International Journal of Obstetric Anesthesia (2013) **22**, 294–297
0959-289X/$ - see front matter
http://dx.doi.org/10.1016/j.ijoa.2013.05.010

ORIGINAL ARTICLE

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Assessing blocks after spinal anaesthesia for elective caesarean section: how different questions affect findings from the same stimulus

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ABSTRACT

Background: A block to touch to T5 is widely used to indicate an adequate level of block for caesarean section with spinal anaesthesia. However, two studies using a ''block to light touch'' to T5 as their end-point, had a high requirement for intraoperative analgesia and their results cast doubt on the adequacy of a block to touch to T5. On enquiry, these two papers did not assess complete block to touch, but asked mothers when the touch sensation ''was the same as'' a control stimulus. The difference between these two assessment methods is unknown. The current study presents prospectively collected sensory block data which included both block to touch and the level when touch was the same as a control stimulus.

Methods: The levels of block were assessed using a Neurotip®. The mother was asked four questions to assess the block: first touch level, first sharp level, touch same as control and sharp same as control.

Results: The first touch level was a median of two dermatomes lower than the touch same as a control level [IQR 0–3, range 0–6]. Block level assessment methods using first sharp and touch same as control were equivalent.

Conclusion: When describing a sensory block, not only is it necessary to indicate the exact stimulus used, but it is important to define the actual question asked of the patient. Clinically, block assessment using the first sharp level and touch same as control are equivalent.

Keywords: Neurotip®; Spinal anaesthesia; Sensory block assessment; Caesarean section

Introduction

In 1965 Bromage described detailed tests for assessing lower limb motor function during epidural analgesia.[1] A year later Hollmén described detailed sensory tests for touch and pinprick sensations in relation to the assessment of brachial plexus blocks.[2] Today, motor block in association with epidural or spinal anaesthesia is frequently described in terms of the Bromage score;[1] the accompanying sensory block is generally poorly described. The majority of publications on neuraxial anaesthesia for caesarean section state the modality used to assess the level of block (e.g. cold, pinprick or touch), but the actual description of how this modality was used is either lacking or is so imprecise that the reader does not know what has been assessed. A study may state simply that sharp pinprick was used to assess the block, but there are four possible end points: (1) total loss of all sensation to the pin; (2) the pin is recognised as a touch sensation but is not recognised as being sharp; (3) the pin is recognised as being sharp but is less sharp than normal; or (4) the pinprick feels normal. In addition, there is also a variable, and at times a very wide number of dermatomes difference in block levels assessed by these four end points.[3–7]

The current observational study was prompted by the results of two up-down minimum local anaesthetic concentration (MLAC) studies,[8,9] which described their end-point as ''a block to light touch to T5.'' Despite achieving this level of block, both studies reported a relatively high requirement for intraoperative analgesia: 17/186[8] and 18/80.[9] These high proportions of women requiring analgesic supplements are very different from the experience in our own unit where ''a block to touch to T5'' is rarely associated with a need for additional intraoperative analgesia. Subsequent communication with one of the authors (GR Lyons, personal communication, March 2006) revealed that the block level end-point was when the patient considered that the touch sensation was the same as a control stimulus on the forehead. This is different from the total

Accepted May 2013
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loss-of-touch sensation (Hollmén grade 3)[2] utilised in our unit and, in addition, the "touch same as a control" stimulus level is not a grade used in the Hollmén scale. Since the dermatomal difference between levels of block to touch as assessed by these two methods ("touch same as a control" versus "total loss-of-touch sensation") was unknown, we modified our routine sensory assessment to include the level of block when touch was the same as a control stimulus.

