Human volunteer study examining the sensory changes of the thorax after an erector spinae plane block

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INTRODUCTION

The erector spinae plane (ESP) block has been widely adopted despite a lack of randomized control trials supporting its efficacy. The mechanism of action remains elusive despite several cadaver studies. Using human volunteers is important as the spread of local anesthetic is influenced by the biomechanics of the fascial layers and tension in muscle that cannot be replicated in cadaver studies,[1] as well the potential for cadaver preservation techniques to alter the spread of local anesthetic through tissues.[2] In this study, we aim to better understand the mechanism of action of ESP blocks in healthy volunteers by assessing the sensory block.

METHODS

The study was prospectively registered with the Australia New Zealand clinical trials registry (ACTRN12618001872224). All volunteers had the study explained to them and signed written consent. They did not receive any payment for their participation.

Six healthy, male volunteers had an ESP block performed in the sitting position using a high frequency (13–6 MHz) linear transducer under standard monitoring conditions. Under standard aseptic conditions and following 1% lidocaine skin infiltration, ESP blocks were placed at the T4 level on the patients left as previously described,[3] using 30 mL of 0.375% ropivacaine. In volunteer six, the spread under the ESP muscles was not deemed to be satisfactory so the needle was advanced past the transverse process prior to injection of the local. The sensory extent of the block was tested with a gel ice pack, marked out and photographed.

Our study attempted to use Somatosensory evoked potential (SSEP) information to better characterize the qualities of the ESP block, but inability to get adequate baseline responses meant that effect of ESP blockade on the SSEPs could not be ascertained.

RESULTS

The six male volunteers had an age range of 31–45 and body mass index range of 22–29. Figures 1 and 2 show the spread of the block to the standardized cold stimulus in the six volunteers.

No volunteers had any sensory change of the contra-lateral thorax. All volunteers reported resolution of sensory changes by the following day. There were no immediate or delayed complications encountered.

DISCUSSION

The rapid rise in popularity of the ESP block illustrates three key points, the significant demand for providing good quality analgesia to the thoracic region, the inherent difficulty in undertaking a paravertebral block, and the degree to which epidural analgesia has currently fallen out of favor.

The key finding of our volunteer study is that the block that is achievable with this technique varies significantly between individuals. This has implications on the clinical utility of this block. It is our opinion that the extensive block that occurred in one volunteer in this study represents the ability to access the paravertebral space with the needle from this approach.

Crucial to the ability to provide an extensive block is the ability of the local anesthetic to reach the ventral rami of the spinal cord in either the epidural or paravertebral space. Cadaver studies examining local anesthetic spread post an ESP block have shown inconsistent spread of dye. If cadaver studies were a football match, it would be 3–2 to paravertebral spread, with no explanation of how the ball ended up in the goal.[4–8]

Importantly, the block in our volunteers almost uniformly spread caudad with very little cephalad spread, in direct contrast to the previous cadaver studies. This has implications when considering which vertebral level to target for maximal clinical effect.

CONCLUSION

This study suggests a lack of consistent sensory change that extending beyond the posterior chest wall when undertaking an ESP block. Analgesic benefit may be obtained in patients with posterior rib fractures and some patients with lateral rib fractures will benefit. From this study it would indicate that this block is unlikely to be useful in surgeries involving the chest from the mid-axillary line anteriorly, unless the paravertebral space can be accessed.

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Contributors KB: study design and planning, manuscript preparation and editing, analysis of results. CS: manuscript preparation and editing, analysis of results, data collection.

