CHANGES IN PLASMA CATECHOLAMINE CONCENTRATIONS DURING ENDOTRACHEAL INTUBATION

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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.

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−1) which contained glutathione 5 mmol litre−1. The samples were centrifuged and the plasma separated from cells. Samples were then deproteini zed 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 I.** Changes in mean arterial pressure and arterial catecholamine concentration. Time intervals relative to the time of intubation. Pre-A = before onset of anaesthesia. Pre-I = after onset of anaesthesia but before intubation. Mean arterial pressure was taken as diastolic + one-third pulse pressure and expressed in mm Hg (± SEM). The arterial plasma catecholamine concentrations are expressed in pmol ml⁻¹ (± SEM). *P<0.05; **P<0.01 (comparisons were made with the values immediately preceding these in the table).

<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>
<th>r</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>
<td>0.40</td>
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<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>
<td>(P&lt;0.001)</td>
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<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>
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<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>
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<tr>
<td>n</td>
<td>16</td>
<td>8</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 1.** Changes in mean arterial pressure (D) and arterial noradrenaline (●), adrenaline (○) and dopamine (▲) concentrations associated with endotracheal intubation. *P<0.05; **P<0.01. Pre-A = before anaesthesia; pre-I = after onset of anaesthesia, but before intubation. Significant and correlated increases in arterial pressure and plasma noradrenaline concentrations were noted 1 min after intubation.
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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 mmHg systolic and 54 mmHg 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.

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REFERENCES


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

SUMMARY
Our findings 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.

KONZENTRATIONSÄNDERUNGEN VON CATECHOLAMIN IM PLASMA BEI ENDOTRACHEALROHREINFÜHRUNG

ZUSAMMENFASSUNG

CAMBIOS EN LAS CONCENTRACIONES DE CATECOLAMINA DEL PLASMA DURANTE LA INTUBACION ENDOTRAQUEAL

RESUME
On a surveillé sur 16 patients subissant une intubation endotrachéale, les variations se produisant dans la pression artérielle et dans les concentrations artherielles de noradrenaline, d'adrénaline et de dopamine. On a constaté des augmentations significatives de la pression artérielle moyenne et de noradrenaline dans le plasma. Les augmentations de pression artérielle ont été reliées à l'augmentation des concentrations de noradrenaline. Les concentrations d'adrénaline et de dopamine n'ont pas sensiblement changé après l'intubation. Les résultats obtenus laissent penser à une réaction à prédominance sympathique pendant l'intubation et le besoin de prophylaxie chez les malades exposés au danger.