Assessing sensory blockade with alcohol and pinprick after subarachnoid block

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The purpose of this study was to determine the accuracy of alcohol swabs in assessing dermatome levels in comparison to pinprick after subarachnoid block.

Room temperature alcohol swabs and pinprick were used to determine dermatome levels at 5, 10, and 15 minutes after a 15-mg hyperbaric bupivacaine subarachnoid block was administered with the patient in the sitting position.

The sample population consisted of 53 men scheduled for elective transurethral resection of the prostate or bladder tumor with an ASA classification of I to IV. Subjects were assessed while they were in the preoperative holding area for the ability to discriminate pinprick and cold sensation.

Data were analyzed using the Wilcoxon signed rank test. There was a statistically significant difference between alcohol and pinprick at the 10- and 15-minute assessments. \( P < .05 \).

Key words: Alcohol assessment, dermatome levels, hyperbaric bupivacaine subarachnoid block.

Introduction

After spinal anesthesia is administered, determining the adequacy of the block is essential. This determination is traditionally performed with the use of a needle pinprick. A needle pinprick is performed by lightly poking the skin, starting at the groin and moving cephalad at 1- to 2-inch intervals until the patient verifies the intensity of the pinprick is the same as an unanesthetized area.

Early research examining pain and temperature discrimination found temperature blocked two spinal segments higher than pain. Recent studies comparing zones of differential sensory blockade also found temperature sensation blocked more cephalad than the sensation of pinprick. Additional studies found a correlation between pain and cold sensation, eventually recommending the use of the alcohol sponge to test the level of a block.

Pinprick may cause interruption of skin integrity, which may provide easy access for bacterial entry and may interfere with surgical preparation and incision. Limiting patient anxiety and painful stimuli are also areas to be considered when choosing a testing method for dermatome levels.

There are several alternate methods for determining the level of blockade that utilize changes in pain or temperature sensations. Cold sensation can be tested by a variety of methods including alcohol swabs, ethyl chloride spray, and ice cubes. The instruments used to evaluate pain sensation include a safety pin, transcutaneous electrical stimulator, and a neurologist’s pinwheel. These alternative methods may be used because the Aδ and C fibers, which are responsible for sharp pain and cold reception, belong to the same bands in the fiber spectrum.
Nerve fibers are classified into three major groups based on size, velocity of conduction, and myelination (Figure 1). Aβ fibers transmit pain responses, such as pinprick and cold and heat sensation, and tissue damage. C fibers are responsible for dull pain, temperature, and postganglionic autonomic function (Table I). The optimal temperature for cold fiber conduction is between 10°C and 30°C. The room temperature alcohol swab falls within this optimal range and should yield an accurate result.

Figure 1
Comparison of nerve fibers—size and speed of conduction

Table I
Comparison of nerve fibers

<table>
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<th>Type</th>
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<th>Function</th>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>A-α</td>
<td>Muscles, joints</td>
<td>Motor and proprioception</td>
</tr>
<tr>
<td>A-β</td>
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<td>A-γ</td>
<td>Muscle spindles</td>
<td>Muscle tone</td>
</tr>
<tr>
<td>A-δ</td>
<td>Sensory roots, peripheral nerves</td>
<td>Pain, touch, and temperature</td>
</tr>
<tr>
<td>B</td>
<td>Preganglionic, sympathetic</td>
<td>Pain, touch, and temperature</td>
</tr>
<tr>
<td>Unmyelinated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Postganglionic, sensory roots, peripheral nerves</td>
<td>Pain, touch, and temperature</td>
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</table>

Cold sensation, which is noninvasive, may be as accurate as pain sensation when assessing dermatome levels. We were very interested in the comparison of the alcohol swab and pinprick in assessing the level of blockade because these two tools are readily available to the anesthesia clinician.

Few studies have attempted to demonstrate differences in dermatome levels when using pinprick and alcohol swab methods. Clinically, the results may be similar when assessing dermatome levels. This study compared the alcohol swab to the pinprick method of assessing dermatome levels at 5, 10, and 15 minutes, after administering a subarachnoid block (SAB).

Methodology
This is a quasi-experimental study in which the subjects served as their own controls. The subjects were recruited during a 5-month period from two large hospitals in the Midwest. The study was approved by both hospitals' internal research committees, and informed consent was obtained from each subject in accordance with each hospital's human subjects review boards.

Sample
The convenience sample of 58 subjects consisted of men admitted for elective transurethral resection of the prostate or a bladder tumor. These surgical procedures are preferentially performed at these two institutions with an SAB as the anesthetic technique. Excluded from the study were subjects who had absolute or relative contraindications to an SAB.

Four subjects were unable to participate in the dermatome testing because of the failure of the SAB and the need for general anesthesia. One subject was removed from the study because he was unable to cooperate with the investigator after midazolam was administered. The remaining 53 subjects completed the dermatome testing process. As with any anesthetic case, each subject was carefully scrutinized by the anesthesiologist and nurse anesthetist as to the appropriateness of an SAB with 15 mg of bupivacaine for the planned surgical procedure. The subjects were volunteers, 51 to 91 years of age, with an ASA classification of I to IV.

The subjects demonstrated the ability to discriminate cold and pinprick sensations prior to the administration of the block in the preoperative holding area and before receiving midazolam. This was accomplished by lightly poking and touching the shoulder area with the same technique and tools used to perform the dermatome testing.