Methods

Following approval from the Hull and East Yorkshire Hospitals Local Research Committee, as part of her standard clinical practice, one of the authors (NMN) kept a detailed contemporaneous record of the levels of Hollmén block and the level at which touch sensation was the same as a control stimulus. The study population were American Society of Anesthesiologists physical status class I or II women scheduled for elective caesarean section under spinal anaesthesia, who were not involved in other research, and who gave informed consent to participate. Women were seen on the morning of surgery when a 5-cm wide strip of low allergenic tape (Micropore, 3M Health Care Ltd, Leicestershire, UK) was applied to the midline, from sternal notch to umbilicus. Dermatomal levels from T3 to T10 were estimated and marked on the tape.

A spinal anaesthetic using 0.5% w/v hyperbaric bupivacaine 2.5 mL with diamorphine 0.3 mg (total volume 2.8 mL), was administered at what was estimated to be the L3–4 interspace. Sharp sensation was assessed using the round-tipped metal pin of the Neurotip® and touch was assessed using the blunt plastic point of the Neurotip®. Block levels were assessed at 2, 5, 10, 15, and 20 min after spinal injection and at the end of surgery. A screen over the mother's chest ensured that she could not see when the stimulus was applied to her skin. The levels of block collected were:

- First Touch Level (FT). The level where the sensation of touch to the blunt plastic tip of the Neurotip® was first appreciated: the question asked of the woman was, "Tell me when you feel something touch your skin" (Hollmén grade 2). [2]
- Touch Same as Control Stimulus (TSA). The level where the patient indicated that the touch sensation from the blunt plastic tip of the Neurotip® was the same as the control sensation: the question asked of the woman was, "Tell me when the touch feels the same as this" (blunt plastic tip of Neurotip® pressed against the skin of the upper outer arm).
- First Sharp Level (FS). The level where the round tipped metal pin of the Neurotip® was first appreciated as sharp: the question asked of the woman was, "Tell me when you know something sharp is touching your skin" (Hollmén grade 1).[2]
- Sharp Same as Control Stimulus (SSA). The level where the sharp pinprick sensation from the round tipped metal pin of the Neurotip® was felt to be the same as a control stimulus: the question asked of the woman was, "Tell me when the sensation is the same as this" (the round tipped metal pin of the Neurotip® pressed against the skin of the upper outer arm) (Hollmén grade 0).[2]

Since sensory testing was performed from caudad to cephalad (i.e. from blocked to unblocked dermatomes) these questions identify the first unblocked dermatome. Data presented in this paper are one dermatome lower, to represent the dermatomes blocked to that stimulus. A clinically significant difference in the assessed block levels was taken to be more than one dermatome.

Statistical analysis

For statistical analysis, spinal segments were numbered from S5 to C2 as 1 to 29; these were treated as interval data. Based on our previous studies, to have a 90% chance of detecting a difference of two dermatomes (SD 2.6) at the 5% significance level, data from 40 women were required. Statistical analysis was performed using the software IBM SPPS Statistics version 19.0.0 (IBM Corporation, Armonk, NY, USA). Because of the rapidly changing block levels at 2 min these data were not used in statistical analysis. The Friedman test was used to assess differences in the levels assessed by the four questions and a post hoc Wilcoxon signed-rank test for pairs of related samples was used to investigate individual paired differences. In the post hoc tests, the Bonferroni correction was used and since six paired tests were performed, the significance value was $P < 0.0083$. The two one-sided t-tests (TOST) method was used to assess the equivalence of two of the sensory tests. Equivalence was defined as a dermatomal difference of <0.5 dermatomes.

Results

Complete data from 38 women were available for analysis. Fig. 1 illustrates the onset of the spinal block for each of the four categories of block. The Friedman test indicated that there was a statistically significant difference between the levels of block defined by each of the four assessment methods for the entire data set ($P < 0.0001$). Post hoc paired tests revealed that there was a statistically significant difference between all the individual comparisons (Fig. 2).

Despite the FS-TSA difference being statistically significant, the actual dermatomal differences were minimal (95% CI for the differences between FS and TSA were -0.02 to -0.26 dermatomes) and a TOST test