ANALGESIA FOR BURNS DRESSING IN CHILDREN

A Dose-finding Study for Phenoperidine and Droperidol with and without 50 per cent Nitrous Oxide and Oxygen

BY

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SUMMARY

A method for providing analgesia for the dressing and desloughing of burns, using neuroleptanalgesia combined with 50 per cent nitrous oxide and oxygen, is described. The method is compared with experience gained with neuroleptanalgesia alone and it has been found that the additional analgesia provided by nitrous oxide enables the dose of phenoperidine to be reduced and, therefore, the danger of respiratory depression to be minimized. The combined technique could have wide application in several minor but painful procedures.

The provision of satisfactory analgesia during desloughing and dressing of the severely burned child has always posed a problem.

The method previously used at Frenchay Hospital, Bristol, consisted of simple sedation with an opiate, usually morphine, papaveretum or pethidine, sometimes combined with pentobarbitone. However, it was found that these drugs, when used in doses which did not cause significant respiratory and cardiovascular depression, frequently did not produce analgesia sufficient for the performance of this painful procedure; the result was distress for the patients, which in turn distressed nurses and doctors. Each succeeding dressing filled the child with increasing dread, indeed often frank terror, and all co-operation was lost.

General anaesthesia does not seem to hold the answer to our problems. Apart from the danger for these patients, who are often very ill and may show abnormal reactions to some of the agents used, there are many other practical problems which may arise. Dressings are required frequently, usually every 4–6 days, sometimes over a period of many weeks. Nutrition is interfered with, both before and after the procedure, at a time when it is particularly important. Either the patient is taken to the operating theatre, which introduces all the difficulties of moving a seriously ill patient from the ward to the operating theatre and also exposes the theatre to infection and uses valuable theatre time, or the anaesthetic machine and other equipment have to be taken from the theatre into the ward cubicle.

In 1966 Barry Smith and Hollis, at the McIndoe Burns Centre at East Grinstead, used neuroleptanalgesia, employing phenoperidine and droperidol to provide analgesia for the dressing of burns. They claimed success on 70 of 76 occasions, and partial success in the remaining 6. The principal side effect which they noted was respiratory depression, some degree of cyanosis being observed in 20 per cent of cases.

The object of this study was to investigate this promising technique, to rationalize the dosage scale of these drugs and, if possible, to improve the technique so that the danger of respiratory depression could be eliminated.

NEUROLEPTANALGESIA ALONE

Phenoperidine and droperidol were used on 27 occasions in 20 children. These children varied in age from 9 months to 6 years and weighed between 10 and 36 kg. The extent of the burns was between 10 and 60 per cent of the...
body surface area. The dressings usually took place in the child's cubicle in the ward. The child was visited by an anaesthetist before the procedure but otherwise no special pre-operative measures, such as starvation or premedication, were undertaken, although the procedure was not performed within an hour of having taken solid food.

Method

Droperidol 0.2 mg/kg, followed by phenoperidine in a dose range of 0.05-0.1 mg/kg were given intravenously through a needle with a Forrester adaptor attached. Both drugs were suitably diluted by normal saline to facilitate accurate administration of the correct dose. A period of at least 5 minutes was allowed to elapse before the dressings were disturbed. This was considered a most important part of the technique and during this time ventilatory function was carefully observed.

After 5 minutes the child passed into a light sleep, from which he could easily be aroused by calling his name. There was a characteristic "deadpan" face and some degree of catatonia of the limbs was noted in eight of the patients. At this stage the dressings were removed and desloughing begun. If analgesia was insufficient, incremental injections of phenoperidine were given through the Forrester adaptor in doses of approximately 0.025 mg/kg, again suitably diluted.

Results

Analgesia.

On 25 of the 27 occasions, very successful analgesia and mental tranquillity were obtained for desloughing and dressing; on two occasions analgesia was only partially satisfactory and the patients cried during part of the procedure, despite injection of incremental doses of phenoperidine. Many of the children had several experiences of the new method and did not seem at all upset when they were visited again and again for repeated dressings; indeed most of them had complete amnesia for the period of induction on each occasion.

Cardiovascular function.

Serial arterial pressure measurements could only be made in six of the patients because of the difficulty of finding an unburnt surface to apply the sphygmomanometer cuff to the arm. In these six patients a consistent but small fall in arterial pressure was noted but in no case was the fall in the systolic pressure greater than 15 mm Hg. The pulse rate tended to rise in most cases, but again the change was small, being no more than 20 beats/min in any patient.

Ventilation.

Careful observation was made of the respiratory rate and colour of the patient. The circumstances were unsuitable for making volume measurements using apparatus such as the Wright ventilation meter and it was not considered justifiable to perform arterial puncture in these children in order to obtain samples for measurement of arterial oxygen and carbon dioxide tensions. In every case a fall in respiratory rate occurred within 2 minutes of the injection of phenoperidine. This fall tended to persist for 5-10 minutes and was followed by a gradual return to normal values over the next 40 minutes. In most cases the rate could be increased by asking the child to breathe.

Control values were recorded in each child before phenoperidine was given. The lowest rate reached after this drug was administered was also noted. The maximum percentage fall in respiratory rate was calculated from these figures and the results are shown in figure 1. Three cases in which there was a fall greater than 45 per cent of the control values required ventilatory assistance with an AMBU bag (BOC), which was always kept available. On each occasion the spontaneous respiratory rate had increased sufficiently after 10 minutes to adequate values without the need to resort to the use of an opiate antagonist.

