The final theoretical consideration involves pencil-point spinal needles. Only the shoulder of a pencil-point tip makes contact with the inside of the Tuohy needle curve so that, in addition to their other advantages, these needles theoretically are preferable for needle-through-needle techniques.

Both Portex U.K. Ltd, using an independent institute for biomedical equipment evaluation to test a variety of spinal and extradural needle combinations, and the Becton Dickinson company, using their own technical department to test their own spinal-extradural needle sets, have investigated the possibility of spinal or extradural needle damage and the production of metallic particles. In addition to microscopic examination, tests included energy-dispersive x-ray analysis of any particular matter found. In none of the tests was any damage found to the tip of the spinal needle. Some extradural needles showed fine markings after the test, as reported by Eldor and Brodsky [3], but such marks were also present before the tests and are part of the normal manufacturing process. Neither investigation found any evidence of metallic particulate contamination.

In summary, while there is no evidence of spinal or extradural needle damage during needle-through-needle combination spinal-extradural anaesthesia, it is preferable to use pencil-point needles or very fine spinal needles and an extradural needle having a tip with a generous radius of curve. It is also wise to use one of the manufacturers’ needle combinations recommended specifically for the technique. Examples include those from Portex, which combine 26-gauge cutting or pencil-point spinal needles with 16- or 18-gauge extradural needles, from Becton Dickinson, who provide a choice of 25- or 27-gauge cutting or pencil-point spinal needles and Braun, whose new Espocan system contains a spinal needle with a plastic sleeve which holds it centrally in the extradural needle lumen and guides it through a hole cut in the outer curve of the extradural needle tip.

L. E. S. CARRIE
Oxford


Sir,—In previous correspondence, Dr Carrie has written that “The origin of many innovations seems to lead back inevitably to Biblical times” [1]. So I searched there and found that “Iron sharpeneth iron; so a man sharpeneth the countenance of his friend” [2]. It is not necessary to be a metallurgist to understand that, when metal passes through another bent metal, it causes friction. Friction causes metallic fragments. The question is not if there are metallic particles, but if they have any clinical significance, or if there is a way to avoid them. Concerning the first question—it is too early to judge. We need to investigate the impact of these small particles on the spinal cord to determine both early and late implications. As to the second question—we can straighten the extradural needle tip, but create a problem in introducing the catheter. Alternatively, the Eldor needle consists of an 18-gauge extradural needle with a 26-gauge external spinal conduit. The spinal needle is introduced through the straight guide tube with no bent tip, so avoiding the problem.

I encountered this problem with my previous needle [3] and have abandoned it. To my surprise, companies (Portex, Becton Dickinson, Braun, etc.) continue to market these packs, even after my observations [4].

Dr Carrie uses the word “contact” throughout his letter. I think it should be replaced by “friction”, as it is obvious that contact between the two needles cannot be avoided. I have found no difference between any alignment, or any spinal needle, including a pencil-point tip needle.

I have not seen the results of the work by Portex or Becton Dickinson, although I also was told by Portex that “Independent laboratory tests conducted by Portex show no metal particles produced on passing 26-gauge spinal needles through 16-gauge and 18-gauge Tuohy needles” [Russell CA, personal communication].

Dr Carrie said that “some extradural needles showed fine markings after the test”. With enough magnification these “fine” markings would become “not fine”. I cannot understand the next sentence that “such marks were also present before the tests”.

This kind of remark arouses much suspicion. Sir Arthur Conan Doyle wrote: “How often have I said to you that when you have eliminated the impossible, whatever remains, however improbable, must be the truth.”

J. ELDORE
Jerusalem


INSPIRATORY TO END-TIDAL OXYGEN DIFFERENCE

Sir,—I wish to comment on the interesting article by Bengtsson and colleagues [1] on oxygen difference monitoring.

In my experience (I use oxygen and nitrous oxide with isoflurane in a low-flow system, ventilating manually to maintain an end-tidal carbon dioxide concentration of ±4.5 vol %) the rate of ventilation influences (l_0 - E_p^o) inversely, complicating the interpretation of the oxygen difference further. (l_0 - E_p^o) is merely a tidal measurement; to judge oxygen uptake the dimension “time” must be considered. To maintain E_p^o = 4.5 vol % I can, for example, ventilate 14 times per minute with a tidal volume of 470 ml, or 8 times 730 ml... this causes an increase in (l_0 - E_p^o); meantime the SaO_2 will be constant at ±98% and I assume that the oxygen uptake will also be constant. Is this assumption incorrect?

