Kombine spinal ve epidural anestezide idrar test stribinin kullanımı

Use of urine test strips in combined spinal and epidural anesthesia

Fatih Şimşek¹, Süleyman Deniz², Tarık Purtuloglu³, Ömer Yanarates³, Tuna Ertürk², Ercan Kurt³

ABSTRACT

Aim: In this study, we aimed to show which parameter can be used to get a reliable result in differentiation of cerebro spinal fluid (CSF) and saline by using the urine test strips. We compared the effectiveness of glucose and pH parameters by dripping CSF samples obtained from spinal needle during combined spinal-epidural anesthesia (CSEA) by means of glucose and pH regions of the urine test strip. Methods: After obtaining written consent, 70 patients scheduled for lower extremity surgery under CSEA were included in this unicenter and randomized clinical study. During the intervention, block levels and color changes in urine test strips’ glucose and pH parameters were all recorded. Results: In both groups, urine test strip color change were positive in 34 patients and negative in 1 patient. There was no statistically significant difference. In our study, even free CSF flow was detected after CSEA implementation, block levels were detected as “none” in 3 patients in “glucose” group (9%) and 1 patient in “pH” group (3%). There was a statistically significant difference in comparison of block levels. Conclusion: We found out that CSF samples dripped on urine test strips caused a color change in glucose and pH parameters, similar to previous results. However there was no block levels in 1 patient in “pH” and 3 patients in “glucose” groups. We concluded that pH parameters are more reliable than glucose parameters in detecting CSF.

INTRODUCTION

Central nerve blocks such as spinal, epidural and combined spinal-epidural anesthesia (CSEA) can be used for maintaining anesthesia and analgesia in many surgical operations. Nerve blocks have advantages compared to general anesthesia in terms of consciousness, protection of pulmonary function, less surgical bleeding, rarity of complications such as thromboembolism and costs. In addition, continuous techniques like CSEA can be used for analgesia after the surgery, which is one of the important reason for choosing this technique (1,2).

Combined spinal-epidural anesthesia is gaining rapid acceptance in orthopedic surgery, thanks to its quick onset of spinal anesthesia, minimal toxicity and prolonged analgesic effects of epidural anesthesia (3). However this increase in popularity also increases some of the negative outcomes during and after the administration of this technique. One of those negative outcomes can be seen in loss-of-resistance in epidural space localization technique. In loss-of-resistance technique, saline is injected into epidural space through Tuohy needle connected to
the injector. Until the fluid reaches this space, it shows resistance. With the loss of resistance, it is considered to be in the epidural space. There can be an unintended dura puncture, causing entry into cerebro spinal fluid (CSF). It is very important to define the fluid flowing freely as CSF or saline after the removal of Tuohy needle from the injector. The most trustworthy result in differentiation is obtained through chemical analysis. There is some information in the literature for using urine test strips (4-7). However, there is no clear definition whether to use glucose or pH parameters on urine test strips to detect CSF.

In this study, we aimed to show which parameter can be used to get a healthy result in differentiation of CSF and saline by comparing the effectiveness of parameters. We compared these parameters by dripping CSF samples obtained from spinal needle during CSEA to glucose and pH regions of the urine test strip.

MATERIALS AND METHODS

This study is carried out between September 2012 and May 2013 following Ethics Committee's approval. Seventy American Society of Anesthesiologists (ASA) risk group I-III patients between the ages of 18 and 85 scheduled for lower extremity surgery under CSEA were included in this unicenter and randomized clinical study after obtaining their written consent. Patients were randomly separated into 2 groups (at each group, n=35). In group “glucose”, CSF control was realized by glucose parameter part of urine test strip and the group “pH” CSF control was done by pH parameter of the urine test strip (Combur-Test®, Istanbul, Roche Diagnostics Turkey A.Ş.).

Patients with hypovolemia, coagulation disorders, local infection in the operating zone and allergies were excluded from the study.

