PARA VERTEBRAL BLOCK DURING CHOLECYSTECTOMY:
EFFECTS ON CIRCULATORY AND HORMONAL RESPONSES

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Paravertebral block (PVB) was described first in 1919 by Kappis [1]. It may be used for the same indications as intercostal extradural blocks, but has advantages such as a unilateral sympathetic blockade without the disabling hypotension found often when an extradural technique is used [2]. It is easy to perform and carries a small risk of complications [3,4]. Several studies have demonstrated beneficial effects of extradural [5] and intercostal blocks [6–12] for postoperative pain relief and pulmonary complications. These advantages should hold for PVB in addition.

The complications reported for PVB include: total spinal block, headache, pneumothorax, and i.v. injection of local anaesthetic. The two former complications are probably more common when the medial technique [13] is used, while the risk of pneumothorax is greater with the lateral technique [14]. The overall frequency of complications accompanying PVB is not known. We have performed approximately 200 PVB, and have caused one small pneumothorax and a few instances of i.v. injection. None of these complications required treatment.

The present study was designed to examine the effect of PVB on the perioperative stress response to anaesthesia and surgery.

PATIENTS AND METHODS

Twelve healthy patients undergoing cholecystectomy through a subcostal incision were studied. All had given informed consent for the study, which was approved by the local Ethics Committee. Following i.m. premedication with morphine 0.15 mg kg\(^{-1}\) or ketobemidone 0.1 mg kg\(^{-1}\), six of the patients received PVB with bupivacaine 20 ml. We used the lateral technique for performing PVB, as described by Eason and Wyatt [3].

All patients received general anaesthesia induced with thiopentone 3–5 mg kg\(^{-1}\) with atropine 0.5 mg and maintained with 1% isoflurane and 66% nitrous oxide in oxygen. Muscle paralysis was obtained with pancuronium 0.1 mg kg\(^{-1}\). Residual neuromuscular blockade was antagonized at the end of operation with neostigmine 2.5 mg preceded by atropine 1 mg.

The left radial artery was cannulated with a 20-gauge Teflon catheter for continuous measurement of arterial pressure and sampling for blood-gas determinations. Intermittent blood samples were obtained for measurement of plasma catecholamine, cortisol and glucose concentrations at the following sampling times:

**SUMMARY**

Surgical trauma induces a hormonal metabolic response which is partly responsible for postoperative catabolism. In this study 12 patients underwent cholecystectomy during isoflurane anaesthesia, six with a paravertebral block (PVB) in addition. Plasma concentrations of glucose, cortisol and adrenaline, and heart rate and arterial pressure were compared between the two groups. The patients with PVB showed a significantly diminished response to noxious stimuli.
TABLE I. Patient characteristics (mean (SEM)). Anaesthetic time measured from start of anaesthesia to end of operation

<table>
<thead>
<tr>
<th>Sex</th>
<th>Age (yr)</th>
<th>Weight (kg)</th>
<th>Anaesthetic time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>isoflurane</td>
<td>6/4</td>
<td>40 (6)</td>
<td>104 (19)</td>
</tr>
<tr>
<td>Isoflurane + PVB</td>
<td>6/4</td>
<td>45 (5)</td>
<td>87 (10)</td>
</tr>
</tbody>
</table>

(1) before induction of anaesthesia; (2) after induction of anaesthesia; (3) 1 min after tracheal intubation; (4) immediately before skin incision; (5) 1 min after skin incision; (6) during surgical exploration; (7) during surgical exploration.

Catecholamines were measured by high pressure liquid chromatography [15]. Cortisol was measured with radioimmunoassay [16] and blood glucose by a glucose oxidase method.

In the postoperative period, subjective experience of pain was measured by VAS (visual analogue scale), immediately after operation and then hourly until the patients felt pain and required analgesics.

Statistical analysis of data was performed using the Wilcoxon rank sum test and Mann–Whitney test as appropriate.

RESULTS

Details of the patients studied are shown in table I.

During the surgical procedure the plasma concentrations of adrenaline increased significantly from sampling times 1 to 7. In the
group given isoflurane only, there was a significant increase in plasma adrenaline concentration during surgical stimulation ($P < 0.05$) but this did not occur in the PVB group (fig. 1). There was a similar pattern for changes in plasma cortisol concentrations, with a significant increase only in the isoflurane group (fig. 2). For both groups, plasma glucose concentrations increased significantly ($P < 0.05$) during surgery. The increase in the isoflurane-only group was significantly higher than in the PVB group ($P < 0.025$) (fig. 3).

