the dial by two screws, but in the faulty vaporizer one had fallen out, into the top of the casing. With the cam loose, it was possible to turn the dial a few degrees clockwise beyond the OFF position, when a strong smell of enflurane was noticed in the fresh gas flow. Anaesthetists should be aware that unless the OFF mark on the concentration setting dial coincides with the datum mark, then their Enfluratec or, presumably, Fluotec 3, may still deliver vapour.

I have reported this finding to Cyprane, making two suggestions. First, all existing Enfluratecs should be modified by fixing the cam to the dial by four instead of two screws. The cam and dial are already drilled and tapped for this, the extra holes being used at present to attach the name-plate to the dial.

Second, the present design, with a hard steel spring working on a soft plastic cam, seems unsatisfactory and bound to cause excessive wear. The cam on the faulty vaporizer was badly worn after only 8 months’ use. The rim of the concentration setting dial could be used as a cam, with different machining for different models, from the same stock of parts. A spring made of plastic in the same way as the one-piece hinges found on some plastic boxes would avoid the wear problem.

J. R. DAVIES
Stockholm, Sweden

REFERENCES

Sir,—Unfortunately we have not had the opportunity to examine the Enfluratec with which Dr Davies experienced his reported problems, but we have tried removing the stop mechanism completely from another Enfluratec to examine the performance under these conditions. With steady-state conditions we were unable to detect any measurable concentration of Enflurane below the OFF position until the dial had been turned approximately 90° below OFF where a concentration of approximately 1% was observed. As the dial was rotated further the concentration again decreased to zero until the maximum graduation of the scale was approached from the reverse direction when the concentration suddenly increased to 7%. The apparatus used for these measurements was sensitive to concentrations of approximately 0.01% enflurane.

In a correctly functioning Enfluratec, the port which permits the flow of fresh gases into the vaporizing chamber is closed by the rotary valve from the position 90° below OFF to a position close to the lowest graduated mark on the scale. Our belief is that Dr Davies may have been observing either trace concentrations of the type reported by Robinson, Thompson and Barratt (1977), or minor surges which could occur if the inlet connected to the vaporizing chamber is closed off, but the outlet port is open. Such surges would be of short duration. The precise time depends on a number of factors such as the circuit configurations and pressure in the circuit.

Any minor misalignment of a few millimetres of the OFF mark and the scale pointer, will not in itself result in the delivery of clinically significant concentrations as in this case both the inlet port to and the outlet port from the vaporizing chamber are closed by the rotary valve. If for any reason the dial can be turned approximately 5 mm below the OFF mark, it is conceivable that intermittent pressure surges or diffusion could result in the delivery of very small concentration of enflurane indicated by a smell of enflurane at the outlet. A through flow of fresh gases through the vaporizing chamber could not occur because the inlet to the vaporizing chamber is closed by the rotary valve.

Dr Davies makes a number of positive suggestions for design modification and it is interesting to note that since the date of manufacture of this particular vaporizer we have made a number of modifications, namely:
(1) Using a much tougher material for the stop control ring.
(2) Fitting flanges on the leaf spring.

These modifications were introduced as a result of our observations of very occasional heavy wear which only became evident after examining many thousands of Fluotec Mk 3 vaporizers passing through our Cyprane Service Centres (covering more than 20 countries). Modifications of the type indicated above are automatically incorporated into vaporizers at the time of annual servicing at Cyprane Service Centres and this fact alone demonstrates to both manufacturers and users of equipment the value of regular preventative maintenance.

It is very difficult to comment on how the particular screw in question could become loose without a detailed examination of the vaporizer. However, we can confirm that Cyprane, and its overseas Service Centres, have been unable to identify any general problem of security of this item.

We have, however, taken note of Dr Davies’ comments and have introduced a minor modification to the security of attachment of the stop control ring.

We would like to emphasize that, in common with most manufacturers, we occasionally carry out minor design changes even to products which may be very reliable. Where these are of functional importance it is our normal practice to incorporate these changes into vaporizers returned to our Service Centres wherever practicable at the time of annual service.