In the operating room patients were monitored with electrocardiography (ECG), non-invasive blood pressure and pulse oximeter (SpO2). 6-8 ml/kg/h saline was administered through peripheral venous line either through the hand or antecubital fossa. All patients were sedated using 0.03 mg/kg IV midazolam. Both groups’ regional anesthesia interventions were done either lateral decubitus or sitting position considering the complaints of the patients between L2-L3, L3-L4 and L4-L5 spaces.

In both groups, loss-of-resistance technique was used for identification of the epidural space. With the spinal needle advanced through epidural needle, subarachnoid space was found. After observing the free flow of CSF, 1 drip of CSF was dropped on the previously ready urine test strips glucose region on “glucose” group and pH region in “pH” group, while blocking the view of the applying doctor (EK). Results were recorded by another doctor (FS). Spinal anesthesia was completed administering hyperbaric bupivacaine. Spinal needle was pulled out prior to epidural catheter placement. In both groups, catheters were adhered to the skin and patients were placed into supine position.

During the intervention, various data such as level of intervention, position, entry attempts, dural puncture presence, the fluid volume given to epidural space, color changes in urine test strips’ glucose and pH parameters, local anesthetic amount, sensory block levels, Bromage scores and if additional anesthesia was necessary were all recorded.

Sensory block levels were controlled by pin-prick test. T10 sensory block was desired for initiation the surgery. In case when sensory block level was below T10 dermatome, additional local anesthetic administration through epidural catheter was planned for obtaining the desired anesthesia level. Surgery was initiated in patients when sensory block level was reached T10 dermatome. Motor blockage was determined using a modified Bromage scale.

Patients were closely monitored during the operation for additional anesthesia. Patients were taken to the recovery room following operation. Their sensory and motor block levels were assessed. In patients with no apparent problems, test doses were administered and they were sent to their respective clinics.

Recorded data sets were analyzed using SPSS 15.0 statistics program. Kolmogrov-Smirnov test was used to compare the spread of the values to the normal spread. In descriptive statistics, statistical mean values, standard deviation, number and percentages were used. Chi-square and Fischer tests were used to compare discrete variants between 2 groups. Constant variables comparison between two groups were made using Student-t test. In all tests, data with a P <0.05 were considered statistically significant.

RESULTS

There was no significant difference between the groups in terms of age, height, weight, ASA risk group, sex and other demographic values regarding the surgery. Also, there was no difference between the CSEA application level, position, number of attempts, dural puncture incidence, volume of local anesthetic use, bromage score and additional anesthesia requirements (p>0.05) (Table 1). In both groups, urine test strip color change was positive in 34 patients and negative in 1 patient. There was no statistically significant difference (p=0.05) (Table 2). According to the observer physician taking the notes, pH parameter color changes were much more significant.

Block levels after CSEA administration were detected as “none” in 3 patients in “glucose” group (9%) and 1 patient in “pH” group (3%). There was a statistically significant difference in comparison of block levels (p<0.05) (Table 3).
Combined spinal-epidural anesthesia is gaining rapid acceptance in lower extremity surgery, thanks to its quick onset of spinal anesthesia, minimal toxicity and prolonged analgesic effects of epidural anesthesia (3). CSEA can be done in various techniques such as double segment, specialized single segment, needle-through-needle and so on. Needle-through-needle is the most popular and recent method used today (3).

In CSEA technique, epidural space can be identified using 2 different methods. One of them uses negative pressure and the other one uses loss of resistance. Loss-of-resistance method can be explained as the sudden loss of resistance to the in epidural needle’s way between interspinous ligaments and ligamentum flavum when the strong resistance goes out as the needle passes ligamentum flavum. This technique can be used by injectors or balloons. Injector method is applying a constant and continuous pressure to the piston of the injector, filled with either air or saline. When the performing anesthesiologist reach the epidural space the pressure will suddenly decreases and piston can be pushed more easily. In balloon method, a small specially designed balloon attached to the end part of the epidural needle is inflated 2-3 ml of air and balloon goes out in epidural space. In loss-of-resistance method, saline usage is far more popular to air. The reason for this is the risks of air embolism, neurological damage and insufficient local anesthetic distribution (8-11).

