, ranging from obesity to childbirth trauma. It may arise as a consequence to soft tissue, bony, or even visceral pathology (e.g., spinal cord convergence, pressure on the coccyx, or an atypical pain referral pattern). In patients who do not respond to conservative treatment for coccydynia, ganglion impar block can be used as a good alternative to pain relief. However, the factors associated with successful responses to ganglion impar block for coccydynia are not well understood.

Methods: From January 2013 to December 2017, we performed a retrospective review of 192 cases with coccydynia patients who underwent ganglion impar blocks. Patients were considered successful responders if they showed a decrease of more than 50% or 4 points on the numerical rating scale. Logistic regression analysis was performed to determine the factors associated with successful responses to this surgical procedure. Results: After ganglion impar block, 36 (18.75%) of patients were considered successful responders. Univariate logistic regression analysis showed that coccydynia related with cancer was independently associated with successful responses after this surgical procedure (odds ratio = 3.236; 95% confidence interval = 1.368 s study is a retrospective study, the follow-up period varies from patient to patient. The different definition of successful response may have led to different results. In addition, the correct method of assessing functional status, which might have affected the outcome, could not be used in this study. Conclusion: These results suggest that ganglion impar block can be more effective on cancer-related coccydynia than other causes.
Comparison of Whitacre and Chiba type needles on the incidence of intravascular injection in caudal epidural injections

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**Background:** Intravascular injection is one of the complications of caudal epidural injection, which can cause embolization and local anesthetics systemic toxicity as well as failure of procedure. Whitacre type needle has been reported reducing intravascular injection during transforaminal epidural injection. Therefore, we assessed the effect of Whitacre type needle on incidence of intravascular injection during caudal epidural injection. **Methods:** A total of 164 caudal epidural injections were performed in patients with disc herniation or spinal stenosis on lumbosacral region. Patients were randomly allocated to Group W (n=82) and Group C (n=82). Patients in Group W received caudal epidural injection using Whitacre type needle and those in groups C received the procedure using Chiba type needle. Intravascular injection was assessed with blood aspiration and angiography during real-time fluoroscopy. **Results:** There were no differences between groups in terms of patient characteristics. There was no significant difference on incidence of intravascular injection between Group W and Groups C (19.5% vs 11.0%, P=0.128). In addition, there were no complications associated with procedure in both group. **Conclusions:** In this study, Whitacre type needle do not reduce the incidence of intravascular injection, compared to Chiba type needle. References: 1. Ann Conn, Ricardo M.Buenaventura, Sukdeb Datta, Salahadin Abdi, Sudhir Diwan. Systematic Review of Caudal Epidural Injections in the Management of Chronic Low Back Pain. Pain Physician 2009; 12:109-1352. 2. Jaehyuck Shin, Yong Chul Kim, Sang Chul Lee, Jae Hun Kim. A Comparison of Quincke and Whitacre Needles with Respect to Risk of Intravascular Uptake in S1 Transforaminal Epidural Steroid Injections: A Randomized Trial of 1376 Cases: prospective, randomized study. Anesth Analg 2013;117:1241.
Continuous cervical epidural block: Treatment for intractable hiccups

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Objectives: Intractable hiccups, although rare, may result in severe morbidity, including sleep deprivation, poor food intake, respiratory muscle fatigue, aspiration pneumonia, and death. Despite these potentially fatal complications, the etiology of intractable hiccups and a definitive treatment are unknown. This study aimed to evaluate the effectiveness and safety of continuous cervical epidural block as a treatment for intractable hiccups. Methods: Records from 28 patients with a history of unsuccessful medical and invasive treatments for hiccups were evaluated. Continuous cervical epidural block was performed with a midline approach at the C7-T1 or T1-T2 intervertebral space with the patient in the prone position. The epidural catheter was advanced through the needle in a cephalad direction to the C3-C5 level. Catheter placement was confirmed using contrast radiography. A 6 mL bolus of 0.25% ropivacaine was injected, and a continuous infusion of 4 mL/h of ropivacaine was administered through the epidural catheter using an infuser containing 0.75% ropivacaine (45 mL ropivacaine and 230 mL normal saline). When hiccups stopped and did not recur for 48 h, the catheter was removed.

Results: Cumulative complete remission rates were 60.71% after the first cervical epidural block, 92.86% after the second, and 100% after the third. One patient complained of dizziness that subsided. No other adverse effects were reported.

Discussion: Continuous C3-C5 level cervical epidural block has a successful remission rate. We suggest that continuous cervical epidural block can be an effective and safe treatment for intractable hiccups.

<table>
<thead>
<tr>
<th>Table 1. Characteristics of patients with intractable hiccups</th>
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<tbody>
<tr>
<td>Characteristic</td>
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<tr>
<td>Cervical fracture (n=28)</td>
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<tr>
<td>Gastrointestinal problems</td>
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<tr>
<td>GERD</td>
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<tr>
<td>Gastroparesis</td>
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<tr>
<td>Cholangitis</td>
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<tr>
<td>CNS problems</td>
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<tr>
<td>Central nervous system</td>
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<tr>
<td>Comorbidities</td>
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<tr>
<td>Cholecystitis</td>
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<tr>
<td>Malignancy</td>
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<tr>
<td>Prognosis caused by hiccups (n=25)</td>
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<tr>
<td>Weight loss</td>
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<tr>
<td>Depression</td>
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</table>

Values are expressed as mean ± standard deviation (SD) for age and hiccups duration. GERD = Gastroesophageal reflux disease, CNS = Central nervous system

<table>
<thead>
<tr>
<th>Table 2. Parameters related to the continuous cervical epidural block</th>
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<tr>
<td>Parameters</td>
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<tr>
<td>-------------------------------------------------------------------</td>
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<tr>
<td>Cervical block</td>
</tr>
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</table>

Values are expressed as mean ± standard deviation (SD).

Poster
Clinical efficacy of transforaminal epidural injection for management of zoster-associated pain: a retrospective analysis

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Objectives: Transforaminal epidural injection (TFEI) has superior accessibility to the dorsal root ganglion, which is an essential location of pain signaling in herpes zoster. However, the effectiveness of TFEI for herpes zoster patients has not previously been studied. We retrospectively analyzed the efficacy of TFEI for pain control and prevention of PHN in patients with acute and subacute herpes zoster. Methods: Medical records of 137 patients who underwent TFEI for zoster-associated pain (ZAP) were reviewed. The participants were divided into two groups: acute TFEI group (TFEI within 30 days after zoster) and subacute TEEI group (TFEI between 30 and 90 days). The efficacy of TFEI was assessed by a numerical rating scale (NRS), doses of medications, and time to relief of ZAP. Incidence of PHN at 1 week to 6 months after TFEI was evaluated. Results: Time to ZAP relief was significantly shorter and the incidence of PHN was significantly lower in the acute TFEI group than in the subacute TFEI group. Rate of medication discontinuation was significantly higher in the acute TFEI group than in the subacute TFEI group. Conclusions: Early application of TFEI in the acute phase of zoster can be a useful option for ZAP control and prevention of chronic neuropathic pain such as PHN.

Table 5: Proportion of patients who were able to discontinue the prescribed medication

<table>
<thead>
<tr>
<th>Antidepressants</th>
<th>Tricyclic antidepressants (TCA)</th>
<th>Analgesics</th>
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<tbody>
<tr>
<td>Acute TFEI group (n=75)</td>
<td>Subacute TFEI group (n=62)</td>
<td>p-value</td>
</tr>
<tr>
<td>1 week</td>
<td>15/75 (20%)</td>
<td>15/62 (24%)</td>
</tr>
<tr>
<td>1 month</td>
<td>30/75 (40%)</td>
<td>31/62 (50%)</td>
</tr>
<tr>
<td>2 months</td>
<td>81/75 (55%)</td>
<td>82/62 (52%)</td>
</tr>
<tr>
<td>3 months</td>
<td>90/75 (60%)</td>
<td>91/62 (56%)</td>
</tr>
<tr>
<td>4 months</td>
<td>90/75 (60%)</td>
<td>91/62 (56%)</td>
</tr>
<tr>
<td>5 months</td>
<td>90/75 (60%)</td>
<td>91/62 (56%)</td>
</tr>
<tr>
<td>6 months</td>
<td>90/75 (60%)</td>
<td>91/62 (56%)</td>
</tr>
</tbody>
</table>

TFEI: Transforaminal epidural injection

*p = 0.05

Fig. 1: Photomicrographs of TFEI. A: Anteroposterior (AP) view. B: Lateral view. TFEI: Transforaminal epidural injection.
**P-10**

### How drugs spread to the epidural space when caudal block

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**Background:** Caudal block is a safe and effective procedure for radiculopathy or back pain. This is an effective method for patients who have severe vertebral deformation or surgery and are difficult to perform epidural block with interlaminar approach. The purpose of this study was to inquire how caudal block can spread to the epidural space.

**Materials and Methods:** From July 2016 to October 2017, 29 patients suffering from back pain and post-laminectomy syndrome and spinal stenosis were enrolled. A caudal block under the C-arm guide was performed. All patients were injected with a solution of 0.2% ropivacaine + dexamethasone 2mg + hyaluronidase 1500U + dye 5cc. Continuous imaging showed that the drug with the dye spread to the epidural space. After the completion of drug injection, we measured the height of the dorsal space and the ventral space, respectively.

**Results:** The results showed that the highest level of drug was L2=3, L3=2, L4=10, L5=14 in dorsal space and L2=1, L3=3, L4=7, L5=17, S1=1 in ventral space.