R. W. CARTER
Cyprane Ltd, Keighley, Yorks

REFERENCE

ANALGESIC ACTION OF EXTRADURAL FENTANYL

Sir,—Animal studies have shown that morphine acts selectively on the nociceptive receptors in the dorsal horns of the spinal column (Yaksh and Rudy, 1976a; Yaksh, 1978; Yaksh and Henry, 1978). Following these reports there has been increasing interest in the clinical application of intrathecal narcotics (Yaksh and Rudy, 1976b; Behar et al., 1979; Samii et al., 1979; Wang, Nauss and Thomas, 1979).

In a previous communication by Wolfe and Nicholas (1979), it was reported that satisfactory analgesia was
TABLE I. Plasma fentanyl concentrations (μg litre−1) in eight patients following the administration of fentanyl 0.1 mg diluted with 0.9% sodium chloride 8 ml into the extradural space. The sensitivity of the assay method was 0.15 μg litre−1

<table>
<thead>
<tr>
<th>Surgical procedure</th>
<th>5</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>60</th>
<th>120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caesarean section</td>
<td>0.76</td>
<td>0.17</td>
<td>0.18</td>
<td>0.16</td>
<td>&lt;0.15</td>
<td>&lt;0.15</td>
</tr>
<tr>
<td>Caesarean section</td>
<td>&lt;0.15</td>
<td>&lt;0.15</td>
<td>&lt;0.15</td>
<td>&lt;0.15</td>
<td>&lt;0.15</td>
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<tr>
<td>Caesarean section</td>
<td>&lt;0.15</td>
<td>&lt;0.15</td>
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<td>&lt;0.15</td>
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<td>&lt;0.15</td>
</tr>
<tr>
<td>Caesarean section</td>
<td>&lt;0.15</td>
<td>&lt;0.15</td>
<td>&lt;0.15</td>
<td>&lt;0.15</td>
<td>&lt;0.15</td>
<td>&lt;0.15</td>
</tr>
<tr>
<td>Lobectomy</td>
<td>0.42</td>
<td>&lt;0.15</td>
<td>&lt;0.15</td>
<td>&lt;0.15</td>
<td>&lt;0.15</td>
<td>&lt;0.15</td>
</tr>
<tr>
<td>Pleurectomy</td>
<td>1.02</td>
<td>4.10</td>
<td>1.56</td>
<td>1.24</td>
<td>0.92</td>
<td>—</td>
</tr>
<tr>
<td>Lobectomy</td>
<td>0.84</td>
<td>0.96</td>
<td>0.72</td>
<td>0.22</td>
<td>1.86</td>
<td>1.08</td>
</tr>
<tr>
<td>Lobectomy</td>
<td>0.34</td>
<td>0.72</td>
<td>0.46</td>
<td>0.34</td>
<td>0.32</td>
<td>0.24</td>
</tr>
</tbody>
</table>

Encouraged by these results, but uncertain as to the exact role, if any, of plasma absorption of fentanyl we measured plasma fentanyl concentrations in eight patients; in four, Caesarean section had been performed under extradural anaesthesia with bupivacaine and the remainder had undergone thoracotomy with general anaesthesia. None of the patients received an opiate before or during operation until the administration of fentanyl 0.1 mg diluted in 0.9% sodium chloride solution 8 ml which was given through an extradural catheter inserted at L2–3 in the obstetric group and T6–7 in the thoracic group. Blood samples were taken at the time intervals shown in Table I and the plasma fentanyl concentrations were measured using the method described by McQuay and others (1979). The minimum concentration detectable by the assay method was 0.15 μg litre−1.

The results are from a small sample and statistical analysis is inappropriate. However, with the possible exception of the sixth patient, all results show virtually insignificant concentrations of plasma fentanyl, perhaps not surprising in view of its high lipid solubility compared with other opiates (Höllt and Teschemacher, 1975). Even the solitary value of 4.1 μg litre−1 in the sixth patient is probably less than that associated with an analgesic plasma concentration (R. F. Cookson, personal communication) and most unlikely to produce respiratory depression.

If fentanyl and other narcotics diffuse through the dura, as has been proposed, it would be interesting to know more about the limits of dosage compatible with the absence of undesirable side-effects, and also the extent to which volume of administered drug affects the spread of analgesic block as is the case with local anaesthetics injected to the extradural space.

M. J. WOLFE
G. K. DAVIES
Sheffield

REFERENCES


