

Direction and side used to determine the extent of sensory block after subarachnoid anesthesia do not influence the level of the block

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Summary : Methods of sensory testing in neuraxial anesthesia may supposedly account for different results in reporting the extent of the block. To determine whether the caudad to cephalad versus the cephalad to caudad direction as well as the side of testing, left versus right, may affect the assessment of sensory block after subarachnoid anesthesia, two groups of patients undergoing transurethral surgery were studied. One group, 44 patients were tested for the influence of direction of block determination and another group 50 patients for the influence of side. Subarachnoid anesthesia was performed with 100 mg of 5% hyperbaric lidocaine using a 25 Whitacre needle with its opening consistently pointing cranially and the patient in the sitting position. To assess the sensory block four lines were drawn bilaterally along the posterior, middle, and anterior axillary lines and a line 5 cm medial to the anterior axillary line. A pressure palpator was moved along each of the four lines and patients were asked to answer if they detected a stimulus, with "yes/no". In the 44 patients assessment of sensory block was performed from caudad to cephalad direction on one side and vice-versa on the other. In the other 50 patients the extent of the block was compared between the right and left side. In 44 patients, the level of sensory block determined 20, 25 and 30 minutes after the subarachnoid anesthesia in a cephalad to caudad direction was found at the T11 dermatome at each time point and did not differ when compared to the levels determined following the caudad to cephalad direction. In the second study in a different group of 50 patients, the level of sensory block 20, 25 and 30 minutes after the subarachnoid injection was found at the T11 dermatome on the right side at each time point and did not differ from the level determined on the left side. We conclude that the level of sensory block after subarachnoid anesthesia with lidocaine is independent of the direction of testing and the side the assessment is performed using the pressure palpator.

Key words : Anesthesia : subarachnoid ; Measurements : sensory block ; Level of analgesia : direction and side of assessment.

INTRODUCTION

Published studies have used different techniques to define the level of sensory block. Monitoring of the effectiveness of subarachnoid anesthesia is important preoperatively to assess adequacy of anesthesia, and intraoperatively to monitor the regression of the sensory block while the operation is in progress. In some studies the level of subarachnoid analgesia is reported without reference to the direction or the side along which the needle or other instrument is moved to determine the level of sensory block (1-6).

To our knowledge, the influence of variations regarding the technique of assessing the level of sensory block produced by subarachnoid anesthesia has not been described previously. Therefore, we examined two modalities of sensory examination technique. First, we investigated the possible impact of the cephalad to caudad or the caudad to cephalad direction on the assessment of the level of sensory block after subarachnoid anesthesia. Second, in a different group of patients we studied the possible effect of the right versus the left side to which stimuli are applied for determining the level of sensory block.

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METHODS

Approval from the Hospital Ethics Committee and patient written informed consent were obtained. Patients (ASA physical status I-III) scheduled for transurethral prostatectomy or excision of papillomas in the bladder were recruited for the study. Patients with hearing impairment, central or peripheral nervous system disease interacting with perception of sensation or taking analgesics or drugs that may interfere in determining the level of subarachnoid analgesia were excluded. The study protocol and the instrument used to assess the level of sensory block were explained to all patients during the preoperative visit. Premedication was omitted.

Anesthetic management

On arrival to the operating room, a catheter was inserted in a peripheral vein and Lactated Ringer's solution administration was instituted. Noninvasive arterial blood pressure, electrocardiogram, heart rate, and pulse oximetry were monitored. During the anesthetic procedure and intraoperatively, all patients inspired oxygen 35% via a Ventimask. After skin disinfection and local infiltration with 2% lidocaine, 2 ml of 5% hyperbaric lidocaine (100 mg) were injected in the subarachnoid space using a 25-gauge Whitacre spinal needle through a 20 gauge introducer at the L3-L4 interspace. The hyperbaric solution was injected over 10-15 seconds without aspirating CSF previously and with the patient in the sitting position. Patients were then placed in the lithotomy position.

Two measurements of block extent were used. To duplicate common clinical practice, we related the level of the block to a presumed dermatomal level. To more carefully examine possible small influences of technique, we also measured incremental changes in sensory block during onset of anesthesia using changes expressed in cm.