**Conclusion:** Caudal block is a method known as selective nerve root block that is easier to relieve pain and improve dysfunction. Considering that most of the pathophysiology occurs in the ventral space between the intervertebral disc and the dura, it is desirable that the drug spread to the anterior side. If caudal block is performed, it is possible to send the medication forward with ease even without skilled techniques such as the transforaminal approach. Considering that the minimum amount of drug required to reach the L5-S1 disc site is 10 cc, a caudal block can send the drug to the ventral space over 96%.
Influence of injectate volume on paravertebral spread in erector spinae plane block: an endoscopic, anatomical evaluation

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The paravertebral spread that occurs following erector spinae plane block may be volume-dependent. This cadaveric study was undertaken to compare the extent of paravertebral spread in erector spinae plane block with different dye volumes. After randomisation, fourteen erector spinae plane blocks were performed bilaterally with 10 ml or 30 ml dye at the level of T5 in seven unembalmed cadavers. Direct visualisation of the paravertebral space by endoscopy was performed immediately after injections. The back regions were also dissected, and dye spread and nerve involvement were investigated. A total of five 10-ml injections and seven 30-ml injections were completed for both endoscopic and anatomical evaluation. No paravertebral spread was observed by endoscopy following any of the 10-ml injections. Dye spread to the spinal nerves at the intervertebral foramen was identified by endoscopy at adjacent levels of T5 (median: three levels) in all 30-ml injections. Upon anatomical dissection, all blocks were consistently associated with posterior and lateral spread to back muscles and fascial layers, especially in the 30-ml injections, which showed greater dye expansion. In one 30-ml injection, sympathetic nerve involvement and epidural spread was observed at the injection site level. Although paravertebral spread following erector spinae plane block increased in a volume-dependent manner, this increase was variable, and not pronounced. As injectate volume increased for erector spinae block, injectate spread to the back muscles and fascial layers seemed to be more predominantly increased, rather than the extent of paravertebral spread.
Why did we fail in caudal epidural block: short-term retrospective analysis in elderly veterans

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Low back pain is one of the most common medical illness. About 80% of American people experience the low back pain during their life time. Caudal epidural steroid injection is frequently used method to control radiculopathy or low back pain. The reported short term efficacy was 50-80%. But the efficacy of caudal epidural block in old aged patients seems quiet different from other reports. We performed retrospective analysis in veterans to identify the predictors for better result. The electronic medical records of 89 patients, who took caudal epidural block in Veterans health service medical center from March to August 2018, were analyzed retrospectively. A patient was assigned to response group when NRS based pain relief is bigger than 50% after 4 weeks from caudal epidural block. The percentage of response group was 19%. There was no statistical difference in age (response vs non response: 70.8±12.48 vs 75±6.57), gender (male %: 73.3 vs 85.3), comorbidity and NRS (6.6±1.7 vs 7.2±1.8). In structural abnormality, no significant difference was detected between two groups. There was no significant difference in stenosis type and number of affected spinal level. In symptoms, there was no significant difference in laterality, multiple dermatome, sleep disturbance, and number of neuropathic pain component (response vs non-response : 66.7% vs 41.2%, 7.6% vs 12.7%, 58.8% vs 57.6, 0.59±1.1 vs 0.72±1.2). But there was significant difference in back pain and number of pain characteristics (response vs non-response: 64.7 vs 33.3, p=0.026 , 1.24±0.43 vs 1.54±0.58, p=0.001). In elderly veterans, the effectiveness of caudal epidural block for low back pain and radiculopathy was only 19%, much lower than previously reported results. In our retrospective analysis, there was no statistical significance between two groups in structural abnormalities. The percentage of back pain was two times higher in response group. Symptom complexity and back pain might be good predictors for better pain relief in caudal epidural block.
Electronic population-based data study: Epidemiology of Trigeminal Neuralgia in Korea

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**Background:** Trigeminal neuralgia (TN) is one of the most common facial pain syndromes, causing severe unilateral, paroxysmal facial pain. The International Association for the Study of Pain (IASP) defines trigeminal neuralgia as “unilateral painful disorder that is characterized by brief, electric-shock-like pains, is abrupt in onset and termination, and is limited to the distribution of one or more divisions of the trigeminal nerve.”

**Methods:** Population-based medical data for 51,276,314 subscribers to the National Health Insurance Service (NHIS) from 2013 to 2017 were analyzed in this study for the epidemiology of TN in Korea, such as the incidence, regional distribution, medical cost and healthcare resource utilization and prescription pattern by medical departments.

**Results:** Findings indicate that the incidence of TN in Korea was 100.25 per 100,000 person-years in 2017 and correlated with age and sex. Female predominance was observed (Female-to-male ratio was 2.14:1) and peak incidence was in the 50s. From 2013 to 2017, the number of patient and medical cost of TN increased, respectively. The medical department managing TN the most was Neurology, followed by Otorhinolaryngology, Neurosurgery and Anesthesiology and pain medicine in Korea. Anticonvulsants and Non-steroidal anti-inflammatory drugs were the most frequently prescribed agents in the pharmacologic management of TN, but there was a difference in prescription patterns by the medical departments.

**Conclusion:** This is the first study on the epidemiology of TN in Korea with population-based data. The incidence rate of TN in Korea is 100.25 per 100,000 person-years with steadily increasing trend. Further researches on the cost-effectiveness of the management of TN and more systemic epidemiologic studies are needed for the effective management of TN in Korea.

Comparison between changes in facial temperature in patients after transnasal sphenopalatine ganglion block

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Background: Sphenopalatine ganglion block (SPGB) is a technique developed in the 1990s for the management of head and neck pain patients. Recently, transnasal sphenopalatine ganglion block (TN-SPGB) has been widely used for these patients; however, in literatures TN-SPGB were performed by various tools as cotton ball sticks or special tools for TN-SPGB like Tx360. We compared the facial temperatures after TN-SPGB by cotton ball sticks and by intranasal injection with syringe. In this study, we measured the changes in facial temperature before and 30 minutes after TN-SPGB.

Materials and Methods: The medical records of patients who underwent TN-SPGB between January 2016 and August 2018 were reviewed. TN-SPGBs by cotton ball sticks were performed 36 times in third two patients. TN-SPGBs by intranasal injection by syringes were performed 38 times in ten patients. The changes in facial temperatures measured at the forehead (V1), maxillary area (V2), and mandibular area (V3) before and 30 minutes after TN-SPGB were recorded and compared. Temperature were analyzed in cotton ball group and intranasal injection group.

Results: After TN-SPGB, the temperature decreased significantly on both sides of V1 in cotton ball group. (P=0.0208, 0.0181). But in intranasal injection group, the temperature increased in on both sides of V3. (p=0.038, 0.034)

Conclusion: The changes of temperature after TN-SPGB were different between cotton ball group and intranasal injection group. Further investigation would be needed.
Comparing the injectate spread and nerve involvement between different injectate volumes for GON block at the C2 level

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Purpose: The spread patterns between different injectate volumes have not yet been investigated in ultrasound-guided greater occipital nerve (GON) block at the C2 level. This cadaveric study was undertaken to compare the spread pattern and nerve involvements of different volumes of dye using this technique. Methods: After randomization, ultrasound-guided GON blocks with 1 ml or 5 ml dye solution were performed at the C2 level on the right or left side of five fresh cadavers. The suboccipital regions were dissected, and nerve involvement was investigated. Results: Ten injections were successfully completed. In all cases of 5 ml dye, we observed the deeply stained posterior neck muscles, including the suboccipital triangle space. The suboccipital and third occipital nerves, in addition to GONs, were consistently stained when 5 ml dye was used in all injections (100%). Although all GONs were successfully stained in the 1 ml dye cases, three of five injections (60%) concomitantly stained the third occipital nerves. Conclusion: The clinical efficacy of this technique using the 5 ml injectate seems unlikely to arise from the blockade of GON alone. Instead, its efficacy likely arises from the blockade of most nerves originating from the dorsal ramus of the upper cervical spinal nerve at the suboccipital area. Even using 1 ml of injectate may not guarantee blockade of the GON alone. References: 1. Greher M, Moriggl B, Curatolo M, Kirchmair L, Eichenberger U. Sonographic visualization and ultrasound-guided blockade of the greater occipital nerve: a comparison of two selective techniques confirmed by anatomical dissection. Br J Anaesth. 2010;104(5):637–642. 2. Kim HS, Shin KJ, O J, Kwon HJ, Lee M, Yang HM. Stereotactic topography of the greater and third occipital nerves and its clinical implication. Sci Rep. 2018;8(1):870.
A novel method of locating foramen ovale for percutaneous approaches to the trigeminal ganglion

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Background: For trigeminal neuralgia patients who do not respond to medication and for whom surgical approaches are too risky, percutaneous procedures targeting the trigeminal ganglion are the current standard treatment. Percutaneous procedures are performed via the transoval approach under radiological guidance. Identification of the foramen ovale (FO) under fluoroscopic guidance is an important part of determining the success or failure of the procedures. Objective: Previous studies have described how to visualize the FO under fluoroscopic guidance, but those methods are limited by poor reproducibility. In this study, we have investigated how to visualize the FO clearly and easily under fluoroscopic guidance. Study Design: Retrospective analysis. Setting: University hospital in Korea. Methods: Seventy two 3D facial CT scans without anatomical abnormalities of the skull base were analyzed for verifying the novel method. First, the mandible angle and the occipital cortex line were overlapped and then turned by 15°oblique rotation using the software package. After these manipulations, the visualization of the FO was graded according to a 4-point scale (0: poor; 1: fair; 2: good; 3: excellent), and the inferior transfacial and oblique angles were measured. Results: This enabled clear visualization of the FO. The mean visual grade of 54 right and 46 left FO (total 100) was 2.74 (0: poor; 1: fair; 2: good; 3: excellent). All recorded FOs had at least grade two visibility. Limitation: This study is the lack of application in clinical practice and data compared to submental view. Conclusions: The mandible angle and the occipital cortex line are obvious anatomical landmarks and are visible even to non-experienced practitioners. Therefore, our method using these anatomical landmarks can improve the reproducibility and accuracy of FO visualization.
Case Report: Alcoholic Neurolysis of Genicular Nerve for Chronic Knee Pain under ultrasound and fluoroscopic guidance

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Genicular nerve block is a popular technique to alleviate knee pain particularly in patients with knee osteoarthritis, chronic post-operative pain of the knee after arthroplasty or arthroscopic surgeries. Radiofrequency ablation of these nerve has been widely reported in small scale studies and in multiple case reports and in general this procedure has a 25\% failure rate. However, we would like to report another technique of neurolysis using chemical technique either with alcohol. We report two cases of genicular nerve neurolysis using with use of alcohol. The first patient had mixed neuropathic and nociceptive after multiple arthroscopic knee surgeries and was not responsive to conservative treatments. The second case is a patient with chronic knee osteoarthritis with mainly nociceptive like pain and effusion of the knee. She also has functional limitation effusion of the knee and was not responding to conservative treatment. In both these cases we performed diagnostic genicular nerve block with 2ml of 1\% lidocaine under ultrasonography. After checking the reduction of pain, we performed genicular nerve neurolysis with 0.5ml of 99\% alcohol under both ultrasonography and fluoroscopy guidance with excellent outcome after six weeks review. No complications were noted immediately or after six week. In conclusion, chemical neurolysis of the genicular nerve is a safe and effective alternative techniques for both chronic knee osteoarthritis and post-surgical pain syndrome. Apart from that, the comparatively low cost, ease of use and early clinical outcomes when compared to radiofrequency ablation makes it an attractive alternative.
Effectiveness of percutaneous lumbar foraminoplasty using a safety-improved device in lumbar foraminal spinal stenosis

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Background: Lumbar foraminal spinal stenosis (LFSS) is defined as the narrowing of the nerve root exit associated with a herniated intervertebral disc, osteoarthritic changes in the facet joints, or a hypertrophied ligamentum flavum, which can provoke neurogenic claudication. In order to achieve effective and safe decompression of the lumbar spinal foram, a specially designed instrument (Claudicare®, SEAWON Meditech, Bucheon-si, Gyeonggi-do, Republic of Korea) for percutaneous lumbar foraminoplasty (PLF) was invented. The purpose of this study was to evaluate the clinical efficacy and safety of the newly devised instrument in patients with LFSS.

Methods: PLF was performed for LFSS by a single pain physician. For each patient, an 11-point numerical rating scale (NRS) pain score, the Oswestry Disability Index (ODI), and the duration of walking without radicular pain were evaluated at the 3-month follow-up. The successful responder percentage was defined as ≥ 50% reduction from the baseline NRS score with improvement in ODI and duration of walking.

