CHANGES IN PLASMA CATECHOLAMINE CONCENTRATIONS DURING ENDOTRACHEAL INTUBATION

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SUMMARY
The changes in arterial pressure and arterial concentrations of noradrenaline, adrenaline and dopamine were monitored in 16 patients undergoing endotracheal intubation. Significant increases in mean arterial pressure and plasma noradrenaline were noted. The increases in arterial pressure were associated with increases in noradrenaline concentrations. Adrenaline and dopamine concentrations did not change significantly following intubation. The results suggest a predominantly sympathetic response during intubation and the need for prophylaxis in patients at risk.

The introduction of a foreign body into the trachea is almost always associated with cardiovascular disturbances (Siedlecki, 1975). These include a significant increase in arterial pressure and ventricular premature beats. Although these cardiovascular manifestations during anaesthesia are recognized, there is little documented evidence on the mechanisms of their production. Alpha- and beta-adrenergic blockers have been used to minimize these changes and successful results have been reported following ganglion blockade (Siedlecki, 1975).

The basis for adrenergic blockade is the assumption that increases in plasma catecholamine concentrations could contribute to cardiovascular changes during intubation. This has not been validated; few studies on plasma catecholamine concentrations during surgery have been reported (Butler et al., 1977). The present study examined changes in plasma catecholamine concentrations during intubation to determine if an increase occurred, and if one specific catecholamine might predominate.

METHODS
Sixteen patients aged 25–80 yr undergoing elective surgery were studied. Each received premedication, usually morphine and atropine. Arterial pressure was recorded from a heparinized cannula placed in a radial artery and blood for catecholamine estimations was obtained through this line. Anaesthesia was induced with a sleep-dose of thiopentone i.v. Pancuronium was administered and the lungs ventilated with nitrous oxide in oxygen.

The study was conducted in two stages. Samples from the first eight patients were taken before induction of anaesthesia and at 1, 5 and 10 min after tracheal intubation. The results indicated that a further sample was necessary after induction of anaesthesia, but before intubation, to separate any effects of premedication and anaesthetic agents from the effects of intubation. This further sample was taken in the second group of eight patients; the other sampling sequence remained unchanged. The blood was collected into chilled heparinized tubes (lithium heparin 125 u./10 ml litre⁻¹) which contained glutathione 5 mmol litre⁻¹. The samples were centrifuged and the plasma separated from cells. Samples were then deproteinized with an equal volume of perchloric acid 0.6 mol litre⁻¹ containing EGTA 10 mmol litre⁻¹ and magnesium chloride 1 mmol litre⁻¹, centrifuged again and the supernatant stored at −20°C.

Assay of catecholamines
Catecholamines (noradrenaline, adrenaline and dopamine) were estimated using a modification of the radioenzymatic method of Da Prada and Zürcher (1976). Each of the catecholamines is converted to the respective O-methylated product by catechol-O-methyltransferase (COMT) in the presence of 3H-S-adenosyl methionine. These
products are then extracted, purified, and finally separated by thin-layer chromatography, and radioactivity determined and compared with standards. This assay has been validated in our laboratory by appropriate recovery procedures.

RESULTS

Table I and figure 1 show the changes in mean arterial pressure and plasma catecholamine concentrations which occurred following induction of anaesthesia and endotracheal intubation. As the values before anaesthesia for stages 1 and 2 of the study were similar, the results obtained from all 16 patients were grouped together. A significant decrease in arterial pressure was observed following induction of anaesthesia. The mean values for adrenaline and noradrenaline also decreased, but the changes were not statistically significant.

Significant increases in mean arterial pressure and noradrenaline concentration were noted 1 min after intubation, and these changes gradually regressed with time. Changes in adrenaline and dopamine concentrations over the same time period were not statistically significant.

Analysis of variance suggested a significant positive correlation between arterial pressure and plasma noradrenaline concentration (table I). There was no significant correlation between arterial pressure and adrenaline or dopamine concentrations.

<table>
<thead>
<tr>
<th>Time</th>
<th>Pre-A</th>
<th>Pre-I</th>
<th>1 min</th>
<th>5 min</th>
<th>10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean arterial pressure</td>
<td>100±5.2</td>
<td>77±6.6*</td>
<td>122±5.9**</td>
<td>90±6.5</td>
<td>83±6.1</td>
</tr>
<tr>
<td>Noradrenaline</td>
<td>1.82±0.24</td>
<td>1.43±0.24</td>
<td>2.43±0.27*</td>
<td>1.71±0.40</td>
<td>1.77±0.34</td>
</tr>
<tr>
<td>Adrenaline</td>
<td>0.61±0.19</td>
<td>0.21±0.02</td>
<td>0.36±0.06</td>
<td>0.22±0.05</td>
<td>0.44±0.15</td>
</tr>
<tr>
<td>Dopamine</td>
<td>0.67±0.20</td>
<td>0.76±0.15</td>
<td>0.75±0.11</td>
<td>0.59±0.09</td>
<td>0.75±0.14</td>
</tr>
<tr>
<td>n</td>
<td>16</td>
<td>8</td>
<td>16</td>
<td>16</td>
<td>16</td>
</tr>
</tbody>
</table>

*P<0.05; **P<0.01 (comparisons were made with the values immediately preceding these in the table)
CATECHOLAMINE CHANGES DURING INTUBATION

DISCUSSION

The pre-intubation plasma catecholamine concentrations found in this study are similar to those reported by Bühler and others (1978) and Saar and Gordon (1979). The important difference, however, is that blood samples from our patients were arterial and not venous. Central venous blood samples would have resulted in increased plasma noradrenaline concentrations since noradrenaline is taken up by the lungs to a greater extent than other catecholamines (Fishman and Pietra, 1974).

The most significant findings were increases in arterial pressure and plasma noradrenaline concentration following intubation. The magnitude of the increases in pressure was considerable (115 mm Hg systolic and 54 mm Hg diastolic in one subject) and paralleled the increases in plasma noradrenaline concentration. The plasma adrenaline and dopamine concentrations did not change significantly. These results suggest that intubation is associated with a significant increase in sympathetic nerve activity.

Our findings are relevant to the management of patients at risk from increases in arterial pressure, for example, patients with intracranial aneurysms. Prophylactic measures to block the enhanced sympathetic activity following intubation may be required and the use of purely beta-blocking agents would seem to be an incomplete solution.

ACKNOWLEDGEMENTS

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REFERENCES


VARIATIONS DANS LES CONCENTRATIONS DE CATECHOLAMINE DANS LE PLASMA PENDANT UNE INTUBATION ENDOTRACHEALE

SUMARIO

Se vigilaron los cambios de la presión y de la concentración arterial ocasionados por la noradrenalina, la adrenalina y la dopamina en 16 pacientes sometidos a intubación endotraqueal. Se apreciaron cambios significativos en la presión arterial media y en la noradrenalina del plasma. Los cambios en la presión arterial se asociaron con los incrementos en las concentraciones de noradrenalina. Las concentraciones de adrenalina y de dopamina no cambiaron significativamente durante la intubación. Los resultados obtenidos sugieren una respuesta predominantemente simpática durante la intubación y la necesidad de profilaxis en aquellos pacientes en condiciones de riesgo.