M. SCHRADER
Witten-Buchholz, Germany


Sir,—We thank Dr Schrader for his comment. An increase in (l_0 - E_p^o) is seen as a result of acute hypoventilation, decreased uptake of nitrous oxide, increased inspired oxygen concentration and increased oxygen uptake rate.

Dr Schrader has experience of an increase in (l_0 - E_p^o) as a result of a decreased ventilatory frequency with a constant minute ventilation volume. As far as we understand, this is best explained by a change in VD/VT such that alveolar ventilation has decreased. If this is true, the end-tidal carbon dioxide concentration will also subsequently increase.

J. P. BENGTSSON
A. HARALDSSON
A. BENGTSSON
B.-Å. HENRIKSSON
O. STENQVIST
Gisteberg, Sweden

PRE-EMPTIVE EXTRADURAL ANALGESIA

Sir,—We congratulate Dr Dahl and co-authors [1] on their interesting and fundamental study on pre-emptive extradural analgesia in the context of major abdominal surgery. This topic is most important for both surgeons and anaesthetists, and we feel that it is paramount to try to understand why this study apparently failed to produce the results to be expected from previous experimental work [2].

We wish to raise the following points:

Why was the combination of extradural bupivacaine and morphine chosen? Morphine has not only slow and unfavourable kinetics, particularly when used extradurally [3], it may also—under certain circumstances—possess excitatory [4, 5] and anti-analgesic properties (either directly [6, 7] or via its 3-glucuronide metab-
Inagaki Y, Mashimoto T, Yoshiya I. Segmental analgesic clinical practice. It seems possible that the study did, in fact, show some effect. Demonstrating pre-emptive analgesia is probably easiest via its effects on cumulative analgesic consumption in the first 24 h after operation. Although the number of patients receiving additional morphine in this period was the same in both groups, the amount of morphine given to achieve similar visual analogue pain scores (VAPS) was not (50 mg vs 170 mg, in favour of the pre-emptive group). This difference is particularly convincing because it results from analgesia given on patient demand by nursing staff—a measure of postoperative analgesia known to be less sensitive than that achieved when using patient controlled analgesia pumps [14]. It is not clear if postoperative VAPS or analgesic requirements represent adequate end-points for studying the effects of pre-emptive analgesia. From experimental considerations [2, 15], it would appear that hyperalgesia (increased sensitivity and extended sensitization) is the earliest and most sensitive manifestation of inadequate antinociceptive control. This could perhaps be investigated by measuring sensory and pain cutaneous thresholds [16].

In conclusion, we feel that this study should not be considered as disproving the concept of pre-emptive analgesia, but rather as providing an interesting insight into the questions and problems which remain to be solved before this concept can be realized in clinical practice.

O. H. G. WILDER-SMITH A. BORGEAT M. TRAMÉR D. R. MOREL Geneva

2. Woolf CJ. Recent advances in the pathophysiology of acute pain. British Journal of Anaesthesia 1989; 63: 139-146.

Sir—We appreciate the comments made by Dr Wilder-Smith and colleagues on our paper on pre-emptive extradural analgesia in major abdominal surgery. They propose that bupivacaine and morphine may not be the optimal combination of anaesthetics, that the amount of additional morphine was in favour of the pre-emptive group, and finally that postoperative pain may not represent adequate end-points in the study of pre-emptive analgesia.

In our study, we used bupivacaine and morphine because, in clinical trials, the effect of this combination for postoperative analgesia in humans is well documented compared with other regimens (see references cited in [1]). However, the optimal extradural opioid and local anaesthetic, alone or in combination, for surgical anaesthesia and postoperative analgesia is unknown and, so far, a total afferent block during and after operation has not been documented by any regimen during major abdominal surgery. The clinical implications of the specific antinociceptive and anti-wind up potential of local or systemic lidocaine observed in experimental studies, and the potential value of systemic lidocaine in the treatment of postoperative pain, have not yet been settled. In a recent study, however, no significant differences in morphine requirements or pain scores could be demonstrated between patients with an inguinal field block with lidocaine performed before, compared with after surgery [2].