There were no differences within or between the two groups in heart rate or systolic arterial pressure (table II).

The patients receiving PVB were completely free from pain for 1–6 h after operation.

**DISCUSSION**

The paravertebral space lacks well defined boundaries and it is therefore difficult to ascertain where injected local anaesthetic acts. The space communicates on the medial aspect with the extradural space and on the lateral side with the intercostal spaces [3,17]. Recent studies have reported that radiopaque contrast medium from a PVB may enter the extradural space [18]. We believe that PVB acts as a "partial extradural". This assumption was confirmed by x-ray on two patients receiving PVB with contrast, which demonstrated a thin line of contrast medium

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**TABLE II. Variations (mean (SEM)) in heart rate and arterial pressure (AP) in the two groups**

<table>
<thead>
<tr>
<th>Sampling time</th>
<th>Isoflurane (beat min$^{-1}$)</th>
<th>Isoflurane + PVB (beat min$^{-1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>75 (6)</td>
<td>75 (6)</td>
</tr>
<tr>
<td>2</td>
<td>97 (4)</td>
<td>80 (6)</td>
</tr>
<tr>
<td>3</td>
<td>79 (4)</td>
<td>87 (8)</td>
</tr>
<tr>
<td>4</td>
<td>83 (4)</td>
<td>79 (7)</td>
</tr>
<tr>
<td>5</td>
<td>85 (5)</td>
<td>83 (10)</td>
</tr>
<tr>
<td>6</td>
<td>72 (6)</td>
<td>82 (8)</td>
</tr>
<tr>
<td>7</td>
<td>81 (10)</td>
<td>89 (8)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Systolic AP (mm Hg)</th>
<th>Isoflurane</th>
<th>Isoflurane + PVB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>126 (6)</td>
<td>139 (19)</td>
</tr>
<tr>
<td>2</td>
<td>143 (7)</td>
<td>150 (14)</td>
</tr>
<tr>
<td>3</td>
<td>90 (2)</td>
<td>143 (15)</td>
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<tr>
<td>4</td>
<td>99 (2)</td>
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<tr>
<td>5</td>
<td>122 (4)</td>
<td>111 (13)</td>
</tr>
<tr>
<td>6</td>
<td>100 (7)</td>
<td>121 (15)</td>
</tr>
<tr>
<td>7</td>
<td>123 (5)</td>
<td>118 (14)</td>
</tr>
</tbody>
</table>
PARAVERTEBRAL BLOCK

laterally in the extradural space. This would explain its excellent analgesic effect across so many intercostal spaces without associated hypotension.

We have observed a significant increase in plasma concentrations of adrenaline, cortisol and glucose in patients given isoflurane only, but only for glucose in the patients who received an additional PVB. However, in the PVB group, concentrations of both cortisol and glucose increased slightly, suggesting only partial suppression of the stress response. A similarly differentiated stress response has been shown for other types of regional blocks [19, 20].

It is surprising that the plasma adrenaline concentrations were low at point six. It is possible that the level of surgical manipulation was small at this point for most of the patients. The biological half-life of adrenaline (15 s) makes this hormone more susceptible than cortisol to variations in the degree of trauma.

We may conclude, therefore, that PVB attenuated the stress response occurring in cholecystectomy under isoflurane anaesthesia. This is in agreement with studies on extradural blocks extending to a high level (T5-S5) [21, 22]. After operation, the PVB patients were entirely free from pain for 1-6 h, which is a shorter period than reported elsewhere [12, 23].

Arterial pressure decreased in response to administration of isoflurane and remained at the same low value despite the higher concentrations of catecholamines in the isoflurane-only group. According to Stratton and colleagues [24] this lack of pressor effect from the higher catecholamine concentrations in the isoflurane-only group does not necessarily imply that there were no significant differences in other cardiovascular indices such as cardiac output, ejection fraction, stroke volume or systemic vascular resistance.

The patients who underwent surgery with the addition of PVB showed a significantly diminished response to noxious stimuli, both metabolically and clinically. We suggest, therefore, that PVB should be considered as an alternative to extradural and intercostal blocks for such operations. It is a good alternative to the use of opioids, since it is not associated with respiratory depression or postoperative drowsiness.

ACKNOWLEDGEMENT

This investigation was supported by grant No. 02330 from the Swedish Medical Research Council.

REFERENCES