Results: Among 24 patients who underwent PLF, 15 patients showed successful responses. The NRS pain score and duration of walking without radicular pain were improved significantly from baseline at the 3-month follow-up (P < 0.01). The ODI was also decreased, but the difference was not statistically significant (P = 0.09). The NRS pain score and walking duration without pain at 3 months were statistically significantly different between the groups (P < .001 and P = 0.01, respectively), whereas there was no statistically significant difference in improvement in ODI between the groups (P = 0.23). No serious adverse events occurred in the study.

Conclusions: In conclusion, PLF using the Claudicare® device may be an optimal and safe option for managing intractable LFSS on an outpatient basis.
Treatment of spinal stenosis using multiple intervention treatments – a case report

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Introduction: Spinal stenosis is a common degenerative disease which can be caused by changes in the intervertebral disc, facet joint or ligaments. Though many procedures have been introduced to treat spinal stenosis, none of them are viewed as the outright treatment of choice. In this case report, we present a case that combines various methods in the treatment of spinal stenosis. Case Report: A 70-year-old man visited our clinic, who suffered from lower back pain which radiated to the right leg and was aggravated when walking or standing. He complained of severe pain (NRS 7) in spite of conservative treatment at local clinics for two years. The patient had been diagnosed with L4/5 spinal stenosis through lumbar spine magnetic resonance imaging (MRI) (Figure 1). In order to treat the patient, we first tried series of transforaminal/interlaminar epidural blocks in adjunct to conventional medical therapy. After failure of the aforementioned methods, we attempted intervention treatments such as foraminoplasty using Claudicare and percutaneous epidural neuroplasty in order to depressurize the stenosis of the spinal canal and intervertebral foramen. However, these intervention treatments only had limited improvement in the patient’s symptoms. In consequence, we tried an epiduroscopic procedure, TELA (transforaminal epiduroscopic laser annuloplasty), to mechanically decompress the patient’s spinal canal which also had a limited response. Finally, we resected the patient’s ligamentum flavum with interlaminar PELD (Figure 2). After this procedure, the patient’s pain score decreased to NRS 3 and dropped to NRS 1 after a month. Conclusion: In order to effectively treat spinal stenosis, we should aim to identify the primary cause of the stenosis and focus the treatment according to the cause. Combination of multiple treatments can be beneficial in some patients.
Contrast dispersion may be associated with clinical outcomes after epidural neuroplasty with a balloon catheter

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Background: Contrast dispersion pattern on epidurography may be associated with clinical improvement after epidural neuroplasty. However, insufficient evidence supports this theory. The current study aims to evaluate the relevance of contrast dispersion and clinical improvement after percutaneous epidural neuroplasty using an inflatable balloon catheter.

Method: One-hundred patients with lumbar spinal stenosis who underwent combined balloon decompression and epidural adhesiolysis between March 2015 to December 2015 participated in the present study. Participants were divided into two groups by contrast dispersion pattern on post-procedural epidurography - the complete contrast dispersion (CCD) and incomplete contrast dispersion (ICCD) group. The numeric rating scale (NRS), Oswestry Disability Index (ODI), and global perceived effects (GPE) were each assessed before and 1, 3, 6, 9, and 12 months after the intervention.

Results: After combined balloon decompression and adhesiolysis, significant pain reduction and functional improvement were maintained up to 12 months in patients with lumbar spinal stenosis. NRS and GPE in the CCD group were significantly lower than in the ICCD group from 6 to 12 months after the intervention. The ODI in the CCD group was also significantly lower compared with that in the ICCD group from 1 to 12 months after the intervention.

Conclusion: Combined balloon decompression and adhesiolysis with the inflatable balloon catheter can provide noteworthy pain reduction and improvement of physical function for a long-term period in patients with lumbar spinal stenosis. Because CCD showed better clinical improvement compared with ICCD, a contrast dispersion pattern may be associated with an improved clinical outcome.
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Epiduroscopic Decompression of the Symptomatic Perineural Cyst: a Case Report

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Introduction: A perineural cyst in the spinal canal is usually asymptomatic. However, symptoms can occur when the size of the cyst becomes large enough to compress the nerve root. In this case report, we would like to report a successful decompression of symptomatic perineural cyst using an epiduroscope. Case: A 42-year-old male patient visited our pain center complaining of discomfort and pain in his right posterior thigh. The MRI image of the patient showed a huge perineural cyst (53 x 31 x 21 mm) compressing the right S1 nerve. There were no other abnormalities, which can explain the patient’s symptom. Initially, right S1 transforaminal epidural injection was performed; however, it was unsuccessful, because the cyst blocked the spread of the drug to the nerve root. Aspiration of the cyst via S1 foramen was attempted, but again unsuccessfully. Finally, we tried to perform an epiduroscopic decompression of the perineural cyst. After advancing the epiduroscope and locating the cyst, we fired laser to make a hole in the cyst wall. Then the epiduroscope was advanced into the cyst through that hole. After aspiration of the cystic fluid, the procedure was completed. The symptom of the patient was relieved after the procedure without any complication.

Conclusion: The epiduroscope can be used for the decompression of symptomatic perineural cyst in the spinal canal.
The correlation of perfusion index change and analgesic efficacy in transforaminal block for lumbosacral radicular pain

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Background: Transforaminal epidural injection is used to relieve radicular pain by reducing inflammation and ischemia of affected nerve root. However, there is no objective method to assess improved ischemic status following transforaminal injection. Perfusion index has been introduced to monitor peripheral perfusion and oxygenation status. This study was performed to evaluate the correlation of perfusion index change and analgesic efficacy in transforaminal block for lumbosacral radicular pain. Methods: We retrospectively analyzed data from 100 patients who received transforaminal block for lumbosacral radicular pain. We assessed continuously perfusion index and skin temperature at pre-treatment, 5, 15, 30 minutes following block. Pain score and cold allodynia were recorded at pre-treatment and 30 minutes following block. We defined clinically evident changes of pain score, a 50% decrease from pre-treatment. Then, we categorized patients into group I (improved patients) and Group N (not improved patients). Results: Of 100 patients assessed for eligibility, 8 were excluded. Thus, a total 92 patients were finally analyzed. Of these patients, 57 (61.9%) reported over 50% pain reduction (Group I) and 35 (38.0%) showed below 50% pain reduction (Group N). Group I showed significant increased change in perfusion index at 5 minutes following block (p = 0.029). Conclusions: In this study, clinically improved patients showed significant increased change in perfusion index at 5 minutes following lumbosacral transforaminal injection. Perfusion index at 5 minutes can be an objective method to predict efficacy of lumbosacral transforaminal block.
Nucleoplasty using YES-disc® for the treatment of chronic low back pain

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Objective: Nucleoplasty, using YES-disc®, is a minimally invasive procedure used to decompress herniated discs. Reviews to date recommend nucleoplasty for treating chronic back pain, although with the restriction of limited to fair evidence. The purpose of this study was to evaluate long-term efficacy over 6 month follow-up of nucleoplasty treatment for chronic low back pain. Method: We performed Neucleoplasty using Yesdisc® in 233 Patients who visited our clinic addressing chronic low back pain. 216 patients were followed up to 6 month. Mean age of all patients was 47. 155 patients were treated with one level disc, 77 patients were treated with two level disc, 1 patient was treated with three level disc. Patients were asked to show their VAS score on pre-op, each 1-week, 4-weeks and 6-months follow-up visits. Result: Evaluating 217 patients, VAS of back pain was reduced from 8.1 to 2.8 at 6-month’s visit. For leg radiating pain, VAS changed from 7.1 to 2.7. 14 patients could not complete this study due to consisting pain. Complications occurred in three patients. (2 patients developed infection after the procedure and the catheter was cut off in one patient). Conclusion: Nucleoplasty using Yes-disc® appeared to be an effective and safe method for LBP without significant complications and minimal morbidity. In our study, A significant decrease in both low back pain and leg pain was seen between the preoperative VAS scores and scores after 1-week ,after 1-month and 6-month follow-ups. This study has several limitation. There were 14 patients who could not complete the study due to consisting pain.
Endoscopic contralateral decompression of foraminal stenosis

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Introduction: spinal diseases inducing low back pain are one of the most common diseases that reduce individual activity and social economic activity. And the lifetime prevalence of common low back pain is estimated at 65% to 80% in developed countries. There are variable treatments from conservative management to surgery. Endoscopic surgery has several advantages including less damage to the normal muscles and tissues, and the surgery can be done without general anesthesia. Case: The patient is an 72-year-old woman with a history of low back pain and radiating pain into both buttocks and right thighs. Previously she had received multiple lumbar epidural steroid injections and other conservative therapy. But, over the past few months, symptoms on right side have worsened. The patient underwent a lumbar spine MRI, which showed a spinal stenosis at the L5S1 level and diffuse disc bulging and facet arthrosis at entire level of lumbar spine. After discussion with the patient, she elected to undergo percutaneous endoscopic lumbar decompression. Patient underwent epidural anesthesia with lidocaine 20mg. And midazolam 5mg IV was used for sedation. The patient was placed in a prone position over the Wilson frame. We used a contralateral approach of the symptomatic side to obtain the sufficient decompression without violation of either side facet joints. 2cm transverse incision was made just lateral to the outer border of the interlaminar space. After the guide wire and working cannula docked to the ipsilateral lamina under C-arm fluoroscopy, endoscope was introduced through the working channel. To expose a contralateral outer boundary of spinal canal, ipsilateral bony structures and outlayer of ligamentum flavum were removed. And we removed the contralateral outer layer, inner layer of ligamentum flavum. then, decompressed foraminal region. Procedure time took 2 hours and postoperative pain was controlled with NSAIDs. Radiating pain was decrease VAS 8 to 2 in POD 2. and maintained during 1 month. Conclusion: With this approaching technique, we can decompress lumbar stenosis under visualization without violating the segmental motion unit of the spine (facet).
The effect of percutaneous lumbar foraminoplasty combined with epidural adhesiolysis

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Background: Non-surgical lumbar percutaneous foraminoplasty (FP) is an emerging technique in pain physicians these days. Scraping hypertrophied facet joint, ligamentum flavum and foraminal ligaments with a curette-like needle, foraminal and central decompression and perineural adhesiolysis can be achieved. Method: We performed FP using a newly designed device (FORAMOON) combined with percutaneous epidural adhesiolysis (PEN) for patients who had suffered from lumbar spinal stenosis. They were classified to 3 groups: Group 1: spinal stenosis, Group 2: Spinal stenosis and spondylolisthesis, group 3: spinal stenosis and previous lumbar surgery history. Numeric Rating Scale (NRS) pain score and modified Macnab criteria of each group were evaluated for 3-month follow-up. Result: Among 113 patients who underwent the procedure, 80 patients completed 3 months follow-up. There were 58 patients (73%) who showed 50% or more reduction of NRS, classified to successful responder. In group 1(n=42), reduction of NRS score was from 7.3 to 2.6, statistically significant (p=0.003). 68% of patients responded excellent or good for Modified Macnab score. In group 2(n=19) and 3(n=19), thought mean NRS score was reduced (group 2: 7.3 to 2.7 / group 3: 7.9 to 3.4), not statistically significant (p=0.27 / p=0.38). 58% / 63% % of patients responded excellent or good for Modified Macnab score. Conclusion: Lumbar percutaneous FP combined with PEN showed effective pain reduction for treatment of spinal stenosis.
The Effectiveness of Additive Transforaminal Epidural Blocks in patients with radicular pain during Treatment of PEN

