MEPERIDINE IN ROUTINE PAEDIATRIC ANAESTHESIA

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MEPERIDINE SUPPLEMENTATION of thiopental, nitrous oxide anaesthesia in adults is widely used today and has been practically routine in our hospital for several years (1). The purpose of the present paper is to report on its use in children and to show that they need much larger dosage of meperidine than might be expected.

Some of the advantages gained from meperidine are: a non-explosive anaesthetic, less tendency to bronchospasm, fewer cardiac irregularities and, particularly, a quiet and early awakening. An analysis of 100 post-anaesthetic recovery room records in recent consecutive unselected adult cases (Table I), which included

TABLE I
POST-ANAESTHETIC RECOVERY ROOM COURSE WITH AND WITHOUT MEPERIDINE

Cases	Anaesthetic	Awake immediately (%)	Average awakening time of remainder (mins.)	Restless (%)	Cried (%)	Restless and cried (%)	Total restless and/or cried (%)	Vomit (%)	Croupy (%)
100 adults	Thiopental, meperidine, N ₂ O/O ₂ , Mecostrin, or Flaxedil	71	23	3 (mild)	0	0	0	9	0
200 children (ages 3-13 inclusive)	Thiopental, meperidine, N ₂ O/O ₂ , Mecostrin, or Flaxedil	42	20		4	1	8	4.5	0
100 children (ages 3-13 inclusive)	Thiopental, N ₂ O/O ₂ , relaxant	29	24	22	7	17	46	18	4
100 children	Vinethene or Vinam, di-ethylether, N ₂ O/O ₂	91	22	10	19	10	39	20	5

NOTE: Practically all patients were intubated. "Awakening time" is when the patient makes a coherent response to the spoken word.

thirty-six laparotomies and ten vaginal operations, revealed that there were no patients with a systolic blood pressure below 100 mm. Hg during surgery and only two who had a systolic pressure under 90 at any time in the recovery room. No vasopressors were employed at any time and blood was used conservatively. Five patients were given blood in the recovery room. Nine patients vomited a total of fourteen times and three were noted to have been "restless," but required no treatment.

It seems logical to apply this technique to children as their tolerance of hypnosis and pain is less than that of adults. The restless, crying, or screaming children not infrequently seen in the immediate postoperative period are not only hurting themselves but are also keeping the nursing staff busy and distracted, and dis-

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turbing other patients. The incidence of what sometimes amounts to "emergence delirium" is greater now that more and more children receive an intravenous anaesthetic which often does not include an analgesic (Table I). The old-fashioned ether anaesthetic provided some postoperative analgesia. This restlessness, nearly always due to pain or residual curarization, is aggravated in many instances by the hypnotic action of the barbiturate which reduces what control the child may have developed. Residual curarization is easily recognized by the short jerky movements of the extremities, due to relatively ineffectual attempts to move, along with a slack jaw and drooping eyelids. Adult patients who have experienced this feeling of weakness or inability to move state that it is very unpleasant.

The administration of adequate doses of meperidine with the anaesthetic, as well as providing analgesia, allows a considerable reduction in the thiopental dosage as well as a reduction in the dose of muscle relaxant, so that the three factors mentioned, pain, hypnosis, curarization, which lead to crying and restlessness are, at least partially, overcome. Since 1952, all my major intravenous anaesthetics have included intravenous meperidine as a preliminary.

Generally speaking, children under nine have received sodium seconal gr. ss to gr. i ninety minutes preoperatively and atropine gr. 1/150 on the stretcher "on call." Those who would not take the seconal orally were given it per rectum after perforating the capsule. Rectal seconal capsules are quite ineffective and the route used was often unknown except by the sedated or unsedated state of the patient. Those who received it orally would need less thiopental. Children aged nine to thirteen usually received meperidine 20-50 mg. with atropine 1/150 gr. one hour preoperatively. Those who received meperidine, but no barbiturate, would need somewhat more thiopental and possibly a little less meperidine with their anaesthetic.

The only contraindications to an intravenous anaesthetic were asthma, inaccessible veins, or a marked lack of patient co-operation. Asthmatics were always given ethyl vinyl ether or vinyl ether/di-ethyl ether/nitrous oxide anaesthetic (2). In practice almost all children six years of age or over received an intravenous anaesthetic. About 50 per cent of the five-year-olds were anaesthetized in this manner, but only a few under five.