Influence of direction of testing (Study I)

To assess the level of sensory block four lines were drawn bilaterally along the posterior, middle, and anterior axillary lines as well as a line 5 cm medial to the anterior axillary line (7-11). Twenty minutes after the subarachnoid injection the level of sensory block was assessed using a pressure palpator. This instrument consists of a tube, a spike sliding into the tube and a spring resting on the bottom of the tube. The instrument is placed perpendicular

to the skin and the tip of the spike pushes backwards the spring, which then exerts against the surface of the skin the exact weight of 650 g (11). The pressure palpator was moved along each of the four predetermined lines from caudad to cephalad direction on the one (right or left) side or the reverse direction on the other side. The side to be tested first and its direction were determined using 44 sealed envelopes, 22 envelopes indicating "first right" and 22 "first left". Patients were blinded to the test site by a screen. The specific question they were asked was if they detected a stimulus, "yes/no". The level of sensory block for each assessment was defined as the line joining the four points lying on the four drawn lines below which the pressure stimulus was blocked, i.e. first contact of sensory site. Sensory block was assessed 20, 25 and 30 minutes after the subarachnoid injection bilaterally. Changes in sensory block between 20 and 25 minutes, between 25 and 30 minutes and between 20 and 30 minutes were recorded in cm as well as in dermatomes.

Influence of side testing (Study II)

In a different group of fifty other patients, the procedure for assessing sensory block described above was applied bilaterally, and testing from a caudad to cephalad direction on both sides. The side tested first was randomized.

Statistical Analysis

In order to ensure a power of 0.8 (80%), for detecting a clinically relevant difference of 2 cm, it was estimated that approximately 40 patients should be included in each study. Alpha error was assumed as 0.05 and a standard deviation of approximately 3 cm was estimated from initial pilot observations. Demographic data and the changes in the level of the sensory block expressed in cm were compared between the two groups with the unpaired Student's t-test. The dermatomal levels assessed 20, 25 and 30 minutes after subarachnoid injection were compared using the Mann-Whitney test. $P \leq 0.05$ was considered significant.

RESULTS

Demographics of subjects in each study are shown in Table I. The subarachnoid block failed in four patients in the study of the direction testing, and in two patients in the study side of the side testing.

Table I

Demographics of patients that participated in the direction of testing study (assessment of sensory block cephalad to caudad and vice versa) and in the side testing study (assessment of sensory block in the right versus the left side)

	Age (years)	Body Weight (kg)	Height (cm)
<i>The direction of testing study</i> (n = 40)	69 ± 7	75 ± 10	169 ± 8
<i>The side testing study</i> (n = 48)	70 ± 10	77 ± 10	171 ± 8

Values are mean ± SD.

Table II

Levels of sensory analgesia expressed in dermatomes for assessments performed in a cephalad to caudad or the reverse direction. Levels of sensory analgesia expressed in dermatomes for assessments performed in the right side versus the left side

	20 minutes after the block	25 minutes after the block	30 minutes after the block
<i>The direction of testing study</i>			
Cephalad to caudad	T11 ± 2.7	T11 ± 2.6	T11 ± 2.5
Caudad to cephalad	T10 ± 2.5	T11 ± 2.6	T11 ± 2.6
<i>The side testing study</i>			
Right side	T11 ± 2.4	T11 ± 2.4	T11 ± 2.5
Left side	T11 ± 2.2	T11 ± 2.4	T11 ± 2.5

Values are mean ± SD.

The level of sensory block determined cephalad to caudad 20 minutes after subarachnoid anesthesia was at T11 and did not differ from the level determined in the caudad to cephalad direction (T10). Similarly, the level of sensory block determined at both 25 minutes and 30 minutes after subarachnoid anesthesia was found at T11 for both directions of testing (Table II). Measurement of changes in sensory level by cm are shown in Table III and did not differ at any time point for both cephalad to caudad and caudad to cephalad directions.

