Simultaneous combined spinal epidural anesthesia technique without catheter

sCSEA technique without catheter, EVE

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Abstract
Aims: The extension of spinal anesthesia by extradural injection has been identified as a modification of the combined spinal-epidural anesthesia. Epidural volume extension (EVE) is a rescue strategy that can raise the level of insufficient post-spinal sensory block. Material and Method: After approval of Adnan Menderes University Ethics Committee (Decision 2016/834/37), the data of 455 patients who had undergone insufficient simultaneous combined spinal epidural without catheter between 2010 and 2016 were retrospectively analyzed in terms of ASA scores; demographic and hemodynamic data; surgery type; pre-operative and postoperative sensory and motor block levels; operation onset times after anesthesia; need for peroperative additional anesthesia, vasopressor (ephedrine) and atropine; and postoperative pain onset times. Results: Of the 455 patients, there were two groups. In the first group, there were 238 patients who had undergone cesarean section and in the second group there were 217 patients who had undergone surgery for inguinal hernia. There was no mortality and morbidity in any group. There was a statistically significant decrease in heart rate, systolic, diastolic, and mean arterial pressures during the peroperative period in both groups (p<0.05). Discussion: The simultaneous combined spinal-epidural technique (sCSEA) without catheter may be considered as an alternative to conventional methods for appropriate surgeries. It can be safely used with local anesthetic combinations instead of saline for EVE. The advantages and disadvantages of EVE compared to the conventional method should be demonstrated with clinical randomized studies.

Keywords
Combined Spinal Epidural Anesthesia; Epidural Volume Extension; without Catheter; Bupivacaine; Lidocaine; Morphine
Introduction
Combined spinal-epidural anesthesia (CSEA) was first described by Brownridge 36 years ago [1]. In 1982, the needle-through-needle technique, which has become the standard nowadays for CSEA, was introduced into clinical practice by Coates [2]. CSEA has become a suitable neuroaxial technique for urological, gynecological, and lower extremity surgeries and caesarean sections. CSEA offers the advantage of a rapid onset of anesthesia provided via the spinal route and can also provide postoperative analgesia via an epidural catheter [3]. Later, extension of spinal anesthesia by extradural injection was identified as a modification of CSEA by Blumgart et al [4], and became known as epidural volume extension (EVE). EVE means injecting normal saline into the epidural space after the subarachnoid block, which aims to rapidly increase the sensory block level resulting from intrathecal local anesthetic injection [4, 5]. EVE is a rescue strategy that can raise the level of insufficient post-spinal sensory block. In this study, we conducted a retrospective evaluation of cases that had been performed with local anesthesia at low dose with spinal and epidurals simultaneously, which we defined as sequential CSEA without catheter aspiration by EVE mechanism.

Material and Method
After approval of the Adnan Menderes University Ethics Committee (Decision 2016/834/37), the data of 455 patients who had undergone insufficient simultaneous combined spinal epidural without catheter between 2010 and 2016, was analyzed retrospectively in terms of ASA scores; demographic and hemodynamic data; surgery type; preoperative and postoperative sensory and motor block levels; operation onset times after anesthesia; need for peroperative additional anesthesia, vasopressor (epidrine) and atropine; and postoperative pain onset times.

Simultaneous combined spinal epidural technique without catheter (sCSEA)
In this method, a simultaneous combined spinal-epidural kit without catheter, with 18G epidural and 27G spinal needles (suitable needles for the needle-through-needle technique), may be preferred. In the application of sCSEA, the appropriate interval is marked by examination. After skin sterilization and covering, a local anesthetic substance is applied by a 18G needle technique, which has become the standard nowadays for CSEA, was introduced into clinical practice by Coates [2]. CSEA has become a suitable neuroaxial technique for urological, gynecological, and lower extremity surgeries and caesarean sections. CSEA offers the advantage of a rapid onset of anesthesia provided via the spinal route and can also provide postoperative analgesia via an epidural catheter [3]. Later, extension of spinal anesthesia by extradural injection was identified as a modification of CSEA by Blumgart et al [4], and became known as epidural volume extension (EVE). EVE means injecting normal saline into the epidural space after the subarachnoid block, which aims to rapidly increase the sensory block level resulting from intrathecal local anesthetic injection [4, 5]. EVE is a rescue strategy that can raise the level of insufficient post-spinal sensory block. In this study, we conducted a retrospective evaluation of cases that had been performed with local anesthesia at low dose with spinal and epidurals simultaneously, which we defined as sequential CSEA without catheter aspiration by EVE mechanism.