TECHNIQUE

The head of the operating table must be slightly lowered to prevent hypotension. One nurse holds the child's arm while another holds his head to the opposite side and distracts his attention until the venupuncture is accomplished and the patient asleep. The puncture is made with a #22 or #20 needle attached to a 2 cc. syringe containing the meperidine. At least two minutes is taken to administer the meperidine followed by the relaxant (Mecostrin³ or Flaxedil⁴) which is given in a few seconds. The thiopental syringe is now attached and an estimated dose given (3-5 cc. of 2 per cent). The patient's lungs are inflated

³Tubocurarine dimethyl ether chloride.

⁴Gallamine triethiodide.

with oxygen for about half a minute and then a little more thiopental is usually given (2-3 cc. of 2 per cent) and the intubation is performed. The anaesthetic is then continued with nitrous oxide-oxygen 6/2 L. per minute with either a circle system or a modified Ayres T-tube technique. Respirations are controlled or assisted as necessary. This is usually all that is required for short operations, for example, tonsillectomies. If the procedure lasts longer than thirty-five minutes, increasing the nitrous oxide-oxygen percentage to 8/2 L. per minute will usually give about ten minutes more of adequate anaesthesia. In longer procedures, 12-25 mg. of meperidine may be given intravenously as needed. If an intravenous is not running, then a little cyclopropane or ether is used. If the procedure is finished in under twenty-five minutes and/or the jaw or abdominal muscles are slack, 0.5 mg. of Prostigmine is given slowly intravenously or intramuscularly while the patient breathes 100 per cent oxygen. Opiate antagonists have not been found necessary but could be used, for example, 1 mg. Lofan⁵ if the respiratory rate is unduly low at the end of operation.

Meperidine is not usually used if the procedure is expected to take less than twenty-five minutes.

DOSAGE

Table II gives the average of the doses actually used in 332 consecutive patients. The apparent discrepancy in the case of the four three-year-olds is because these were long operations and a little heavier dosage during induction would not leave a residual effect at the end. Early in the series the dosage of

TABLE II
AVERAGE DOSES OF DRUGS USED INTRAVENOUSLY FOR INTUBATION FOR VARIOUS PROCEDURES IN 332 CONSECUTIVE CASES

Age	Cases	Meperidine (mg.)	Thiopental (2 per cent) (20 mg./cc.)	Mecostrin (1 mg./cc.)	Flaxedil (20 mg./cc.)
3	4	32	6	—	1.5
4	14	40	5	2	1.3
5	29	47	5.7	2.3	1.7
6	64	54	5.8	2.7	2
7	52	58	6.1	3	2
8	52	60	7	3.7	2.4
9	35	61	7	4	3
10	27	62	7.6	4.4	3
11	19	68	7.7	4.6	4
12	19	63	11	4.9	4
13	17	66	11	5.6	4

meperidine was too low for the desired effect (25-50 mg.) and later it was too high in some cases (75-100 mg.). For the last three years it has been around 40-70 mg. which has proven very satisfactory in the great proportion of cases. Individual variations in reaction to drugs exist of course, but one can judge the dose of meperidine to a great extent by the age, sex, size, and vigour of the patient, as well as by the effect of the slowly administered drug. The relaxant dosage is necessarily a pure estimate based on the above factors and the dose

⁵Levallorphan tartrate.

of thiopental is just a little more than a sleeping dose, which is usually added to immediately before intubation or, occasionally, immediately afterwards.

COMPLICATIONS

With the dosages of meperidine indicated in the table and given slowly, the child becomes a little sleepy, the pupils contract, and many complain of an itchy nose. Breathing remains adequate and the colour is unchanged. With too large a dose the child may suddenly feel that he is falling and tend to panic, throwing the free arm up and grasping. If this happens, the relaxant and thiopental are given quickly and the patient intubated after oxygenation. There have been no ill effects from this. A little less than 1 per cent of patients complained of nausea near the end of the meperidine injection and another 1 per cent vomited; 0.5 per cent complained mildly of being dizzy; 1 per cent complained of some epigastric pain. Some of these patients had received too much meperidine too fast. The blood pressure was usually not taken but in one case where hypotension occurred it was soon corrected by lowering the head of the table which had inadvertently been left a little elevated. When any of the undesirable features noted above occur, the meperidine injection is terminated and the induction completed.