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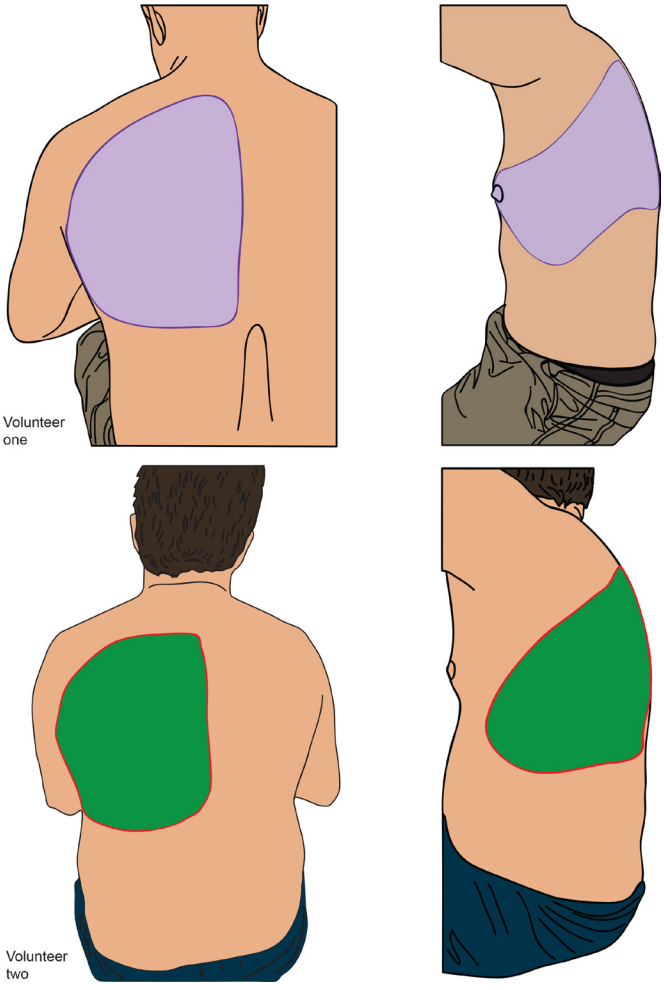

Figure 1 Sensory changes to standardized cold stimulus in volunteers one and two.

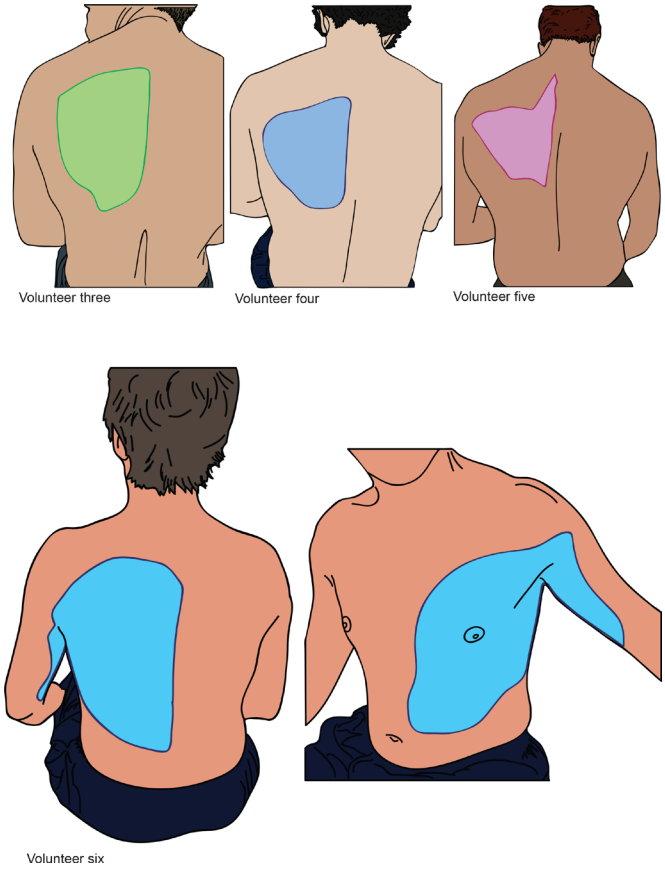

Figure 2 Sensory changes to standardized cold stimulus in volunteers three, four, five and six.

Competing interests None declared.

Patient consent for publication Patients were not involved in this study

Ethics approval This study was approved by the Northern B Ethics Committee, and institutional approval was granted by the Waikato Hospital Research Committee.

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