TABLE 1. Comparison of Experimental Conditions in Animal Trials in Which Sufentanil Was Administered Intrathecally or Epidurally

<table>
<thead>
<tr>
<th>Species</th>
<th>Route of Administration</th>
<th>Mean Dose (µg/kg)</th>
<th>Volume (ml)</th>
<th>Frequency</th>
<th>Spinal Cord Pathology</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheep</td>
<td>Intrathecal</td>
<td>1.5–7.5</td>
<td>4.2–0.8</td>
<td>4×/day for 3 days</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>Rat</td>
<td>Intrathecal</td>
<td>0.2–60</td>
<td>0.01</td>
<td>1×</td>
<td>†</td>
<td>2</td>
</tr>
<tr>
<td>Cat</td>
<td>Intrathecal</td>
<td>1–100</td>
<td>0.2</td>
<td>1×/day during 5 days</td>
<td>Yes</td>
<td>2</td>
</tr>
<tr>
<td>Dog</td>
<td>Epidural</td>
<td>1.5–10</td>
<td>2.0</td>
<td>1×/day for 15 days</td>
<td>Yes</td>
<td>3</td>
</tr>
<tr>
<td>Guinea pig</td>
<td>Epidural</td>
<td>2,500</td>
<td>0.25</td>
<td>1×/day for 7, 14, 28 days</td>
<td>Yes</td>
<td>*</td>
</tr>
</tbody>
</table>

† Not investigated.

the observed spinal damage—especially so if a hypotonic highly lipophilic substance (sufentanil) is compared to an isotonic hydrophilic control (saline). Moreover, inflammatory changes at the catheter insertion were observed in the saline-injected sheep.1

In addition to these differences in injection techniques, species differences may exist. After an intrathecal injection of local anesthetics, Rosen et al.4 reported neurologic deficits in sheep but not in monkeys. The widespread use of spinally administered local anesthetics in humans is also inconsistent with the reported toxicity in sheep. In conclusion, these data indicate that extrapolations of toxicity data from sheep to humans should be done very cautiously and that clinical and experimental data, in more commonly used laboratory animal species, give no evidence of any drug-related spinal toxicity. Spinal toxicity is even more unlikely to happen with the isotonic solution of sufentanil, which has recently been made available for spinal and intravenous application.

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In Reply—Van Deun et al. suggest that the neurotoxic changes described by us may be due to large volumes of injectate, species differences, and frequency of injections. For evaluation of the neurotoxic potential of a drug, it is important to investigate histologic and functional changes. The absence of histopathologic changes alone is not sufficient to absolve a drug from possible neurotoxic effects. Conversely, it is possible for behavioral effects not to be observed and toxicity still to be present.1 In our study, there was a general correspondence between the degree of behavior change and the degree of histologic change.

In the study mentioned by Van Deun et al., motor dysfunction and catalepsy were noted in all rats receiving 10 or 30 µg intrathecal sufentanil. In fact, a mortality of 20% was noted in rats receiving 10 µg, and a mortality of 60% was noted in rats receiving 30 µg sufentanil intrathecally.4 Similarly, in cats receiving 100 µg intrathecal sufentanil, excitation, labored breathing, and hindlimb motor weakness (lasting 24 h) were noted. Intrathecal administration of 300 µg sufentanil resulted in convulsions and death after 7 h.4

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We agree with Van Deun et al. that a large volume of drug can conceivably increase cerebrospinal fluid pressure and cause neurologic deficit. However, we noted a dramatic difference in the behavioral responses between animals receiving large but identical volumes of saline or opioids. When an identical volume of saline was injected intrathecally in animals who had recovered from moderate to severe behavioral effects of sufentanil and butorphanol, no behavioral changes occurred. This suggests that the behavioral and neurologic changes in our study were not due to barotrauma after the administration of large volumes of injectate.

The authors suggest that neurotoxicity may have been related to the frequency of injections. We injected the drugs every 6 h, i.e., four times a day for 4 days, instead of the more usual single daily administration for 1–2 weeks. This was done because of the short duration of action of these drugs and because this closely parallels the use of these opioids in clinical practice. However, this administration schedule was used only in the low-dose sufentanil group. Because of major behavioral changes and prolonged motor weakness of hindlimbs after
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Retrograde Wire-guided Direct Laryngoscopy in a 1-month-old Infant

To the Editor—Passing a wire retrograde through the cricothyroid
membrane and cords and into the pharynx to serve as a guide for an
endotracheal tube is an option for airway management in both adults
and children in whom tracheal intubation is difficult.1–5 ∗ Audenaert
et al recently described retrograde-assisted fiberoptic trachael intu-
bation in children, including several small infants.5 Since a small-di-
ameter flexible laryngoscope was not available to us, we used a modi-
fication of this technique to intubate the trachea of a 1-month-old
infant.

A 1-month-old 3.6-kg girl required a gastrostomy tube and Nissen
fundoplication because of poor feeding and gastroesophageal reflux.
The child was known to have a chromosomal abnormality (2q–). On
physical examination, microphthalmia, a recessed chin, anterior larynx,
clenched palate, and systolic murmur were noted. The child’s surgery was
originally scheduled 1 week earlier but had to be cancelled after several

* Schmidt DI, Hasewinkel JV: Retrograde catheter-guided direct

attending anesthesiologists were unsuccessful in performing an awake,
oral intubation. Most reported that they could not see normal airway
structures. On the day of surgery, while the infant was still in the
neonatal intensive care unit, awake oral intubation was attempted by
an attending neonatologist, who was also unsuccessful. Because of these
multiple unsuccessful attempts at awake oral intubation by skilled
personnel, we decided to try a retrograde approach.

The child was brought into the operating room, where monitors
were placed and intravenous access started. Intravenous glycopyrrole
0.05 mg was given to dry oral secretions, while intravenous ketamine
5 mg and midazolam 0.1 mg were given for sedation. Spontaneous
breathing was maintained throughout the procedure, while oxygen
was insufflated over the child’s face. A roll was placed under the shoul-
ders to extend the head slightly. The skin over the cricothyroid mem-
brane was cleansed with alcohol; a 1% lidocaine wheel was raised; and
an 18-G needle inserted through the membrane with the bevel pointing
cephalad. Tracheal placement was confirmed by aspirating air with a
3-ml syringe, after which 0.25 ml 1% lidocaine was injected to anes-
thesize the vocal cords. The syringe was then removed, and an Arrow

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