On two occasions the needle came out of the vein after the relaxant had been given. One case was given cyclopropane and intubated and the other nitrous oxide oxygen while another vein was found. Both children were curarized and unhappy, but neither one remembered the incident, the meperidine having produced amnesia.

POSTOPERATIVE COURSE

The following remarks are based on 200 consecutive cases for which recovery room notes are available (Table 1). Of these, 84 patients (42 per cent) were awake on arrival in the recovery room and the remaining 116 were "awake" in an average of twenty minutes. Some of these latter were simply dozing and could easily have been aroused earlier. Eight (4 per cent) patients were noted to have cried and six (3 per cent) to be restless at some time. Two were both restless and crying. Nine (4.5 per cent) vomited. The respiratory rate was nearly always in the range 18-24 per minute. Only one patient had a respiratory rate as low as 14 per minute on one occasion. The total of 8 per cent, who were restless and/or crying contrasts with 46 per cent of those who received an intravenous anaesthetic without meperidine and 39 per cent who were given an ether-nitrous oxide anaesthetic.

Restlessness and/or crying was usually due to a residual curarization, too little meperidine or an excess of barbiturate (thiopental and/or seconal). Residual curarization, easily recognized by short sharp jerky movements of the extremities, was corrected by Prostigmine 0.5 mg. intramuscularly or intravenously. An excess of barbiturate, sometimes due to too much seconal preoperatively, would correct itself in time.

Two children (ages 8 and 6), who were bleeding from the tonsillar fossa, were controlled by digital pressure with an adrenalin-impregnated sponge. They co-operated very well and did not appear to be feeling pain. These patients would otherwise have been returned to the operating room for haemostasis under anaesthesia.

There were no cases that gave cause for alarm postoperatively. On the contrary, it was very satisfying to see the child awake, quiet, and co-operative in the great majority of instances. It should be mentioned that in our post-anaesthetic recovery room all children have the foot of their cribs elevated to a 30° angle. The beds are levelled when they regain consciousness.

DISCUSSION

This method was developed in an attempt to have a quiet, safe immediate postoperative course as well as a smooth induction and maintenance. It has been used on all indicated cases for the last six years and will be used until something better comes along.

One advantage is the excellent conditions for intubation and the lack of reaction to or "bucking" on the tube. It is ideal for teaching interns, who are not rushed. The lack of bucking during intubation and the smooth course of the anaesthetic probably protect the vocal cords. There were no laryngeal reactions in these cases.

The apparently large doses of meperidine used may be surprising, but it seems that children tolerate and metabolize it quickly. In fact in the longer procedures, for example, mastoids and laparotomies, it was nearly always necessary to give another dose of meperidine (12-25 mg.), thirty-five to forty minutes after induction. Doses indicated in the table are not used preoperatively but only in the operating room with all facilities present. Also, when meperidine is used after an ether induction, much smaller doses are given (for example, 5-15 mg.) and repeated when necessary.

Another asset of this form of anaesthesia is noted when doing cystoscopies and retrograde pyelograms in children. The respirations are slow, thus facilitating X-ray examinations.

The sequence meperidine-relaxant-thiopental must be adhered to. Intravenous meperidine develops its peak action in about four minutes, the relaxant in one to two minutes and the thiopental in fifteen to twenty seconds, so that all drugs are at practically maximum effect for intubation. Intubation was invariably simple and bucking or straining on the tube absent. The course of the anaesthetic is very smooth also. The successful suturing of a badly lacerated eye which was leaking vitreous was certainly facilitated by this method. In this type of case, where vomiting or straining is a great hazard, promethazine 6-12 mg. should be given prior to the meperidine.

In conclusion, reflex apnoea should be mentioned in relation to this technique. The commonest cause by far of apnoea with this technique, and with some others, is reflex. The presence of the endotracheal tube, the artificial respiration, and the lack of afferent impulses, all combine to produce this effect. Moving the

tube or turning the patient at the end of the operation will always initiate respiration.

CONCLUSIONS

The restless and crying children in the modern post-anaesthetic recovery room have been attributed to hypoxia during the anaesthetic and to psychological causes. There is no doubt that in the great majority of cases these little patients are suffering from the pain of acute recent trauma, the hypnotic effect of barbiturates, or residual curarization. The use of meperidine intravenously, as part of the anaesthetic, reduces the incidence of these unpleasant sequelae markedly, as well as providing smooth induction and maintenance and early awakening from anaesthesia.

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