The level of sensory block determined on the right side 20, 25 and 30 minutes after subarachnoid anesthesia was found at T11 at all three times and did not differ when compared with the level determined on the left side. The level of sensory block determined on the left side 20, 25 and 30 minutes after subarachnoid anesthesia was also at T11 at each time (Table II). Measurement of changes in sensory level from 20 to 25 minutes and from 25 to 30 minutes as well as cumulative changes over the period 20-30 minutes after the block are shown in Table III and did not differ at any time from measurements on the right versus left side.

DISCUSSION

Our results demonstrate that the level of sensory block after subarachnoid anesthesia determined by the pressure palpator is not affected by the direction of determination, cephalad to caudad and vice versa. The level of sensory block is also independent of the side-tested, left versus right. Therefore discrepancies between studies regarding evaluation of different techniques or different drugs given intrathecally are not necessarily explained by differences in these aspects of sensory assessment techniques.

Published studies have used different techniques to define the level of sensory block produced after subarachnoid anesthesia. The most common technique is testing sensory response to pinprick (1-9). We previously studied the level of subarachnoid anesthesia determined by the pressure palpator, compared the results with the pinprick method and demonstrated the reliability of the technique (11). The pressure palpator is better tolerated by the patient, and most important it maintains the integrity of the epidermis, which is not often possible with the pinprick method. As in all our previous studies so in the present one we conducted measurements 20, 25 and 30 min after subarachnoid lidocaine injection so the lidocaine block will have reached its maximal effect. Otherwise our measurements may be influenced by time course of block installation.

It cannot be assumed that the identification of the onset of a new sensation will occur at the same threshold as the loss of a sensation. In testing the level of block, this implies that moving the stimulus from an area of blockade to a sensate area may reveal a first sensation at a different level than the site of last sensation when moving the stimulus from an area of intact sensation to an area of blockade. Therefore a cephalad to caudad or the reverse direction may affect the assessment of sensory block. Discrepancies between studies may occur and evaluation of new local anesthetics and other drugs given in the subarachnoid space might be considered as having different pharmacokinetic and pharmacodynamic profile due to different methodology of block measurements. This also applies to the side on which the assessment is implemented. It is conceivable that side of testing would have affected sensory level determination. Brennum et al measured the pressure-pain thresholds on fingers and toes in right-handed subjects and found threshold values on the right side slightly but significantly higher than for the left side (12).

Table III

Changes in levels of sensory analgesia expressed in cm when assessment follows a cephalad to caudad or the caudad to cephalad direction. Changes in levels of sensory analgesia expressed in cm when assessment is performed in the right side versus the left side

	Changes in level (cm) 25 minutes after the block	Changes in level (cm) from 25 to 30 min after the block	Changes in level (cm) from 20 to 30 min after the block
<i>The direction of testing study</i>			
Cephalad to caudad	-1.7 ± 3.8	-1.8 ± 2.9	-3.4 ± 4.9
Caudad to cephalad	-0.9 ± 3.2	-1.6 ± 2.1	-2.3 ± 4.1
<i>The side testing study</i>			
Right side	-1.5 ± 2.8	-2.2 ± 4.2	-3.7 ± 5.8
Left side	-1.2 ± 3.6	-2.1 ± 4.3	-3.3 ± 6.1

Values are mean ± SD (median).

Sensory block expressed in dermatomes depends on the map used, as there is inconsistency in dermatomal anatomy (13-15). This may be a reason of discrepancy regarding the results of different studies dealing with subarachnoid or epidural anesthesia. However, variability in dermatomal anatomy would not affect our results as we assigned segmental levels consistently by a single segmental map, specifically one devised by KEEGAN and GANNETT (14). According to it, T1 supplies the arm and subclavian area, T4 innervates the nipple, T10 provides cutaneous branches to the umbilical region and T12 innervates the inguinal area.

We conclude that the longitudinal sequence of sensory testing and the choice of right versus left have no impact on determination of the level of the sensory block after subarachnoid anesthesia. These results apply to the conditions of our study in which the subarachnoid injection was performed with the patient in the sitting position and the solution of local anesthetic was hyperbaric. If the patient is placed in the lateral position, the extent of block on the right and left sides is expected to be different, and the influence of longitudinal direction is undetermined.

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