In the surgical suite, an SAB was administered in a sterile fashion with the patient in the sitting position. Fifteen milligrams of plain hyperbaric bupivacaine was used for each block. Subjects were placed supine after the block was administered, and surgical prepping and positioning commenced.
Subjects were given midazolam in the preoperative holding area and the operative suite as was deemed necessary by the Certified Registered Nurse Anesthetist providing care. The doses of midazolam ranged from 0 to 3 mg with a mean of 0.78 mg. Although administering midazolam was an uncontrollable variable, we felt that its use was essential in alleviating anxiety during the anesthetic experience and consistent with routine anesthesia care at each institution. Narcotics were not administered preoperatively or during the dermatome assessment period.

Prior to assessment of dermatome levels, the volunteers were subjected to an alcohol swab and pinprick on the shoulder to demonstrate the sharp and cold sensations. Assessment of the dermatome levels was performed using pinprick and alcohol swabs at 5, 10, and 15 minutes after the block was administered. Pinprick testing was accomplished by lightly poking the skin with a sterile, 18-gauge, 1½-inch short-bevel sharp needle (Becton Dickinson & Co., Franklin Lakes, New Jersey). Cold sensation was tested by touching the skin with a room temperature, sterile, alcohol swab (VHA Supply Co., Irving, Texas). A new needle and alcohol swab were used each time the subject was assessed.

The side of the body to be tested was randomly assigned to each subject. Each subject was assigned a computer-generated, random, two-digit number. All subjects with an odd number were tested on the left side of the body, while subjects with an even number were tested on the right side of the body. All testing occurred on the assigned side of the body, including the shoulder control test. Only one side of the body was tested as the interest was in the testing tools not the uniformity of the block.

The subjects were tested with the alcohol swab and pinprick at each assessment period. The order of the assessment tool (alcohol swab or pinprick first) was also randomly assigned using the computer-generated two-digit number. The same order was followed for each of the three testing periods.

Abdominal testing began at the L-1 dermatome level on the vertical nipple line and proceeded cephalad one dermatome level at a time. The dermatome level of anesthesia was ascertained when the sharp or cold sensation on the abdomen or thorax was the same as the shoulder. Dermatome levels were determined according to the dermatome chart in *Neural Blockade.*

Dermatome level assessments were performed by one of the two investigators (senior nurse anesthetist students). Interrater reliability was established prior to the initiation of the study. A correlation coefficient of 0.85 was established. It is possible that a higher correlation coefficient could have been obtained if a more precise form of measurement was used; however, the purpose of the study was to investigate clinically accessible tools.

### Results

Demographic data are presented in Table II. Statistical analysis was performed using the Wilcoxon signed rank test with a $P < .05$ indicating significance. No statistically significant differences were noted between the alcohol and pinprick at the 5-minute assessments. However, significance was noted at the 10- and 15-minute assessments. These data are illustrated in Figure 2.

At the 10-minute assessment, 8 subjects tested at a higher dermatome level with alcohol, and 2 subjects tested at a higher level with pinprick. The remaining subjects tested at the same dermatome level with alcohol and pinprick. In the final assessment at 15 minutes, 10 subjects tested at a higher dermatome level with alcohol. The remaining subjects tested at the same dermatome level with alcohol and pinprick (Figure 3).
These findings are consistent with Greene's work that found temperature discrimination was blocked higher than fibers conveying the sense of pinprick. Greene also found the area of differential blockage greater at 15 minutes than at 5 minutes. Our study did not confirm these findings, but our assessments were performed at more precise time intervals than those reported by Greene. His assessments were approximate at 5 and 15 minutes, and our assessments were precisely timed at 5, 10, and 15 minutes. Greene also found a mean block difference of 1.19 dermatomes, whereas our mean block assessment difference was less than 1 dermatome. Finally, at no time did Greene show temperature blocked lower than pinprick. Our study showed temperature blocked lower than pinprick on all 3 assessments.

Our findings were also not consistent with the elaborate multiple drug study by Rocco et al, who reported higher dermatome levels with pinprick at 5, 10, and 15 minutes after hyperbaric tetracaine SAB in the sitting position. Despite differences in study drugs, our results were in agreement that cold sensation tested higher than pinprick at 10 and 15 minutes.

Our results were similar to the more recent study by Brull and Greene who studied light touch, pinprick, and temperature discrimination with tetracaine and bupivacaine SABs. They found that temperature was blocked at a higher dermatome level than pinprick; however, their method of temperature administration consisted of spraying the skin with a mixture of dichlorofluoromethane and trichloromonofluoromethane. In this study using bupivacaine, the area of differential blockade between temperature and pinprick was 0.79, 0.79, and 1.14 dermatomes at 5, 10, and 15 minutes assessments, all of which were not statistically significant.

Conclusions

Our results demonstrated pinprick and alcohol were not equal when assessing the dermatome level after hyperbaric bupivacaine SAB. This was determined statistically, as shown in Figure 2, and the actual differences between the dermatome levels are as follows. At 5 minutes, the mean thoracic dermatome level for alcohol was 7.07 and pinprick, 7.22 (mean difference, 0.15 dermatome). At 10 minutes, the mean dermatome level for alcohol was 5.6 and for pinprick, 5.76 (mean difference, 0.17 dermatome). Finally, at 15 minutes, alcohol had a mean dermatome level of 4.86 and pinprick, 5.09 (mean difference, 0.23 dermatome).

As demonstrated, the differences in results are not greater than one half of a dermatome level. When assessing an SAB to determine readiness for surgical incision, one half of a dermatome is probably not clinically significant. However, despite the alcohol swab testing results being slightly higher than pinprick at 10 and 15 minutes, the alcohol method may be preferable to pinprick by decreasing the risks for pain, interruption of skin integrity, infection, and psychological trauma.

Further studies could include a wider sample of the SAB population in order to generalize the results.

Subarachnoid block continues to be a popular regional technique. The manner of testing dermatome levels after SAB will remain a fertile area for discussion among clinical practitioners.
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