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ORIGINAL ARTICLE

A comparison of a Neuropen monofilament and ethyl chloride for assessing loss of touch sensation during combined spinal–epidural anaesthesia for caesarean section☆

P. Walsh,[a] M. Columb,[b] R. Russell[a]
[a] *Nuffield Department of Anaesthetics, John Radcliffe Hospital, Oxford, UK*
[b] *Department of Anaesthesia, University Hospital of South Manchester, Wythenshawe, Manchester, UK*

ABSTRACT
Background: Before caesarean section is performed under regional anaesthesia the block should be assessed, preferably using a touch stimulus. What constitutes a touch stimulus remains unclear. The aim of this study was to compare a Neuropen monofilament with ethyl chloride in the assessment of touch.
Methods: Forty women undergoing elective caesarean section received combined spinal–epidural anaesthesia. The upper dermatome spread was assessed using touch to a monofilament and ethyl chloride and cold to ethyl chloride at 5, 10, 15 and 20 min after intrathecal injection and again at the end of surgery. Visual analogue pain scores and Apgar scores were collected.
Results: Two one-sided test analysis demonstrated equivalence for Neuropen touch and ethyl chloride touch within one dermatome ($P < 0.0001$). Wilcoxon post tests showed that Neuropen touch was marginally lower than ethyl chloride touch ($P = 0.0056$). The median level of block to touch using both stimuli was below T5 at all time points. Pain scores had a median value of 0 cm and Apgar scores were 10 in all infants at 10 min.
Conclusion: Data from this study suggest that a Neuropen monofilament and ethyl chloride are equivalent when used to assess a block to touch. However, subtle differences in the level of block to touch indicate that sensory level assessments should state the stimulus used. As the block to touch was below T5 at all time points, when opioids are added to local anaesthetics, T5 might no longer represent a necessary goal to ensure the absence of pain during caesarean section.

Keywords: Neuropen; Monofilament; Ethyl chloride; Sensory level; Combined spinal–epidural; Caesarean section

Introduction

The majority of pregnant women undergoing elective caesarean section in the UK receive regional anaesthesia.[1] This is considered to be safer than general anaesthesia but carries the risk of intraoperative discomfort, which is unpleasant for the woman and the leading cause of complaint against obstetric anaesthetists.[2] To minimise this risk, the adequacy of regional anaesthesia must be assessed before surgery, usually by testing the level of block. This assessment can be made using a variety of sensory modalities such as cold, pinprick and touch. Current knowledge favours the use of a touch stimulus and the inclusion of the T5 dermatome as the upper block level to ensure the absence of pain during caesarean section.[3–5]

Although clarity exists in terms of the correct sensory modality and level of block, the correct mechanism of delivering a touch stimulus is less apparent. Comparisons of ethyl chloride, a Neurotip and a Neurotip mounted in a Neuropen have been reported.[6,7] The Neurotip mounted in a Neuropen is a device designed to assess reduced sensation to sharpness and pain in small nerve fibres. We have previously used ethyl chloride to assess level of block to touch after combined spinal–epidural (CSE) anaesthesia. It is administered in an individual droplet fashion from a height of approximately 5 cm above the skin. Maintaining a block to touch at T5 or above using this technique as an assessment tool has been shown to be satisfactory for caesarean section under CSE using bupivacaine and fentanyl.[8] It was decided that a comparison should be made between a Neuropen monofilament, a device which is

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Correspondence to: Dr. Peter Walsh, Department of Anaesthesia, York Hospital, Wigginton Road, York YO31 8HE, United Kingdom.
E-mail address: peterwalsh@doctors.org.uk

specifically designed to assess touch and pressure sensation in large nerve fibres, and ethyl chloride.

Methods

The study was approved by the Oxfordshire Research Ethics Committee and following this, women booked for elective caesarean section under CSE anaesthesia were invited to participate. Written informed consent was obtained from all subjects. Exclusion criteria included diabetes mellitus, pregnancy-induced hypertension, neurological disease, multiple pregnancy, gestation less than 36 weeks and body mass index greater than 35 kg/m^2.

