Can one predict arterial $P_{\text{CO}_2}$ from end-tidal $P_{\text{CO}_2}$?

Sir,—The variation in the arterial to end-tidal $P_{\text{CO}_2}$ difference ($P_{\text{aCO}_2} - P_{\text{eCO}_2}$) during anaesthesia in an adult population is wide (0.3–2.5 kPa). Preoperative spirometry cannot discriminate between patients with large and small ($P_{\text{aCO}_2} - P_{\text{eCO}_2}$) values in the supine or lateral position [1, 2]. I was interested to read about a simple non-invasive manoeuvre described by Fletcher which may allow us to identify those patients with an increased ($P_{\text{aCO}_2} - P_{\text{eCO}_2}$) [3]. In 18 patients (mean age 63 yr) presenting for coronary artery bypass surgery, I applied the same manoeuvre in the period before bypass. The patients’ lungs were ventilated with oxygen at 20 b.p.m. via a Carden ventilator. $P_{\text{eCO}_2}$ was measured using a Datex Capnomac calibrated before each case. At steady state, $P_{\text{eCO}_2}$ was noted (mean of five successive breaths) and arterial blood obtained for analysis. Immediately after blood sampling, ventilator frequency was reduced to 10 b.p.m. and the mean $P_{\text{eCO}_2}$ of the next five breaths noted.

In 12 patients, $P_{\text{eCO}_2}$ increased by a mean of 0.26 (SD 0.21) kPa when ventilatory settings were reduced to 10 b.p.m., doubling tidal volume. There was no change in two patients and in four, $P_{\text{eCO}_2}$ decreased by mean 0.15 (0.17) kPa. There was a linear relationship between the change in $P_{\text{eCO}_2}$ brought about by the change in ventilatory settings and ($P_{\text{aCO}_2} - P_{\text{eCO}_2}$) at 20 b.p.m. ($r = 0.49$, $P = 0.04$) (fig. 1); patients whose $P_{\text{eCO}_2}$ value increased the most had greater ($P_{\text{aCO}_2} - P_{\text{eCO}_2}$) values. Mean ($P_{\text{aCO}_2} - P_{\text{eCO}_2}$) in the “risers” was 1.01 (0.47) kPa and 0.83 (0.32) kPa in the “fallers”.

In patients with poor lung function, who have a large $V/Q$ spread and increased ($P_{\text{aCO}_2} - P_{\text{eCO}_2}$), increased tidal volume improves ventilation of low $V/Q$ regions ($P_{\text{CO}_2}$ increases). In efficient lungs, this manoeuvre generates more carbon dioxide at a smaller partial pressure ($P_{\text{CO}_2}$ decreases). These findings appear to support those of Fletcher [3]. However, in the two patients who had no change in $P_{\text{eCO}_2}$ with this manoeuvre, ($P_{\text{aCO}_2} - P_{\text{eCO}_2}$) were 1.0 and 0.6 kPa, respectively.

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3. Fletcher R. Can one predict arterial $P_{\text{CO}_2}$ from end-tidal $P_{\text{CO}_2}$? British Journal of Anaesthesia 1993; 71: 316–317P.

Incidence of aspiration with the laryngeal mask airway

Sir,—We read the useful comments of Haden, Pinnock and Campbell on the laryngeal mask airway (LMA) for intracocular surgery, but were particularly interested in the comparisons between the LMA and tracheal tube [1]. From data collected from over 9600 patients, they found a significantly lower incidence of difficult placement and laryngospasm with the LMA than with the tracheal tube (0.9 vs 3.4 %). Whilst their method of data collection was not described, this represents the biggest documented series of LMA usage and could provide other valuable information.

Of great concern is the theoretical possibility that the LMA may increase the risk of aspiration by reducing lower oesophageal sphincter tone [2–7]. Only limited information is available about the incidence of aspiration with the LMA. Cumulative data from two large prospective surveys suggested an incidence of 1:4300 [8, 9] and this is comparable with that found for elective [10] and outpatient general anaesthesia [11] before the availability of the LMA.

We believe that the data of Haden, Pinnock and Campbell may shed more light on this important issue and hope the authors could comment on their method of data collection and the incidence of regurgitation, aspiration, or both, in their series.

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Table 1. Incidence of perioperative regurgitation, aspiration and vomiting in 16,663 general anaesthetics with or without a local anaesthetic technique. (In a further 2,678 patients, the airway was self-maintained, that is operations were carried out solely under peripheral or central neural block with or without sedation. One patient vomited without aspirating (1:2600) and another aspirated in the early postoperative period (1:2600)).

<table>
<thead>
<tr>
<th>Airway management</th>
<th>n</th>
<th>Regurgitation</th>
<th>Aspiration</th>
<th>Vomiting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face mask</td>
<td>4723</td>
<td>(1:4700)</td>
<td>(1:4700)</td>
<td>(1:1500)</td>
</tr>
<tr>
<td>Laryngeal mask (LMA)</td>
<td>7043</td>
<td>(1:3500)</td>
<td>(1:3500)</td>
<td>(1:3450)</td>
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<tr>
<td>Tracheal tube</td>
<td>4897</td>
<td>(1:4900)</td>
<td>(1:4900)</td>
<td>(1:4900)</td>
</tr>
</tbody>
</table>

Critical incidents are universally under-reported [4-6] but for those that are reported, audit of our record system suggests that the information extracted has less than 1% factual errors. Therefore, we can be reasonably confident of the data in table I. With respect to the concerns of Brimacombe and Berry on the possibility that the LMA may increase the risk of aspiration [7,8], our data suggest that the incidence of both regurgitation and aspiration may be greater with the LMA than with either face mask or tracheal tube. Awake patients under local anaesthesia may also aspirate. The precise relevance of these findings to clinical management is debatable.

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