<table>
<thead>
<tr>
<th>Length</th>
<th>Cesarean Section</th>
<th>Inguinal Hernia</th>
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<tbody>
<tr>
<td>&lt;150cm</td>
<td>10mg Bupivacaine</td>
<td>15mg Bupivacaine</td>
</tr>
<tr>
<td></td>
<td>40 mg Lidocaine</td>
<td>60 mg Lidocaine</td>
</tr>
<tr>
<td></td>
<td>2-4mg Morphine</td>
<td>2-4mg Morphine</td>
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<tr>
<td></td>
<td>Total 5-8ml</td>
<td>Total 5-8ml</td>
</tr>
<tr>
<td>150-155cm</td>
<td>0.5-0.7ml Bupivacaine</td>
<td>0.5-0.7ml Bupivacaine</td>
</tr>
<tr>
<td></td>
<td>0.6-0.8ml</td>
<td>0.7-0.9ml</td>
</tr>
<tr>
<td></td>
<td>Total 6-9ml</td>
<td>Total 6-9ml</td>
</tr>
<tr>
<td>155-160cm</td>
<td>0.6-0.8ml Bupivacaine</td>
<td>0.6-0.8ml Bupivacaine</td>
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<tr>
<td></td>
<td>0.8-1ml</td>
<td>0.9-1.1ml</td>
</tr>
<tr>
<td></td>
<td>Total 6-9ml</td>
<td>Total 6-9ml</td>
</tr>
<tr>
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<td>0.7-1ml Bupivacaine</td>
</tr>
<tr>
<td></td>
<td>0.9-1.1ml</td>
<td>1-1.2ml</td>
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<td></td>
<td>Total 6-9ml</td>
<td>Total 8-10ml</td>
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<tr>
<td>165-170cm</td>
<td>0.8-1ml Bupivacaine</td>
<td>0.8-1ml Bupivacaine</td>
</tr>
<tr>
<td></td>
<td>1-1.2ml</td>
<td>2-4mg Morphine</td>
</tr>
<tr>
<td></td>
<td>Total 8-10ml</td>
<td>Total 8-10ml</td>
</tr>
<tr>
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<tr>
<td></td>
<td>1-1.2ml</td>
<td>2-4mg Morphine</td>
</tr>
<tr>
<td></td>
<td>Total 8-10ml</td>
<td>Total 10-12ml</td>
</tr>
</tbody>
</table>

Table 2. Need for additional anesthesia, ephedrine, and atropine in peroperative period

Statistical analysis
Demographic data, ASA, surgery, peroperative supplemental anesthesia requirement, and vasopressor (ephedrine) requirement were compared using x² and Fisher exact tests. One-way variance analysis (ANOVA) for multiple comparisons and post-hoc Bonferroni tests for nominal values were used and Kruskal-Wallis analysis was performed for ordinal data. A p value smaller than 0.05 was considered as statistically significant.
Results
Of the 455 patients, there were two groups. In the first group, there were 238 patients who underwent cesarean section, and in the second group there were 217 patients who underwent surgery for inguinal hernia. There was no mortality and morbidity in either group. There was a statistically significant decrease in heart rate, systolic, diastolic, and mean arterial pressures during the peroperative period in both groups (p<0.05). The need for peroperative anesthesia, vasopressor (epinephrine), and atropine in cesarean and inguinal hernia operations are shown in Table 2; sensory levels before and after surgery are shown in Table 3; pre- and post-surgery Bromage levels are shown in Table 4. Postoperative pain initiation times were 14±4 hours in cesarean patients and 16±2 hours in inguinal hernia operations. The mean operation onset times after anesthesia were 300 ± 83 s in the cesarean section group and 240 ± 75 s in the inguinal hernia group.

Discussion
Opinions regarding the impact of EVE vary. Studies advocating the effect of EVE have compared saline volumes with analgesia durations affecting motor and sensory levels [5-9]. Lew et al. [10] achieved satisfactory anesthesia in only 55% of patients using the EVE method when performing cesarean sections. They attributed this finding to the fast ending of the motor block. In our cases, we found the rate of satisfactory anesthesia was 77% in cesarean patients. We believe this difference was due to the use of spinal low-dose isobaric bupivacaine as a local anesthetic instead of epidural saline. Loubert et al. [11] reported that they did not find any benefit to using EVE with 5 ml saline in caesarean section patients. Lin et al.'s letter [12] criticized Loubert et al.'s study because of the inadequacy of the epidural volume. Lin et al. suggest at least 10 ml of epidural saline.

Takiguchi et al. [7] and Dogancı et al. [13] suggest 10-15 and 20 ml of epidural saline for EVE. In EVE, there are studies suggesting the block level is time-dependent and it has been determined that the average block resistance time is 12 minutes [14]. In our cases, this period was shorter. We believe that the combination of epidural local anesthetic and opioid is beneficial in reducing both spinal and epidural doses, and that this therefore reduces the likelihood of complications associated with spinal and epidural anesthesia. Steenstra et al. [15] attribute the epidural top-up effect of the increased spinal block level to the effect of epidural volume.

It is obvious that epidural bupivacaine, morphine, and saline increase the spinal anesthesia level due to epidural volume effect in sCSEA.

In conclusion, the sCSEA technique may be considered as an alternative to conventional methods for appropriate surgeries. It also can be safely used with local anesthetic combinations instead of saline for EVE. Advantages and disadvantages of EVE compared to the conventional method should be demonstrated with clinical randomized studies.

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Scientific Responsibility Statement
The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement
All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest
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