In needle-through-needle technique and loss-of-resistance method CSEA interventions, there is always a suspicion of free flowing fluid being CSF and frequent controls are deemed necessary. In order to eliminate this suspicion, many studies were done and many techniques were tried (4-13).

As mentioned above, many techniques were employed to identify CSF in regional anesthesia applications such as spinal, epidural and CSEA approaches. The most commonly used technique in here is to watch free flow of CSF but it’s not a very reliable one. There are also other tests

### Table 1. Demographic data, clinical characteristics and comparison of them (n=70).

<table>
<thead>
<tr>
<th></th>
<th>Glucose group n=35 (%)</th>
<th>pH group n=35 (%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)*</td>
<td>57.66 ± 18.351</td>
<td>58.06 ± 17.356</td>
<td>0.73</td>
</tr>
<tr>
<td>Height (cm)*</td>
<td>168.29 ± 10.799</td>
<td>164.69 ± 10.862</td>
<td>0.75</td>
</tr>
<tr>
<td>Weight (kg)*</td>
<td>78.14 ± 12.027</td>
<td>76.43 ± 10.692</td>
<td>0.44</td>
</tr>
<tr>
<td>ASA (1, 2, 3)</td>
<td>17, 17, 1 (48.5, 48.5, 3)</td>
<td>8, 25, 2 (23, 71, 6)</td>
<td>0.78</td>
</tr>
<tr>
<td>Sex (Female/Male)</td>
<td>17/18 (49/51)</td>
<td>20/15 (57/43)</td>
<td>0.63</td>
</tr>
<tr>
<td>CSEA Application Level (L2-L3, L3-L4, L4-L5)</td>
<td>1, 30, 4 (3, 86, 11)</td>
<td>0, 34, 1 (97, 3)</td>
<td>0.22</td>
</tr>
<tr>
<td>Number of attempts (1, 2, 3, 4, 5)</td>
<td>22, 8, 4, 1, 0 (63, 23, 11, 3)</td>
<td>23, 10, 1, 0, 1 (66, 28, 3, 0, 3)</td>
<td>0.40</td>
</tr>
<tr>
<td>Dural puncture (Yes/No)</td>
<td>0/35 (0/100)</td>
<td>0/35 (0/100)</td>
<td>1.00</td>
</tr>
<tr>
<td>Used local anesthetic (3/4 ml)</td>
<td>32/3 (91/9)</td>
<td>29/6 (83/17)</td>
<td>0.48</td>
</tr>
<tr>
<td>Bromage score (0, 1, 2, 3)</td>
<td>3, 0, 4, 28 (0, 0, 11, 80)</td>
<td>2, 0, 2, 31 (6, 0, 6, 88)</td>
<td>0.60</td>
</tr>
<tr>
<td>Additional anesthesia (Yes/No)</td>
<td>4/31 (11/89)</td>
<td>4/31 (11/89)</td>
<td>1.00</td>
</tr>
</tbody>
</table>

* Values are presented as mean ± standard deviation.