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Background: Percutaneous epidural neuroplasty (PEN) is an effective interventional treatment for radicular pain. But in some cases with wire catheter like Racz catheter, contrast runoffs were not shown to the foramen. We investigated contrast runoff would affect the results of PEN and in cases which contrast runoff were not shown, additive transforaminal epidural blocks would affect the results of PEN. Materials and Methods: Medical records were investigated in patients who were performed PEN with ABEL catheter (wire type) from May 2016 to August 2018. One hundred twelve patients were enrolled. Cervical PEN was 19, Lumbar PEN 93 (FBSS 18 included). Analysis was performed. We compared 1) Success rate of Runoff group and Nonrunoff group in all enrolled patients, 2) Success rate of Runoff group and Nonrunoff group in lumbar spine patients, 3) Success rate of Runoff group and Nonrunoff-NonTransforaminal group in lumbar spine patients. Results: First, the success rate was statistically different between Runoff group (n=50) and Nonrunoff group (n=62) in all patients. (p=0.044) Second, the success rate was not statistically different between Runoff group (n=39) and Nonrunoff group (n=54) in lumbar spine patients. (p=0.15) Third, the success rate was statistically different between Runoff group (n=39) and Nonrunoff-NonTransforaminal group (n=14) in lumbar spine patients. (p=0.012) Conclusion: Contrast runoff influenced the success rate of PEN with wire type catheter. In cases which contrast runoff were not shown, additive transforaminal epidural blocks were increasing the results of PEN with wire type catheter.
Patient-activated bolus device added to previously implanted intrathecal morphine pump in non-cancer chronic pain

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Background: Intrathecal drug delivery (ITDD) is an effective treatment option for severe cancer pain with acceptable life expectancy or non-cancer chronic pain refractory to other treatments. However, continuous intrathecal infusion mode has frequently required systemic short-acting opioid (SAO) for breakthrough pain (BTP). This may lead to opioid-related aberrant behavior such as abuse, diversion, coping, and drug accident, and can damage the effect of ITDD. Patient-controlled intrathecal analgesia (PCIA) with on-demand bolus device (myPTM) was introduced since 2017. This retrospective cohort study aims to evaluate SAO consumption change and cost-saving change, and review withdrawal cases for suggesting indications of PCIA add-on to ITDD.

Method: Authors reviewed demographics, pain intensity, SAO usage, cost change, and cause of withdrawal for 1 year after PCIA of non-cancer chronic pain patients underwent ITDD at least 3 months before PCIA. The primary outcome was the proportion of who stopped SAO. The secondary outcome was morphine milligram Equivalents (MME) change, cost change by PCIA itself charge, additional refill fee and transportation expense, and the reasons of PCIA withdrawal.

Conclusion: Twenty-seven patients underwent PCIA and 14 were included in the per-protocol set. Six of 14 (43%; p = 0.04) completely stopped SAO. SAO MME was not changed in the PPS (median -8.8; IQR -28.5 between the group who stopped SAO and the group did not stop SAO. Annual cost-saving was very heterogeneous between subjects ranged between KRW -1,395,740 to 16,943,792 (median 151,957; IQR -601,444 95,740 and 17,064,833 (median 47,582; IQR -321,541 sed bolused doses. Financial break-even point was 5.9 (2.1 with positive optimized net cost-benefit. In the cluster analysis, the patients with high SAO MME and seeking IV opioid behavior fentanyl (ROF) usersly, but showed better cost-savings than other patients. Eight of 27 FAS (30%) withdrew PCIA, and the reasons were night pain (4), improved BTP (3), and fear of tolerance (1). Discussion: PCIA add-on to previously implanted ITDD in chronic pain showed the discontinuation in the significant proportion of SAO users. Cost-saving was not generally significant except in the ROF users, but it can be improved by regimen optimization. ROF users may not stop SAO completely, but they are the most indicative for PCIA because of prominent cost-saving. Pain at night is the most important reason of SAO discontinuation. Therefore, analgesia for BTP during night with only PCIA could be more unsatisfactory than other situations.
Epiduroscopic disc decompression by both approaches via sacral hiatus and Kambin’s triangle

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Epiduroscopy is an interventional treatment for various spine disease. Conventional epiduroscopy has been performed through sacral hiatus. But nowadays, the transforaminal approach is used by some tools like TELA. We present three cases of epiduroscopic disc decompression by both approaches via sacral hiatus and Kambin's triangle with good results. The patients of three cases had radicular pain induced by lumbar herniated disc. Disc decompression was made by holmium-YAG laser. All patients treated by both approaches via sacral hiatus and Kambin's triangle showed good results in radicular pain, daily living and walking. Epiduroscopic disc decompression by both approaches via sacral hiatus and Kambin's triangle would be a good choice of treatment for the patients with radicular pain by lumbar disc disease.
Optimal cut-off points of lumbar pedicle thickness as a morphological parameter to predict lumbar spinal stenosis

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Purpose: Lumbar spinal stenosis syndrome (LSSS) is induced by factors such as ligamentum flavum hypertrophy, facet joint hypertrophy and disc degeneration. However, the role of lumbar pedicle (LP) in LSSS has yet to be evaluated. We devised a new morphological parameter called the lumbar pedicle thickness (LPT) to evaluate the connection between LSSS and the LP. We hypothesized that the LPT is a major morphological parameter in the diagnosis of LSSS. Patients and methods: The LPT data were collected from 136 patients diagnosed with LSSS. A total of 99 control subjects underwent lumbar spine magnetic resonance imaging (MRI) as part of a detailed medical assessment. Axial T2-weighted magnetic resonance (MR) images were acquired from all the participants. Using our picture archiving and communication system, we analyzed the thickness of the LP at the level of L5 vertebra on MRI. Results: The average LPT was 9.46±1.81 mm in the control group and 13.26±1.98 mm in the LSSS group. LSSS patients showed a significantly greater LPT (P<0.001) than the control group. The receiver operating characteristic (ROC) curve analysis showed an optimal cutoff point of 11.33 mm for the LPT, with 83.8% sensitivity, 83.8% specificity and area under the curve of 0.92 (95% confidence interval [CI], 0.89d with a higher possibility of LSSS, suggesting its importance in the evaluation of patients with LSSS. Keywords: lumbar pedicle, lumbar pedicle thickness, lumbar spinal stenosis syndrome, diagnosis
National epidemiologic study of complex regional pain syndrome in Korea

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Introduction Although social burden for complex regional pain syndrome (CRPS) is crucial clinical issue, epidemiological evidence is still limited due to complexed decision process. This study aimed to investigate the updated epidemiology of CRPS in Korea using National Health Insurance Data. Methods KCD codes for CRPS together with CRPS national registry has been used to define CRPS cohort from 2009 until 2016. CRPS was divided into CRPS type 1 and type 2. CRPS registry was established as registering a new patient of CRPS and registry began to be cumulated from 2009. Primary outcome was investigating overall incidence rate for CRPS, and secondary outcome was annual trend of incidence rate of each CRPS types, and investigating affecting factors including age, gender, area and level of hospitals for annual trend of each CRPS incidence rate. For statistical analysis, chi-square test, linear and logistic linear regression test were conducted. Results A total of 122,210 of patients were registered during observation duration. Overall incidence of CRPS was 15.83 per 100,000 people in Korea (type1, 19.5; type2, 12.1, respectively). Overall trend of CRPS incidence showed a significantly decreasing trend. Among the two types, annual trend of CRPS type 2 showed sharper decrease in its incidence rate (p<0.01). Among the total CRPS, the proportion of CRPS type 1 (61.7%) was more common than that of type 2 (38.3%), and female proportion was larger in both type of disease. Most common affected age group per year was over sixties in both CRPS type 1 and 2 and also in both sexes (P < 0.05, respectively). There was no significant association between sex or hospital level with annual trend of CRPS incidence rate. However, non-Metropolitan area showed significant association with higher decreasing trend of CRPS incidence rate compared with Seoul area in both CRPS types. Conclusions This is the first epidemiological study of CRPS using national registry set. Overall incidence of CRPS in Korea was 15.83 per 100,000 people and showed decreasing trend in all age groups. Further studies are needed to investigate the relationship between trend of incidence rate and age structural change, and also needed to investigate the socioeconomic burden of CRPS in Korea.
The effects of SCS in neuropathic pain and assessment of prognostic factors—pain duration and adaptive mode

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Spinal cord stimulation has been used for chronic neuropathic pain. Spinal cord is less invasive and relatively simple than surgery, but it has a higher initial cost and is quite invasive compared to other general pain interventions. Patient selection criteria for spinal cord stimulator (SCS) implantation has been developing gradually, but there is continuing need to evaluate predictors of SCS treatment result. Variation in the intensity of neurostimulation with patient position can have negative affect for the result of spinal cord stimulation. Recent technological advances have led to the development of an automatic position adaptive spinal cord stimulator. We analyzed the effect and potential risk factors of treatment failure in SCS therapy. In addition, we also evaluated the safety and efficacy of automatic position adaptive system compared to the conventional manual method. This study retrospectively analyzed the medical records of 198 cases of spinal cord stimulation trial performed at Seoul National University Hospital from 2004 to 2015 for 12 years. For risk factor analysis, the patients were divided into success (133, 67.2%) or failure (65, 32.8%) group either according to the predetermined definition of treatment failure and treatment success. For adaptive mode analysis, patients were divided into adaptive (48, 24.2%) or conventional (150, 75.8%) group respectively according to the application of adaptive mode. The mean VAS of all subjects was reduced by more than 2 points after SCS treatment (p < 0.001). For risk factor analysis, there was statistically significant difference in pain duration (p = 0.027), VAS, satisfaction, trauma-related psychiatric disorders (p = 0.010), pain cause of trauma (p = 0.037), adaptive mode (p = 0.001), numbers of SCS revision (p = 0.045), execution of SCS revision (p = 0.005), and repeated execution of SCS therapy (p = 0.010). As a predictor of SCS treatment failure, we could find pain duration (p = 0.020, Exp = 1.006, 1.001 < CI95% < 1.012) and the use of adaptive mode (p = 0.001, Exp = 0.209, 0.082 < CI95% < 0.531) with 71.2% of predictive value. For adaptive mode analysis, the use of adaptive mode was significantly related to more permanent implantation (p < 0.001), less execution of removal (p = 0.001), less frequent revision (p = 0.014), and less SCS treatment failure (p = 0.001). This retrospective analysis showed that SCS is a safe and effective method to treat chronic neuropathic pain. Pain duration and the use of adaptive mode were showed as a predictive factor associated with SCS failure. The automatic position adaptive system can be used to improve patient satisfaction and induce more effective pain reduction with large potential cost savings.
The effectiveness of continuous epidural analgesia on acute herpes zoster and postherpetic neuralgia Using the Epistim