The amount of additional morphine 0–24 h after operation was not statistically different between groups and represents only three and four patients. No statistical difference in morphine requirements, and no trend, was observed 24–72 h after operation.

In our opinion, pain scores and analgesic requirements represent adequate end-points for studying the effects of clinical pre-emptive analgesia. However, additional assessment of pain and sensory thresholds is interesting, and deserves further evaluation [3].

In conclusion, our regimen may not have provided total afferent nociceptive block during surgery. Thus further studies are needed to compare the effects of different neural block to clarify the clinical significance of pre-emptive analgesia in postoperative pain. Finally, we emphasize that afferent nociceptive stimuli may not only sensitize dorsal horn neurones during, not only sensitizes dorsal horn neurones during, but also after tissue injury, and that factors other than timing of the analgesic treatment may be important to reduce post-injury CNS-hyperexcitability [4, and in preparation].

J. B. DAHL B. L. HANSEN N.-C. HJORTSO C. J. ERICHSEN S. MØNICHKE H. KEHLET Hvidovre, Copenhagen


**SKIN INJURY WITH A PULSE OXIMETER**

Sir,—We were interested in the report of skin injury in an infant with pulse oximetry [1], but doubt if this was a thermal injury or caused by a phototoxic reaction. We recently observed a lesion on the pulp of a patient’s finger after removal of a Datascope Flexisensor which had been in place overnight. The lesion was similar to that described in the case report, being bullous and approximately 5 x 5 mm in extent. Examination of the relative position of the lesion and the diodes of the pulse oximeter suggested that thermal injury was most unlikely and that pressure from a fold that consistently develops on the inner surface of the Datascope Flexisensor was a more likely cause. This was confirmed in subsequent patients in whom a distinct pressure groove could be seen in relation to the fold in the Flexisensor immediately after its removal.

In addition, we are unable to understand the methodology used by Pettersen, Kongsgaard and Aune to find a maximum temperature of 23.6 °C under a sensor probe during use. Using thermocouples between the diodes and the subject’s skin, we found that the temperature under the Datascope Flexisensor probe was related to the temperature of the subject’s skin. Thermocouples between the diodes and the finger registered a temperature up to 6 °C greater than the skin temperature of the adjacent finger, resulting in maximum temperatures of 40-42 °C in normal, well-perfused anaesthetized patients.

Following our initial observations, instructions were issued to ensure that the probes were not wrapped tightly around the end of the finger, there has been no recurrence of this type of injury and examination of patients’ fingers immediately after removal of Flexisensors have failed to show the pressure grooves noted before. The solution adopted in the case report could have had a similar effect, as pressure from irregularities following folding of the probe may have been dissipated against the toe nail.

Alternatively, following observation of a problem, the sensor may have been placed with more care, avoiding tight folding around the end of the toe.

While the case report referred to the Datex Flexalite probe, the causation of the injury may be related to flexible sensors in general and be similar to the problem we have observed with the Datascope Flexisensor.

D. W. Bethune
N. Baliga
Cambridge


Sir,—We appreciate the questions and comments made by Drs Bethune and Baliga regarding our report. Thermal injury was discussed among various other possible causes. Drs Bethune and Baliga have observed a similar lesion and suggest pressure from a fold developing on the inner surface of the sensor to have caused the harm. A similar mechanism in our patient cannot be ruled out, although none of our other patients has presented such lesions.

The skin temperature under the sensor was determined by placing a small temperature probe underneath the diode, attached to the patient’s finger. Under these conditions, the skin temperature never increased beyond 33.6 °C in the reported patient, not 23.6 °C which appeared erroneously in our report. We have now made a small study measuring pulp temperature on the 5th finger before and during pulse oximetry in five female volunteers. A tiny sensor (West Temperature Probe 2070 with Copper Constantan sensor tip, 0.14 mm) was placed underneath the diode without blocking the light emission. Mean pulp temperature before pulse oximetry was 31.4 °C (range 27-34 °C) and mean temperature during ongoing pulse oximetry was 32.0 °C (range 28-34 °C). Mean temperature increase during pulse oximetry was 0.6 °C (range 0-1 °C).

Obviously, modern pulse oximetry devices should not be relied upon completely from a safety point of view. A high level of alertness is always appropriate when patients are connected to technical devices.

B. Pettersen
U. Kongsgaard
H. Aune
Oslo