### Table 2. Comparison of urine test strip color change (n=70)

<table>
<thead>
<tr>
<th></th>
<th>Glucose group n=35 (%)</th>
<th>pH group n=35 (%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urine test strip color change (Positive/Negative)</td>
<td>34/1 (97/3)</td>
<td>34/1 (97/3)</td>
<td>1.00</td>
</tr>
</tbody>
</table>

### Table 3. Comparison of block levels (n=70)

<table>
<thead>
<tr>
<th></th>
<th>Glucose group n=35 (%)</th>
<th>pH group n=35 (%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block levels (Yes/No)</td>
<td>32/3 (91/9)</td>
<td>34/1 (97/3)</td>
<td>0.03</td>
</tr>
</tbody>
</table>

### DISCUSSION

Combined spinal-epidural anesthesia is gaining rapid acceptance in lower extremity surgery, thanks to its quick onset of spinal anesthesia, minimal toxicity and prolonged analgesic effects of epidural anesthesia (3). CSEA can be done in various techniques such as double segment, specialized single segment, needle-through-needle and so on. Needle-through-needle is the most popular and recent method used today (3).

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In needle-through-needle technique and loss-of-resistance method CSEA interventions, there is always a suspicion of free flowing fluid being CSF and frequent controls are deemed necessary. In order to eliminate this suspicion, many studies were done and many techniques were tried (4-13).

As mentioned above, many techniques were employed to identify CSF in regional anesthesia applications such as spinal, epidural and CSEA approaches. The most commonly used technique in here is to watch free flow of CSF but it's not a very reliable one. There are also other tests
such as temperature, glucose, protein, pH measurement and turbidity test (4, 5). However, most of them are not completely dependable and other techniques are very hard to measure and identify. In order to satisfy that demand, many techniques were developed but there is still no certain technique that is easy, fast, reliable and can be done in patient bedside (4, 5).

Using urine test strips to detect CSF is a new and current idea. By using urine parameters on urine test strips, chemical properties of CSF can be detected and compared with saline in a relatively short time. Most common parameters used for this purpose are glucose, pH and protein. Many advantages of urine test strips over other materials can be summed up as all parameters being on the same indicator, being economical, mobility (can be carried virtually everywhere) and no additional equipment requirements (4-7).

When we look into glucose parameter for CSF detection, saline has no glucose at all while CSF has an approximate glucose value of 60 mg/dl (6). Considering this fact, a drop of CSF on a urine test strip can show a difference on the indicator mean while saline does none. However, while doing this test, care must be taken about the bleedings and previously injected local anesthetics. This is because of false positive risks that might be caused by blood glucose (70-100 mg/dl) or glucose found in local anesthetics (hyperbaric bupivacaine contains 80 mg/ml glucose) (6). In order to avoid these results, extra attention must be given to the drop that is going to be used on the strip to be free of blood or other anesthetics.

Another parameter used is pH. Saline has a pH value of approximately 5.7 while CSF has a pH value of 7.4, similar to blood. Urine test strips color start to change after pH 5.5, meaning a drop of saline will not change the color mean while CSF will change a fast and remarkable color change in the indicator part of the strip. Again as mentioned above, extra care must be taken not to contaminate the sample to avoid false positive or negative results.

In their study, Walker et al. compared temperature, glucose, pH and turbidity tests to identify CSF. In their results, temperature had 84%, glucose 97% pH 91% and turbidity test had a 50% success rate. They concluded that none of these tests give out a 100% success rate and can not be conclusive only if they are used in combination with another (5). In a similar study, Tessler et al. have reported that separating CSF from other local anesthetics and saline should be done using those 4 parameters in combination (4). Fah et al. have reported a 95% success rate when they measured glucose levels from the fluid samples using a glucometer in patient bedside (8).

We found out that CSF samples dripped on urine test strips caused a color change in glucose and pH parameters, similar to previous results. However there was no block levels in 1 patient in “pH” and 3 patients in “glucose” groups. Against Walker et al’s results, we found out that pH parameters are more reliable in detecting CSF.

CONCLUSION

We concluded that, pH parameter of urine test strips is a much more reliable source in detecting and differentiating CSF from saline solution in free flowing liquid after removing the injector from Tuohy needle in CSEA. If there is an unintentional dural puncture or a suspicion thereof, using a urine test strip’s pH parameter to determine the dural puncture by means of detecting CSF and review for complications for patients’ safety would be a practical solution.

REFERENCES


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