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Objectives: This study was designed to compare the therapeutic and pain relief effects of continuous epidural analgesia on the chronic phase as well as the acute phase of herpes zoster with standard medical treatment. Methods: Medical records of 227 patients with moderate to severe zoster-associated pain that had not subsided despite standard medication were retrospectively reviewed. Response to treatment was defined as a ≥50% reduction in pain severity since the initial visit and remission was considered complete for patients whose pain rating ≤2 for more than 3 successive visits. Results: Patients who received a combination of standard treatment and continuous epidural analgesia (epidural group) reported significantly higher response to treatment (P =0.001) than did patients administered the standard treatment alone (medical group). The adjusted odds ratio for response to treatment in the epidural group versus the medical group were 5.17 (95% confidence interval [CI]: 1.75 to 14.88) in both acute and chronic groups, respectively. The adjusted odds ratios for complete remission in the epidural group versus the medical group were 3.05 (95% CI: 1.20 to 7.62) in both groups, respectively. Discussion: Continuous epidural analgesia can effectively relieve pain caused by acute herpes zoster and postherpetic neuralgia increase the remission rates. Continuous epidural analgesia with standard medical treatment may offer a clinical advantage in the management of pain caused by acute herpes zoster and postherpetic neuralgia.
Dexmedetomidine in supraclavicular brachial plexus block for a patient with intractable CRPS pain: A 2-year follow-up

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Pain management in CRPS remains a major challenge due to lack of evidence-based treatment trials specific for this condition. Nerve block with local anesthetics may relieve pain by reducing afferent transmission of nociceptive pathway, but it usually does not provide long term relief. Recently, dexmedetomidine, a potent α2 adrenoceptor agonist, has shown to prolong duration of block and post-operative analgesia when added to local anesthetic in regional anesthesia. However, there is no report on effect of long term use of dexmedetomidine for CRPS pain management. Here, we describe a case report of satisfactory prolonged pain relief after supraclavicular brachial plexus block with dexmedetomidine, every 2-4 months over 2 years, for total 10 treatments, in a patient with severe upper extremity CRPS pain. Long-term repeated dexmedetomidine usage of brachial plexus block may be an option for alleviating treatment-resistant CRPS pain. Further research and large clinical trials are needed to on the optimum dexmedetomidine protocol (dose, dosing interval, total number of treatment and when to stop).

References
Successful removal of permanent spinal cord stimulators in patients with complex regional pain syndrome

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Objective: It is uncommon for patients who have received a permanent implant to remove the spinal cord stimulator (SCS) after discontinuation of medication in complex regional pain syndrome (CRPS) due to their completely painless state. This study evaluated CRPS patients who successfully removed their SCS. Materials and Methods: This 10-year retrospective study was performed on patients who had received the permanent implantation of an SCS and had removed it 6 months after discontinuation of stimulation, while halting all medications for neuropathic pain. Age, sex, duration of implantation, site and type of CRPS, and their return to work were compared between the removal and non-removal groups. Results: Five (12.5%, M/F = 4/1) of 40 patients (M/F = 33/7) successfully removed the permanent implant. The mean age was younger in the removal group than the non-removal group (27.2 ± 6.4 vs. 43.5 ± 10.7 years). The mean duration of implantation in the removal group was 34.4 ± 18.2 months. Two of 15 patients (13.3%) and 3 of 25 patients (12%) who had upper and lower extremity pain, respectively, had removed the implant. The implants could be removed in 5 of 27 patients (18.5%) with CRPS type 1 (vs. 0 of 13 patients with CRPS type 2). All 5 patients (100%) who removed their SCS returned to work, while only 5 of 35 (14.3%) in the non-removal group did. Conclusion: Even though this study had limited data, younger patients with CRPS type 1 had a better prognosis for complete pain relief after SCS implantation and could remove the SCS within a 5-year period and return to work.
Erector spinae plane block for effective analgesia after total mastectomy

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Background and objective: Case reports have suggested that erector spinae plane block (ESPB) may provide multimodal analgesia for patients undergoing breast surgery. Therefore, we performed a retrospective observational study to evaluate the analgesic effects of ESPB in total mastectomy. Methods: Of 48 patients who underwent total mastectomy, 20 were assigned to the ESPB group and 28 to the control group. Twenty patients in the control group were selected by propensity score matching to the 20 patients in the ESPB group. Patients in the ESPB group were injected with 30 ml 0.375% ropivacaine, followed by catheter insertion for further injections of local anesthetics every 12 hours for 3 days. The primary outcome was total fentanyl consumption during the first 24 hours postoperatively. Secondary outcomes included pain intensity levels (visual analogue scale [VAS]) and postoperative nausea and vomiting (PONV) score. Results: Median cumulative fentanyl consumption during the first 24 hours was significantly lower in the ESPB (33.0 interquartile range [IQR], 27.0 n the control (92.8 up (p = 0.004). Pain level in the early postoperative stage (< 3 hours) and PONV (0% vs 55%) were also significantly lower in the ESPB than in the control group. Conclusions: ESPB after total mastectomy reduces fentanyl consumption and early postoperative pain. ESPB is an excellent option for multimodal analgesia after total mastectomy.
Combined radiofrequency and chemical neurolysis of lumbar sympathetic ganglion on gynecologic cancer-related lymphedema

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Introduction: Gynecologic cancer-related lymphedema is a common problem, characterized by a chronic, swollen leg. Lymphedema causes chronic pain, heaviness and a decreased quality of life. The standard treatment of lower limb lymphedema (LLL) is a conservative treatment. There are a few studies that lumbar sympathetic ganglion block (LSGB) can be helpful on gynecologic cancer-related lymphedema. However, there is no report on the effect of neurolysis of lumbar sympathetic ganglion (LSG) in gynecologic cancer-related lymphedema. We hereby report the case of a patient treated with combined radiofrequency and chemical neurolysis of LSG for cervical cancer-related lymphedema. Case: A 46-year-old woman was referred to our pain clinic with LLL. She was diagnosed with cervical cancer with bone metastasis in the left iliac bone. The patient had pain, heaviness and a limited range of motion in the left leg. The patient underwent caudal block, transforaminal block and continuous epidural block. However, the effects were not satisfactory. We performed LSGB on the patient 2 times at 1-week interval. The pain decreased from NRS 7 to 3. The circumference of the patient's thigh and calf decreased by 4cm and 2cm, respectively. We decided to perform combined radiofrequency and chemical neurolysis for the longer effect. The procedure was performed on the affected side at the L2, L3 and L4 levels. The 15cm radiofrequency electrode was introduced at an angle via tunnel vision technique under fluoroscopic guidance. After checking the correct needle position by contrast medium, the sensory and motor tests were done with 50Hz, 1.0 V electrical stimulation and 2 Hz, 1.0 V electrical stimulation. There was no muscle twitch and somatic nerve stimulation. 1ml of 2% lidocaine was injected. 5 minutes later radiofrequency thermocoagulation was conducted. The temperature was set at 70, 75 and 80°C and three cycles were done for each temperature, with 100 seconds for each cycle. Subsequently, 2ml of dehydrated alcohol was injected to each level. The pain score by the NRS was 2. The tightness and heaviness of the affected limb was alleviated. The relief of symptoms was observed to have well maintained after one month. Conclusion We suggest that combined radiofrequency and chemical neurolysis of LSG can be a therapeutic option for the treatment of gynecologic cancer-related lymphedema.
Comparison Between Intrathecal and Epidural drug infusion for Refractory Cancer Pain: impact on pain, complication

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Introduction: Treating intractable cancer pain is challenging. In 1986, the world health organization has come up with a three step ladder to assist clinicians in treating cancer pain. While 90% of cancer patient’s pain and 75% of palliative cancer patient’s pain are treated well with the use of this guideline, substantial number of patients who may need further treatment or interventions. Thus, a fourth step was proposed which included the use of interventions to treat cancer pain. Neuroaxial infusions are part of this intervention group which includes either intrathecal catheter insertion or epidural catheter insertion. In this article, we performed an audit comparing the efficacy and complications of intrathecal and epidural port insertions.

Methods: We studied the data of 48 patients who was either inserted epidural or intrathecal port. Demographic data, type of cancer, NRS scores before insertion, and post insertion at Day 1, Day 3, Day 7 and Day 30 was collected. All patients were given morphine but other factors such as addition of local anesthetics and dexmedetomidine as adjuvants were noted. Lastly, we also collected data for the number of cases which has complications and the type of complications.

Results: 18 patients had epidural port inserted while 30 patients had epidural port inserted. In the epidural group, the gender distribution was uneven with 15 male patients and 3 female patients while the intrathecal group had equal gender distributions at 15 males and 5 females. There were no difference between mean weights for both groups, which was at 55.5kg. The type of overall mean numeric rating scale (NRS) scores were not significantly different between both groups before insertion and post insertion at D1, D3, D7 and D30. While there were 7 patients in the epidural group with complications and 8 from the intrathecal group who developed complications, statistical comparison with the number of complications between groups were not significant (p=0.44). Most complications in the epidural group were urinary retention while in the intrathecal group it was kinking of the catheter. Three patients in the epidural group developed infection while two patient the intrathecal group developed postdural puncture headaches.

Conclusion: In conclusion, both methods are good methods of controlling pain with no differences in NRS scores and they also had no statistical difference in terms of number of complicated cases. However, the types of complications differ between both groups and the cause for this deference should be studied further.
The Correlation Between the Patient Health Questionnaire-2 (PHQ-2) and Postoperative Pain

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Backgrounds: That postoperative pain control is very important for patient recovery. With growing interest in ERAS(Enhanced Recovery After Surgery) concept, postoperative pain management becomes more important. There were many studies about correlation of depressive mood and musculoskeletal pain. However, correlation between postoperative pain and depressive mood remains unclear.

Objectives: We evaluate the relationship between patient health questionnaire-2 (PHQ-2) and postoperative pain.

Methods: Thirty patients scheduled for elective laparoscopic cholecystectomy with ASA grade 1 or 2 were recruited. They did the PHQ-2 under the supervision of researcher for about 1 minute on the day before surgery. In a post-anesthesia care unit (PACU) after surgery, patients numeric pain rating scale (NPRS) was checked. The total amount of analgesics used for two days after surgery was documented.

Results: The NPRS score in PACU was not significantly related (Pearson correlation coefficient = -0.011[p=0.954]) to the PHQ-2 score. However, in high PHQ-2 group used more postoperative analgesics (Pearson correlation coefficient = 0.782[p=0.000]).