![Graph of % fall in respiratory rate](https://academic.oup.com/bja/article-abstract/41/8/684/32740)
Dosage requirements.

The dose of droperidol (0.2 mg/kg) which was given initially, appeared to be satisfactory for every case, as judged by the adequacy of mental complacency with easy recall to the awake state and the absence of evidence of any gross cardiovascular depression. No further increments of droperidol were given during the procedure.

Phenoperidine was given in an initial dose which ranged from 0.05 to 0.1 mg/kg. Marked weight loss, anorexia, listlessness and the presence of infection were factors which influenced the choice of the smaller dose. Gross anxiety and fear in the child without marked debilitation suggested the larger dose.

The initial dose range of phenoperidine used is shown in a block diagram (fig. 2). The shaded areas in this diagram indicate the cases which required incremental doses. The mean initial dose in this group of cases was 0.075 mg/kg (range 0.05–0.1). The mean total dose was 0.08 mg/kg (range 0.05–0.15).

It is interesting to note that the three patients in whom marked respiratory depression occurred (rate reduced by more than 45 per cent) were the three cases which received an initial dose of 0.1 mg/kg and required a further incremental dose (in one case two further increments). It would therefore seem that marked respiratory depression is to be expected in these children when the dose of phenoperidine is greater than 0.1 mg/kg.

Nitrous oxide and oxygen, in concentrations of 50 per cent of each gas, administered from a single cylinder, has been shown to be a valuable analgesic for a variety of procedures (Central Midwives Board, 1965; Parbrook, 1967; MacGregor and Bracken, 1966; Latham and Parbrook, 1966). It is one of the few potent pain-relieving agents which does not produce significant respiratory depression. The gas mixture can be conveniently administered from the single cylinder arrangement, using the Entonox apparatus (BOC). This has the great advantage over an ordinary anaesthetic machine of simplicity and portability.

Accordingly it was decided to use a combined technique, employing neuroleptanalgesia together with a 50 per cent nitrous oxide and oxygen mixture.

NEUROLEPTANALGESIA COMBINED WITH NITROUS OXIDE AND OXYGEN

Method

This combined method has now been used on 48 occasions. A similar dose of droperidol was given, followed by approximately half the previous dose of phenoperidine. After three minutes the facepiece was applied and the gas mixture inhaled for a further three to five minutes before the procedure was begun.

The only difficulty that was encountered with this method was seen in some patients with facial burns, where pain was produced initially by holding the facepiece tightly enough to obtain an airtight fit in order to enable the demand valve to function properly. This could be overcome by administering the gas mixture by a continuous flow device so that the gas could be "floated" gradually on the patient's face. For this purpose the British Oxygen Company has kindly made a prototype apparatus. It consists of a yoke to fit the Entonox cylinder, a pressure regulator, a needle valve and a flowmeter calibrated to 15 l./min (fig. 3). The apparatus is now being marketed by the British Oxygen Company.
been used mainly in children and the gas from the flowmeter has been administered by means of a modified Ayre T-piece arrangement. A Magill circuit might be more economical for use with adult patients.

**Results**

**(a) Analgesia.**

On the 48 occasions that this combined technique has been used to date, the procedure has been wholly successful. Analgesia has been excellent and on two occasions was sufficient for the taking of skin for grafting. Nevertheless, the patient can be awakened immediately after the mask is removed by calling his name.

**(b) Ventilation.**

This was monitored by careful observation of the respiratory rate and colour of the patient. The maximum percentage falls in respiratory rates are shown in figure 4.
In no case was respiratory depression judged to be clinically significant and none was given any respiratory assistance.

(c) Dosage requirements.

A similar dose of droperidol (0.2 mg/kg) was given initially to each patient. No further increments were given. Phenoperidine was given in an initial dose of 0.03–0.05 mg/kg. Similar factors influenced the choice of dose. Details of dosage are presented, as before, in a block diagram (fig. 5). Using the combined technique, the mean initial dose was 0.039 mg/kg, with a range of 0.03–0.05 mg/kg. The mean total dose was 0.043 mg/kg, with a range of 0.03–0.06 mg/kg.

DISCUSSION

The combination of neuroleptanalgesia with a 50 per cent mixture of nitrous oxide and oxygen can provide satisfactory and profound analgesia for minor procedures. The dosage of the phenoperidine required can be reduced to the range 0.03–0.06 mg/kg, which is well below the level of 0.1 mg/kg at which respiratory depression of a serious nature is found. Statistical analysis of the percentage fall in respiratory rates in the two groups of cases shows that, comparing the difference between the two means, the value of $t = 8.048$ (P<0.001)—a highly significant difference.

A possible criticism of the method is that there may be a risk of vomiting, with inhalation of gastric contents, during the procedure. A suction apparatus is always at hand and the patients, by virtue of their size, are easily turned or tipped into the head-down position. Vomiting or regurgitation has not occurred on any of the 75 occasions, possibly due in part to the potent anti-emetic effect of droperidol. It is the opinion of the authors that the risk is acceptable in view of the advantages of the technique.

Apart from the dressing of burns the technique has also been used for complicated and uncomfortable radiological procedures in children, such as myelography and cisternal puncture, and the removal of wire sutures, pacemaker leads and underwater drains after cardiac and thoracic surgery. It has been found that good conditions are provided for patient and surgeon alike in these minor but nevertheless painful and distressing manoeuvres. Although these are carried out often in hospital practice they appear to have been neglected, hitherto, by many anaesthetists because they do not warrant a full general anaesthetic in an operating theatre.

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REFERENCES