The Neuropen monofilament (Owen Mumford, Oxford, UK) is a retractable, reusable filament mounted in a plastic body (Fig. 1). It is fully deployed and locked in position before use and is then pressed at 90° to the skin with increasing force. The filament begins to bow at which point 10 g of force are exerted on the skin. This test assesses touch and pressure in large nerve fibres and the instrument has been shown to be highly accurate.[9]

All women received oral ranitidine 150 mg on the evening before and on the morning of surgery. With the latter dose they also received oral metoclopramide 10 mg. They wore thromboembolic deterrent stockings throughout the anaesthetic and surgical period. The CSE was performed by a member of the obstetric anaesthetic team (specialist registrar and above). After 16-gauge intravenous access had been obtained, monitoring in the form of automated non-invasive blood pressure, electrocardiography and pulse oximetry was attached. A fluid co-load of 1000 mL warmed compound sodium lactate was administered during the CSE. A needle-through-needle CSE technique was used. The woman was positioned sitting and the L3–4 intervertebral space identified. A 16-gauge Tuohy needle was used to locate the epidural space using loss of resistance to saline in an 8 mL loss of resistance syringe. A 27-gauge atraumatic spinal needle was passed through the Tuohy needle and after confirmation of free flow of cerebrospinal fluid, bupivacaine 12.5 mg in dextrose 8% w/v and fentanyl 15 μg were injected intrathecally. The beginning of the spinal injection was used as time zero. Following this injection an epidural catheter was inserted and the woman was positioned supine with a left lateral tilt and non-invasive blood pressure measurement was taken every minute. The use of vasopressors and further intravenous fluid was left to the discretion of the anaesthetist, as was supplementation of the block by the administration of epidural local anaesthetic.

Fig. 1 The Neuropen, with the monofilament fully deployed from its distal end, shown next to a centimetre rule.

Following positioning an investigator, not involved in siting the block, prepared the woman for assessment. The same investigator was used for all patients to allow consistency. A length of Finepore microporous surgical tape (Premier Healthcare and Hygiene Ltd, Gateshead, UK) was fixed down the midline of the woman's body from symphysis pubis to sternal notch and dermatomes from T12 to T2 were marked on the tape using a dermatomal map as a reference. A screen was erected across the woman's neck to ensure she was unable to see her abdomen and chest.

Block testing was performed at 5, 10, 15 and 20 min after intrathecal injection and again at the end of surgery. At each time point the right side of the body was assessed followed by the left. The woman was asked the question ''tell me when you feel something touch your skin'', a specific question used successfully by Soundararajan et al.[7] The Neuropen monofilament was then applied at 90° to her skin in the mid-clavicular line at L1. This was repeated at approximately 2 cm intervals ascending parallel to the sagittal plane until the woman responded. The dermatome immediately below this level was then documented (the last blocked dermatome). The same procedure was then performed using individual ethyl chloride droplets administered from an aerosol canister held 5 cm above the skin (Ethyl Chloride Fine Spray, Acorus Therapeutics Ltd, Chester, UK). Once ethyl chloride had been detected the woman was asked ''tell me when you feel something cold on your skin'' and the ethyl chloride droplets were administered up her body until she responded. Again, the dermatome immediately below this level was documented. The first assessment was always made by the investigator but subsequently the anaesthetist who sited the block made assessments at their discretion using ethyl chloride. At these points the investigator moved away from the woman so as to be completely blind to the anaesthetist's finding. Surgery was allowed to commence when the anaesthetist had checked the block and was satisfied that the level to touch included T5. The anaesthetists used ethyl chloride to make their final block assessment but their exact technique varied from individual to individual and the length of marked tape was not in place.

The primary end points of the study were the block level to touch for the Neuropen monofilament (NT) and the block level to touch for ethyl chloride (ECT). Secondary end points were the block level to cold (ECC), a 10 cm visual analogue pain score (0 cm representing no pain and 10 cm representing worst possible pain) which was completed by the woman at the end