Conclusions: There is a correlation between the PHQ-2 and postoperative analgesic use. Therefore preoperative PHQ-2 test is useful for predict postoperative analgesic requirement.
The effect of stellate ganglion block for the treatment of cellulitis in infectious breast cancer–related lymphedema

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Introduction: Breast cancer-related lymphedema (BCRL) remains one of the most intractable complications after surgery. Patients with lymphedema may suffer from chronic pain, heaviness, and physically impaired arm function with a limited range of motion which could impede social activities, decrease quality of life, and lead to depression or social isolation of breast cancer patients. Moreover, recent studies have reported that several risk factors of BCRL development, including axillary lymph node dissection (ALND), regional lymph node dissection (RLNR), body mass index (BMI) ≥25 kg/m², and cellulitis. The relationship between cellulitis and lymphedema is a vicious cycle, and cellulitis worsens lymphedema and increases the risk for additional infection. Even though the etiology of infectious lymphedema has not been clearly determined, it is necessary to treat cellulitis as well as lymphedema. We report a case of a patient treated with stellate ganglion block (SGB) to relieve the symptoms and reduce the arm circumference of BCRL patients.

Case Report: We report a case of a 66-year-old woman with BCRL treated with stellate ganglion block (SGB) without steroids over a 1-month period to relieve symptoms and reduce her arm circumference. We measured her arm circumference at four locations: 10 cm and 5 cm both above and below the elbow crease. Additionally, we determined the Numerical Rating Scale (NRS) score and Breast Cancer Questionnaire score (BCQS) on every visit to the pain clinic. Decreases in the arm and pain score were measured after the second injection of SGBs accompanied by intravenous antibiotics treatment. The patient was satisfied with the treatment especially regarding relief of pain and swelling, and her shoulder range of motion improved, which led to better quality of life. Conclusion SGB can be offered as a complementary therapy to conventional cellulitis treatments for infectious BCRL patients. Even though our results in this case are insufficient to prove the relationship between cellulitis and BCRL, these multidisciplinary treatments, including conventional methods and SGB, led to a successful outcome in our BCRL patient. More research on the relationship between cellulitis and BCRL is needed.
The analgesic efficacy of continuous adductor canal block compared to single shot ACB with IV-PCA in TKA

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**Background:** Adductor canal block (ACB) is an effective intervention for postoperative analgesia following total knee arthroplasty (TKA). However, the ideal ACB regimen has not yet been established. We compared the analgesic effects between continuous ACB group and single-shot ACB with fentanyl-based intravenous patient-controlled analgesia (IV-PCA) group.

**Methods:** Patients who underwent TKA were randomly allocated to either continuous ACB group (Group CACB) or single-shot ACB with IV-PCA group (Group ACBIV). Before the surgery, ultrasound guided ACB with 0.5% ropivacaine 20cc was provided in all patients. Before skin incision, the infusion system (0.2% ropivacaine through an adductor canal catheter in group CACB vs. intravenous fentanyl in group ACBIV) was connected. The postoperative pain severity, nausea, and vomiting; side effects of local anesthetics and opioids; administration of rescue analgesics and anti-emetics; and sensorimotor deficits were measured at 30 min, 2 h, 4 h, 8 h, 24 h, and 48 h after surgery.

**Results:** Postoperative pain severity was significantly higher in the ACBIV group at 30 min, 4 h, 24 h, and 48 h after surgery. The averages and standard deviations (SD) of VRS score of postoperative pain were 0.14±0.37, 4.57±2.37, 6.00±1.63, and 4.28±1.49, respectively. Yet, rescue analgesic requirements and quadriceps muscle strength were not statistically different between the groups throughout the postoperative period. Moreover, rescue antiemetic requirements were higher in group ACBIV than group CACB.

**Conclusions:** In this study, the continuous ACB provided more superior analgesia and fewer side effects without significant motor deficit than single shot ACB with IV-PCA.

**Keywords:** Analgesia, Patient-Controlled, Arthroplasty, Knee, Nerve block, Ultrasonography
Erector spinae plane block for effective analgesia after total mastectomy with sentinel lymph node dissection

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Erector spinae plane block (ESPB) is a newly emerging truncal block that can cover a wide range, from T1-2 to T8-10, for 10-12 h. The procedure is easy and safe, and presents a minimal risk of complications, compared with conventional regional block approaches. This report describes cases where ESPB provided effective analgesia after total mastectomy with lymph node dissection. Three patients underwent total mastectomy with sentinel/axillary lymph node dissection. After surgical procedure, continuous ESPB via catheter was performed for postoperative pain control. A bolus of 0.375% ropivacaine with epinephrine (1:200000) was injected through the indwelling catheter every 12 h. Postoperative pain score was maintained between 0 and 2. Total opioid consumption was minimal, and there was no requirement for rescue analgesics during the postoperative period. We believe that the ESPB can provide effective analgesia after total mastectomy with sentinel lymph node dissection.
Comparative effects of endoscopic ultrasound- and fluoroscopy-guided celiac plexus neurolysis: a randomized trial

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Background: Intractable cancer pain causes quality of life (QOL) decreasing of patients who did not sufficiently controlled by medications including opioids. A celiac plexus neurolysis (CPN) is an alternative option to manage pancreatic cancer pain. Although a CPN can be performed with endoscopic ultrasound (EUS) or fluoroscopic guidance, there have been few reports on the comparative effectiveness of the two different CPN modalities. The purpose of the present study was to compare the treatment outcome between EUS- and fluoroscopy-guided CPN to patients with pancreatic cancer pain.

Method: This prospective, randomized, equivalence controlled trial included 60 patients with intractable abdominal and/or back pain caused by pancreatic cancer of whom were randomly assigned to undergo either of EUS- or fluoroscopy-guided CPN. Primary outcome included the change in numerical rating scale (NRS) of pain intensity. Secondary outcomes included The National Comprehensive Cancer Network Functional Assessment of Cancer Therapy Hepatobiliary-Pancreatic Symptom Index (NFHSI) for QOL, global perceived effect of satisfaction (GPES) and opioids consumption.

Results: Significant reduction of NRS, NFHSI and opioid consumption was observed in both groups at 1, 2, and 4 weeks after intervention. However, no significant between-group differences were detected. In GPES, both groups are comparable but more satisfaction reported at 1 month of fluoroscopy-guided CPN group. Conclusion: Both EUS- and fluoroscopy-guided CPN may have comparable effects in managing intractable pancreatic cancer pain.
Evaluation of ultrasound-guided erector spinae plane block for reducing postoperative pain in thoracic surgery

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Introduction: Regional block is one of the concept of enhanced recovery after surgery (ERAS) for acute postoperative analgesia. Regional anesthesia studied and considered part of multimodal anesthesia for thoracic surgery include epidural block, paravertebral block, intercostal block. The erector spinae plane block (ESPB) is a newly defined regional anesthesia technique. ESP is a novel myofascial plane block. The ESPB is targeted at anterior surface of the erector spinae plane, which is oriented cephalocaudally to the spinal transverse process. Local anaesthetic injected in this plane can block the dorsal rami and ventral rami and intercostal nerves. The aim of this study was to evaluate the effect of ESPB on postoperative pain in thoracic surgery.

Method: The data reported in this pilot study were collected between 20 June and 10 August 2018. All patients provided written informed consent when ESPB was performed. This study is retrospective case control study. 15 Patients received ESPB and 12 patients no intervention (control group). ESPB was performed under ultrasound guidance using a linear 6- to 10-MHz ultrasound probe before general anesthesia induction. Linear ultrasound transducer was placed in a longitudinal parasagittal orientation 2~3 cm lateral to the T5 spinous process. A total of 25 injected into the ESP. Pain scores were measured on an 11-point numeric rating scale (NRS) for several time. Residual time of post anesthesia care unit (PACU) was checked. Opioid consumption for staying PACU were compared.

Result: Demographic data, and types and durations of surgeries were similar between the two groups. Mean opioid consumption at PACU was pethidine 36.67 ± 15.80mg in the ESPB group, and 52.08±22.50mg in the control group. ESPB significantly reduced rescue analgesic consumption at PACU (p = 0.048). Residual time of PACU was 30.4 ± 8.1 minutes in ESBP and 37.7±8.4 minutes in control (P=0.035) When patient arrived at PACU, NRS scores were statistically significantly lower in ESPB (4.47±1.25 (ESPB) vs 6.08 ±1.31 (control) , p=0.003).

Conclusion: Our study findings show that US-guided ESPB exhibits a significant analgesic effect in patients undergoing thoracic surgery. ESPB was helpful to reduce the rescue analgesic consumption, especially opioid. The use of analgesics in the recovery room decreased and recovery time at PACU was reduced in ESPB group.
Pectoral nerve block reduces intraoperative opioid use and postoperative pain after breast cancer surgery

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Background: Pectoral nerve (Pecs) block is a recently introduced technique for providing surgical anesthesia and postoperative analgesia during breast surgery. The aim of this study was to investigate the effects of Pecs block for reducing perioperative analgesia in the patients who undergoing breast cancer surgery (BCS).

Methods: Thirty nine patients scheduled for BCS were randomly allocated to receive either general anesthesia plus Pecs block (Pecs group, n=20) or general anesthesia alone (control group, n=19). Remifentanil and propofol based total intravenous anesthesia were anesthetic induction and maintenance for maintain surgical pleth index (SPI) from 20 to 50 and bispectral Index (BIS) between 40 and 60. After anesthesia induction, Pecs group receive an ultrasound-guided PecsII block before the start of the operation using 30 ml of 0.5% bropivacaine. Postoperative pain score and analgesic requirement were assessed at 1, 16-24, 24-48h after surgery.

Results: Total infused remifentanil was significantly lower in the Pecs group than in the control group (6.9 ± 2.3 μg/kg/h vs.10.4 ± 3.6 μg/kg/h, p = 0.001) during the surgery. Postoperative pain scores after arrived at postanesthetic care unit (PACU) and 1h after surgery were significantly lower in the Pecs group than in the control group (P = 0.004 and 0.002). Rescue analgesic requirements in the PACU were significantly lower in the Pecs group than in the control group (P = 0.029).

