ACCURACY OF PLACEMENT OF EXTRADURAL NEEDLES IN THE L3-4 INTERSPACE: COMPARISON OF TWO METHODS OF IDENTIFYING L4

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SUMMARY

The certainty with which the L3-4 vertebral interspace can be identified was investigated by studying 50 cadavers. These were allocated randomly to two groups, differing in the way in which the L4 spinous process was identified. Identification of L4 by physically constructing Tuffier's line on the subject led to an increase in the number of catheters sited at the correct level (P < 0.01).

KEY WORDS

Anaesthesia: extradural, spinal.

There is a wide variation in the vertebral level at which the spinal cord terminates: from T12 to the L3-4 intervertebral disc [1]. Although 51% of adult cords terminate at the L1-2 disc, 12% end at the L2-3 disc or below.

The height of block after induction of both intra- and extradural anaesthesia is related to the level at which the injection is made. One study has shown that intradural analgesia may reach as high as T1 with injection at the L2-3 space, but only as high as T6 with injection at L4-5 [2]. Similarly, for extradural analgesia, injection at L2-3 gave a maximum block height of T3, while injection at L5-S1 caused the block to extend only as high as T11 [3]. The authors of both these studies commented that the amount of haemodynamic instability was greater with injections made at a higher vertebral level.

Thus it is important to know at what level the needle is inserted for regional analgesia. However, it has been shown that intradural needles were not in the expected space on 50% of occasions, being sited one space too high or too low [4]. This study was designed to determine the accuracy of placement of extradural needles.

METHODS AND RESULTS

The study was performed in accordance with local Ethics Review policies. Following consent from the next of kin, 50 cadavers undergoing post-mortem examination were allocated randomly to one of two groups.

In group 1, subjects were placed in the left lateral position, their upper iliac crest palpated and the L4 spinous process identified by dropping an imaginary vertical line from the iliac crest to cross the midline at L4 or the L4–5 disc. An extradural catheter was inserted into the space above (the presumed L3–4 space) using a lateral approach.

In group 2, subjects were placed in the left lateral position and L4 was identified by stretching the extradural catheter between the two iliac crests to construct Tuffier's line [5]. The catheter was placed as before, at the presumed L3–4 level.

In both groups, a midline incision was made over the lumbar spine from the sacrum to the lower thoracic vertebrae. The erector spinae muscles were freed from the vertebrae and the catheter could be seen crossing the incision laterally to medially to enter the vertebral column at an interspace. That interspace was identified by counting upwards from the sacrum.

In all subjects physical characteristics were recorded: sex, age, height, weight and body mass index (table I).

Data were analysed using a two-sample t test for the physical data and a chi-square test with
Table I. Subject characteristics, actual level of placement of the catheters and significance (means (SD) or number)

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (n = 27)</th>
<th>Group 2 (n = 23)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>74.5 (9.4)</td>
<td>73.3 (13.2)</td>
<td>ns</td>
</tr>
<tr>
<td>Sex (M/F)</td>
<td>17/10</td>
<td>7/16</td>
<td>ns</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>167 (9.6)</td>
<td>166 (9.3)</td>
<td>ns</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>69 (17.6)</td>
<td>61.6 (5.9)</td>
<td>ns</td>
</tr>
<tr>
<td>Body mass index</td>
<td>24.6 (5.5)</td>
<td>22 (4.6)</td>
<td>ns</td>
</tr>
<tr>
<td>No. catheters at:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L2–3 (or above)</td>
<td>9 (33.3%)</td>
<td>1 (4.3%)</td>
<td></td>
</tr>
<tr>
<td>L3–4</td>
<td>16 (59.3%)</td>
<td>18 (78.3%)</td>
<td>0.01</td>
</tr>
<tr>
<td>L4–5</td>
<td>2 (7.4%)</td>
<td>4 (17.4%)</td>
<td></td>
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</table>

Yates' correction for the catheter positions and sex, combining cells where necessary. A P value of 0.01 was taken as being significant.

In the freehand (group 1) method of identifying L4, 33% of catheters were placed too high, but in group 2 (constructing Tuffier's line), 80% of catheters were placed correctly and only 4% placed too high (table I).

Comment

In addition to the factors examined in this study, the level at which catheters are placed may be affected by bony abnormalities of the lower vertebrae which are common, particularly lumbarization of S1 and sacralization of L5. There was a case of partial fusion of L5 to S1 in group 1 in this study and the catheter in that cadaver was inserted too high.

It may be argued that performing regional analgesia at the L2–3 level rather than at L3–4 does not greatly increase either the amount of hypotension experienced or the amount of risk to which the spinal cord is exposed. It is important, however, that practitioners of regional analgesia realize that the spinal cord does not always terminate at the L1–2 disc, and that identification of a disc space may be inaccurate.

In one of the cases in group 1, a short man with narrow disc spaces, the needle was inserted at the L1–2 level. In these circumstances the resultant block height would have been noticeably higher than anticipated, and the spinal cord would have been exposed to considerably more risk of damage. Thus, while the added risk involved in placing the needle too high is small in most subjects, occasionally it may be considerable. It is noteworthy that this risk may be diminished by physically constructing Tuffier’s line.

In conclusion, standard methods of identifying L4 are not particularly accurate, and are likely to lead to many spinal and extradural blocks being inserted at a level higher than expected.

References

3. Sharrock NE, Lesser ML, Gabel RA. Segmental levels of anaesthesia following the extradural injection of 0.75% bupivacaine at different lumbar spaces in elderly patients. British Journal of Anaesthesia 1984; 56: 285–287.