Conclusions: PECSB is effective for reducing the intraoperative opioid use and improve the postoperative analgesia after breast cancer surgery.
Salmonella spondylitis: a rare case of septic spondylitis

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Septic spondylitis is one of the major diseases that cause back pain and should not be missed. A wide range of organisms have been associated with septic spondylitis and includes Mycobacterium tuberculosis, Staphylococcus aureus, Escherichia coli, Pseudomonas, Streptococci, and Kelbsiella. Salmonella is rare causative organism of bacterial spondylitis. It is known to cause a number of characteristic clinical infections in humans from gastroenteritis, enteric fever, and bacteremia to the asymptomatic carrier state. Salmonella spondylitis is associated with only small cases of all osteomyelitis cases and the majority of cases are frequently associated with patients with immunocompromised states, such as malignancies, long-term corticosteroid use, and sickle cell anemia. Here, we report our case about salmonella spondylitis occurred in a healthy adult without a specific medical history. He was treated with injection therapy at other local hospitals for a sustained back pain on thoracic region and temporarily improved. But, on 5 days after the injection, his back was suddenly aggravated again and he admitted for proper evaluation and management. Thoracic MRI showed septic spondylitis and salmonella was identified from bone biopsy. After 2 months of antibiotic treatment, he was cured.
Complete AV block in outpatient waiting room

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Introduction: The population of pain medicine is commonly old, which implicates patients have complicated medical history. We present a case of syncope in outpatient clinic. Case Report: A 78-year-old woman with a history of hypertension, type 2 diabetes, and chronic kidney failure had a syncope. On examination, she had marked sinus bradycardia (rate 38 beats per min) on electrocardiogram and hyperkalemia and metabolic acidosis on laboratory findings. Atropine and epinephrine was administered and dopamine was given continuously. It was ineffective. When transcutaneous pacing was done, she was turned to be alert and vital sign also to be stable. She received temporary pacemaker insertion and transferred to the intensive care unit for correction of electrolyte imbalance. Conclusion: Syncope is a common symptom and has various etiology. Hyperkalemia can be associated with electrocardiographic changes which lead a syncopal episode.
Acute Cervical Myelopathy with Quadriparesis after Cervical Transforaminal Epidural Blocks

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Background: Cervical transforaminal epidural blocks (TFEBs) have been postulated to be more effective than cervical interlaminar epidural blocks (ILEB) because transforaminal epidural blocks can deliver the injections accurately to the site of pathology. However, many studies have reported that serious complications following TFEBs occurred more frequently when it was conducted at the cervical level. We report a case of cervical myelopathy and left arm paralysis after TFEBs in a patient with cervical spinal stenosis. Case: The patient is a 63 years old woman, 62.1 kg, 151.3 cm, BMI 27.1 without any history of trauma or disease. She suffered from paresthesia in the C5,6,7 sensory dermatomes and radiating pain. She suffered from weakness and numbness of the left side extremity immediately during TFEBs. A magnetic resonance image (MRI) was obtained and demonstrated intramedullary high signal intensity is seen at left sided spinal cord from C4 to T4 with ill-defined edema and myelopathy (Fig. 1). Conventional conservative care was allowed for the treatment her weakness and neuropathic pain. Although the motor weakness of her left arm recovered sufficiently for casual activity, the neurologic symptom in her left hand remained uncomfortable for nearly 8 months, regardless of treatment. In follow-up MRI, 8 months after spinal cord injury, was obtained and demonstrated decrease size intramedullary high signal intensity (Fig. 2). She had recovery except of grasp, first and second finger abduction weakness and intermittent paresthesia in the hand.
Clinical safety of implantable drug delivery systems in dementia patients: a case study

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Introduction: Implantable drug delivery systems (IDDS) are effective treatments for chronic pain patients who require high doses of narcotic analgesics. Among the complications, drug-induced ones occur mainly due to overdose. However, sudden interruption of morphine infusion may result in withdrawal syndrome. Mechanical failure and catheter damage could cause abrupt stop of infusion. [1, 2] Several patients’ factors may contribute the problem. We present a case of treated acute withdrawal symptoms in dementia patient with cognitive dysfunctions who had failed to keep the refill date. Case presentation: A 68-year-old male patient was diagnosed with complex regional pain syndrome type 1 due to post-traumatic pain above VAS 9/10. He had been suffered severe pain despite of conservative treatments and several operations. Thus, IDDS had placed. Pain intensity was maintained VAS 3-4/10 with a dosage of 1 mg/day of morphine. About 1 year later, the patient was diagnosed with dementia. He managed pain by refilling drugs without any problems for 2 years, follow up loss in recent months. He came to emergency room due to severe pain, agitation and hyperventilation syndrome in 2 months ago. We administered morphine 10 mg, followed by intravenous morphine PCA. Next day IDDS was refilled. There were few drugs left in the pump. We titrated intrathecal morphine 0.8 mg/day within 1 week. Withdrawal symptoms are recovered. The patient did not recognize the alarm from IDDS until he visited the hospital and could not remember the refill date. Discussion: IDDS is semi-permanent and effective method of drug administration. Severe complications can develop if adequate blood drug levels are not maintained for any reasons. This case suggests essential considerations for the management of the IDDS. Patients should be selected considering the risk factors such as cognitive impairment. And physicians must be acquainted with managing withdrawal symptoms. And dementia may develop in elderly during treatment. It seems to active education for patients and caregivers is necessary. References: 1. Hu K, Connelly NR, Vieira P. Withdrawal symptoms in a patient receiving intrathecal morphine via an infusion pump. J Clin Anesth 2002; 14: 595-7. 2. Kosturakis A, Gebhardt R. SynchroMed II intrathecal pump memory errors due to repeated magnetic resonance imaging. Pain Physician 2012; 15: 475-7.
A Case of Allergic Cutaneous Reaction to Spinal Cord Stimulator Device

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Spinal cord stimulation has been used since the 1960s to treat chronic consistent refractory pain such as failed back surgery syndrome and complex regional pain syndromes. The purpose of this paper is to describe a rare case of cutaneous reaction to spinal cord stimulator device component. A 42-year-old man diagnosed of complex regional pain syndrome affecting the right upper extremity underwent implantation of spinal cord stimulator device. The patient developed erythematous plaque and pruritis on right flank area on postoperative day 21. The erythematous rash was localized along the lead, and the anchoring site and the implantable pulse generator site were not involved. Dexamethasone was intravenously administered, and topical steroid was applied. Dexamethasone was changed to oral steroid and was stopped after tapering for 14 days. Some cases of allergic reaction of spinal cord stimulator devices could be controlled by medical treatment like corticosteroid.
Reversible Horner’s syndrome after cervical spinal cord stimulator implantation in a CRPS patient

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We successfully performed cervical spinal cord stimulator (SCS) surgery in a 27-year-old man with complex regional pain syndrome to control intractable pain. The SCS trial was performed twice to adjust the SCS coverage region. After permanent implantation surgery, the patient developed Horner’s syndrome when the region near the C4 spinal dorsal root was stimulated. However, the Horner’s syndrome disappeared after changing the stimulation leads. This case report suggests that cervical SCS can be associated with superior cervical ganglion stimulation.
Hematoma after Transversus abdominis plane block in a patient taking anticoagulants

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Introduction: We performed transversus abdominis plane (TAP) block in a patient undergoing dual antiplatelet therapy with cerebral infarction history and experienced abdominal subcutaneous hematoma. Therefore, we want to share our experience of abdominal hematoma and treatment. Case: The patient was a 77-year-old female with candesartan, clopidogrel, and aspirin medication due to hypertension, cerebral infarction history. Postherpetic neuralgia was followed up from the outpatient clinic and showed improvement by repeated Intercostal nerve blocks without any complication. At the fifth visit, she underwent ultrasound guided TAP block for right lower quadrant abdominal pain. After the block, she went home without any complaints. After 4 hours she was admitted to the emergency room due to swollen abdomen and abdominal pain. On CT abdomen, a high density lesion, estimated to be a hematoma of about 6.7 cm in diameter, was placed on the RLQ abdominal wall subcutaneous layer, and the patient decided to temporarily abort the antiplatelets and observe it with abdominal compression. She was hospitalized for 11 days and her abdominal circumference was reduced without any abnormality during hospitalization. In follow up abdomen CT, the active bleeding of the hematoma disappeared and there was organized hematoma with a smaller size of about 6 cm. Conclusion: Despite ultrasound guided block and compression, there may be always the possibility of superficial vascular injury and hematoma after block. In particular, it should be kept in mind that hematoma formation may occur in patients taking anticoagulants.
Analysis of patterns of QSART for patients with CRPS diagnosed using the Proposed Research Criteria

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Background: Quantitative Sensory Axon Reflex Test (QSART) is an diagnostic method for an objective evaluation of sudomotor dysfunction in complex regional pain syndrome (CRPS), but its validity remains controversial. The aim of this study is to investigate the diagnostic value of QSART for CRPS on the Budapest research criteria. Methods: From January 2013 to December 2015, we investigated the electronic medical records of 184 consecutive patients, who underwent QSART, with a suspected diagnosis of CRPS. The following patient details were available for analysis: age, sex, diagnosis, type of CRPS, injury sites, laterality, secondary gain, pain intensities at the initial outpatient visit, duration of CRPS symptoms prior to evaluation at our pain center, QSART results, QST results, Thermography results, medications, and the treatment modalities received. Results: The sensitivity, specificity, positive likelihood ratio, and negative likelihood ratio of QSART for the diagnosis of CRPS according to the Budapest research criteria were 67.14, 40.62, 0.83, and 0.22, respectively. The odds ratio (OR) of QSART for diagnosing CRPS according to the Budapest research criteria was 1.40 (95% CI, 0.62 er, the OR of QSART for diagnosing CRPS type II among CRPS patients was 3.80 (95% CI, 1.36 ) and statistically significant. Among various signs of CRPS, sweating were the only significant predictors of a positive QSART result. QSART, ANS test, and thermography were not related to the outcome of sympathetic nerve block. Conclusion: In conclusion, the diagnostic value of QSART as a screening or a confirmatory test for CRPS according to the Budapest research criteria is low. The results of autonomic nerve tests including QSART were not related to the outcome of sympathetic nerve block.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Table 7</th>
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<tr>
<td></td>
<td>Neo-CRPS (n=52)</td>
</tr>
<tr>
<td>QSART (+)</td>
<td>20</td>
</tr>
<tr>
<td>QSART (-)</td>
<td>33</td>
</tr>
<tr>
<td>OR</td>
<td>1.40 (0.62 – 3.06)</td>
</tr>
<tr>
<td>Sensitivity (%)</td>
<td>67.14 (59.36 – 74.82)</td>
</tr>
<tr>
<td>Specificity (%)</td>
<td>40.62 (21.41 – 57.64)</td>
</tr>
<tr>
<td>PLR</td>
<td>0.83 (0.76 – 0.90)</td>
</tr>
<tr>
<td>NLR</td>
<td>0.22 (0.11 – 0.33)</td>
</tr>
<tr>
<td></td>
<td>Fail (N=32)</td>
</tr>
<tr>
<td>CRPS_type</td>
<td></td>
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<tr>
<td>Type I</td>
<td>15 (46.87%)</td>
</tr>
<tr>
<td>Type II</td>
<td>8 (24.24%)</td>
</tr>
<tr>
<td>NRS 0-0</td>
<td>7.9 ± 1.1</td>
</tr>
<tr>
<td>Duration (months)</td>
<td>27.3 ± 48.1</td>
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<tr>
<td>Abnormal QSART result</td>
<td>16 (50.0%)</td>
</tr>
<tr>
<td>Abnormal ANS result</td>
<td>7 (20.0%)</td>
</tr>
<tr>
<td>Abnormal thermography result</td>
<td>19 (54.4%)</td>
</tr>
<tr>
<td>- N/A</td>
<td>1</td>
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</tbody>
</table>
The clinical efficacy for diagnosis of CRPS by using 3 phase whole body bone scan, QSART, and infrared thermography.

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**Background:** Complex regional Pain Syndrome (CRPS) is the disease related continuous and spontaneous pain caused by neural deficit. This disease mostly diagnosed with clinical symptom and sign. Therefore, it is hard to make definite diagnosis because there is no specific test for diagnosis. Recently, Quantitative sudomotor axonal reflex testing (QSART) is used subsidiary for diagnosis, but it is not popularized and easy to use clinically. Authors will evaluate the clinical efficacy to diagnose CRPS with infrared thermography, 3 phase whole body bone scan, and QSART. **Method:** Infrared thermography, 3 phase whole body bone scan, and QSART were performed on 32 patients who have symptoms of CRPS. Patients groups were divided to 3. First group patients were examined with infrared thermography and QSART (TS group). Second group were examined with infrared thermography and 3 phase whole body bone scan (TW group), and the last group were examined with all three methodology (TSW group). Logistic regression was used to draw ROC curve with the outcome, and AUC valued was compared. **Results:** The AUC values were 0.882 in the TS group, 0.927 in the TW group, and 0.936 in the TSW group, and there was no statistically significant difference between the groups. **Conclusion:** In diagnosis of CRPS, using all 3 methods (infrared thermography, 3 phase whole body bone scan, QSART) is the most helpful. However, if the clinical circumstance is not proper for all 3 examinations, using one of methods of 3 phase bone scan or QSART with infrared thermography provides good enough diagnostic value.
Perfusion Index as an early indicator of successful lumbar sympathetic plexus block

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Background: Lumbar sympathetic plexus block (LSPB) has been used as an effective diagnostic and therapeutic method for the treatment of various sympathetic mediated pain. However, there is no definitive indicator to determine a successful block immediately after the block. Perfusion index (PI) reflects changes in peripheral blood flow, in real time, with a non-invasive method. Because local anesthetics used in LSPB induce vasodilation and increased peripheral blood flow, PI can represent functional sympathetic block in real time. We evaluated the PI value and PI change over time after LSPB, and obtained the cut-off value of PI, PI change to determine whether LSPB was successful. Methods: Twenty-three LSPB were prospectively performed. The LSPB was performed by administering 8 mL of 1% lidocaine. PI was measured up to 5 minutes at 1 minute intervals from the time of lidocaine administration, and 5 minutes, 7 minutes, 10 minutes, 20 minutes, and 30 minutes after lidocaine administration. We compared the PI, PI change on the treated and untreated sides. The success of LSPB was evaluated as improvement of patient symptoms 20 minutes after injection. Results: Fifteen (68%) LSPB were clinically successful. In a successful case, PI increased significantly after 3 minutes of lidocaine administration (p = 0.007). The receiver operating characteristic curve analysis showed that the optimal cut-off value to determine the success of LSPB at the earliest time was a PI increase of above 3.50 after 3 minutes of lidocaine administration, with 93.8% sensitivity, 75.8% specificity and area under the curve of 0.93. Conclusions: An increase of PI above 3.50 after 3 minutes of lidocaine administration may be an initial objective indicator of successful LSPB.
Dry sauna therapy is beneficial for patients with low back pain

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Dry sauna has been very popular as an alternative therapy for promoting health among people who want to improve their health condition without relying on pharmaceuticals. The aim of this study was to investigate whether dry sauna therapy improved symptoms in participants with low back pain. Study participants comprised a total of 37 consecutive patients, > 20 years old, who reported low back pain. The dry sauna therapy was performed twice per day for 5 consecutive days within 1 week, with a total of 10 sessions each comprising 15 minutes of exposure to a 90°C dry sauna. Clinical parameters and body composition data were measured before and after dry sauna therapy. Blood samples were obtained before and after therapy to assess biochemical data. Heart rate was significantly lower after dry sauna therapy (P < 0.01), as were scores on the verbal numerical rating scale and Oswestry Disability Index (P < 0.001 for both). Satisfaction levels were reported as excellent, good, and fair by 3 (8%), 23 (62%), and 11 (30%) participants after dry sauna therapy. No participant reported a poor satisfaction level. The proportion of participants who reported successful treatment (excellent + good) was 70%. Our results suggest that dry sauna therapy may be a useful and safe option to improve quality of life and reduce pain in patients with low back pain. Therefore, pain physicians can recommend dry sauna therapy as an alternative and complimentary therapy for patients with low back pain.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Before (n = 37)</th>
<th>After (n = 37)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (cm)</td>
<td>156.3 ± 6.2</td>
<td>156.2 ± 6.4</td>
<td>0.335</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>64.1 ± 11.4</td>
<td>62.5 ± 10.6</td>
<td>0.763</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>88.0 ± 7.3</td>
<td>86.8 ± 10.2</td>
<td>0.285</td>
</tr>
<tr>
<td>Systolic BP (mmHg)</td>
<td>135.8 ± 19.1</td>
<td>129.2 ± 18.2</td>
<td>0.087</td>
</tr>
<tr>
<td>Diastolic BP (mmHg)</td>
<td>106 ± 12.5</td>
<td>77.5 ± 12.6</td>
<td>0.510</td>
</tr>
<tr>
<td>Heart rate (beats per minute)</td>
<td>75.4 ± 10.4</td>
<td>71.1 ± 10.3</td>
<td>0.003</td>
</tr>
<tr>
<td>VNSRS</td>
<td>5.0 ± 1.2</td>
<td>3.1 ± 1.1</td>
<td>0.001</td>
</tr>
<tr>
<td>ODI</td>
<td>12.2 ± 4.6</td>
<td>8.28 ± 4.0</td>
<td>0.001</td>
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</table>

Values are presented as mean ± standard deviation. *P < 0.05 compared with before dry sauna therapy.

<table>
<thead>
<tr>
<th>Satisfaction level</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>3 (8%)</td>
</tr>
<tr>
<td>Good</td>
<td>23 (62%)</td>
</tr>
<tr>
<td>Fair</td>
<td>11 (30%)</td>
</tr>
<tr>
<td>Poor</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Successful treatment</td>
<td>26 (70%)</td>
</tr>
</tbody>
</table>

Successful treatment = Excellent + Good

Values are presented as a (%).
The effect of Medications and Epidural Steroid Injections on Fracture in Postmenopausal women with Osteoporosis

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Introduction: Epidural steroid injections (ESIs) are commonly used to manage low back pain and radiculopathy. Recently, studies to warn of complications of ESIs have been reported. Postmenopausal women with osteoporosis have major risk factors for osteoporotic fractures such as the female gender, advanced age, and low BMD. Based on this issue, it is important to evaluate the relationship between ESIs and osteoporotic fracture. The aim of this study was to investigate whether ESI is correlated to osteoporotic fractures after ESI in postmenopausal women with low back pain and osteoporosis.

Methods: A total of 172 patients aged 55 years and older who satisfied the inclusion criteria were selected as the subjects after age (±1 year) and body mass index matching. The inclusion criteria for the study were postmenopausal women with a medical history of ESI or medication for low back pain, who had no fracture with osteoporosis, who had radiographs and BMD assessments performed within a year before ESI or medication, and who had radiographs and medical records performed up to 5 years from ESI or medication for low back pain. Group 1 consisted of patients received medications, Group 2 consisted of patients received ESIs. Each patient's age at menopause, medical history and status with smoking, drinking, physical activity and exercise were obtained using a questionnaire.

Results: The mean total number of ESIs was 6.2, and the mean cumulative administered dose of corticosteroid (dexamethasone) was 31 mg. The incidence of fracture in the medication group and ESI group was 45% and 56% in the thoraco-lumbar spine, 9% and 13% in the hip joint. There were no statistically significant differences between the 2 groups with respect to smoking, alcohol drinking, exercise or physical activity.

Conclusions: Patients in postmenopausal women with osteoporosis and low back pain were higher incidence of fracture at the thoraco-lumbar spine and hip joint. However, the result this study showed that the patients received ESIs did not differ in incidence of fracture at the thoraco-lumbar spine and hip joint patients from the patients received medication in both groups with similar conditions in age, weight, height, BMD, and life style.
Antinociceptive effect of Avenanthramide C in the formalin-induced pain model

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**Background:** Avenanthramides (Avns) extracted from oats and those synthetically prepared exhibit potent antioxidant properties in vitro and in vivo. Avenanthramides C (Avn-C), one of the major forms of Avns has the highest antioxidant activity in vitro. Therefore, the purpose of this study was to examine the effect Avn-C in the rat formalin test. **Methods:** An intrathecal catheter was inserted in male Sprague-Dawley rats. For induction of pain, 50 μL of 5% formalin solution was applied to the hind paw. Pain behavior was quantified by periodically counting the number of flinches of the injected paw after injection. The number of flinches was counted for 1 min periods at 1 and 5 min and at 5 min intervals from 10 and 60 min. For the intrathecal dose-response study, Avn-C was administered intrathecally 10 min before the formalin injection. **Results:** Intrathecal administration of Avn-C decreased dose-dependently the sum of the number of flinches during phase 2, but not during phase 1 in the formalin test. **Conclusions:** These findings indicate that Avn-C is effective against facilitated pain evoked by formalin injection at the spinal level. Thus, the spinal Avn-C may be useful in the management of tissue injury pain. * This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No. 2018R1D1A1B07041771).
Comparative study of chronic post–ischemic pain models in mice: O–ring vs tie method

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Background: The success rate for production of animal models of chronic post-ischemia pain (CPIP) using an O–ring method is complex regional pain syndrome-type I (CRPS-I), and it is more difficult to produce a CPIP model especially for mice. Therefore, We devised a new CPIP model with a higher success rate that induces ischemia for 3h by ting the hind limbs of mice with a rubber band, followed by reperfusion. Methods: A total of 22 C57BL/6 male mice were divided into a Sham group (n=6), a Ring group (n=8), a Tie group (n=8), and Anesthesia was induced using isoflurane. A pre-cut O–ring left ankle in the sham group. A tight-fitting O–ring at the same location in the ring group and tie group. Reperfusion was induced 3h later. The thickness and circumference of hind paws subjected to 10 days of ischemia induction until reperfusion were measured. Mechanical allodynia was measured using a von-Frey filament until 12 weeks after reperfusion. Results: The new tie model took 5 more days until onset of allodynia compared to the CPIP model using O–ring method. However, the rate of successful CPIP model induction was higher in the tie group than in the ring group. And allodynia was maintained for over 30 days in the tie group. Conclusions: The new CPIP tie model has a higher rate of successful induction than existing O–ring models for mice, with longer duration of mechanical allodynia. The model may reduce the number of animals sacrificed in CRPS-I research and the research period and should be useful for studying long-term effects of drugs. Reference: 1. Coderre TJ, Xanthos DN, Francis L, Bennett GJ. Chronic post-ischemia pain (CPIP): a novel animal model of complex regional pain syndrome-type I (CRPS-I; reflex sympathetic dystrophy) produced by prolonged hindpaw ischemia and reperfusion in the rat. Pain. 2004;112(1-2):94-105. PMID: 15494189. 2. Tang C, Li J, Tai WL, Yao W, Zhao B, Hong J, et al. Sex differences in complex regional pain syndrome type I(CRPS-I) in mice. J Pain Res. 2017;10:1811-9. PMID:28831269.