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Comparison of Oral and Intramuscular Preanesthetic Medication for Pediatric Inpatient Surgery

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The child's fear of injections coupled with the concern that the psychologic advantage of intramuscular premedication may be all or in part negated by the trauma of injections prompted the authors to seek an oral preanesthetic medication to safely and reliably replace injections. The authors describe the results of a prospective, randomized, double-blind study comparing the pharmacologic effects of oral *versus* injectable preanesthetic medication in 67 healthy pediatric inpatients older than 1 yr. Children given the oral medication (meperidine 3.0 mg/kg, pentobarbital 4.0 mg/kg) were significantly more drowsy in the holding area ($P < 0.001$) and more cooperative at the time of induction of anesthesia ($P < 0.01$) than the children given intramuscular medication (morphine 0.1 mg/kg, pentobarbital 4.0 mg/kg). There were no other differences between the two groups. These data demonstrate that oral preanesthetic medication can be as or more effective compared with intramuscular medication in producing the desired effects without adverse side effects. As a result of this study, the benefits of preanesthetic medication can now be achieved in nearly all surgical patients without injections. (Key words: Anesthesia: inpatient; pediatric Premedication: atropine; meperidine; morphine; oral; pentobarbital.)

PREANESTHETIC MEDICATION has become an integral part of anesthetic practice for many practitioners and has been most often administered by intramuscular injection both in adults and children. Many combinations of drugs have been used and evaluated for efficacy. Freeman and Bachman[1] demonstrated that optimal results were obtained by intramuscular morphine, pentobarbital, and atropine given to children 60–90 min prior to induction of anesthesia. This combination was superior to 12 other intramuscular regimens in facilitating induction, reducing secretions, and providing postoperative analgesia and sedation with the lowest incidence of emergence delerium.[1] Between 1960 and the early 1980s most pediatric inpatients at our institution were given two intramuscular injections to deliver this preanesthetic medication because of the immiscibility of morphine and pentobarbital. Surveys of pediatric inpatients indicate that injections constitute one of the greatest fears of the hospitalized child.[2] These fears coupled with the concern that the psychologic advantage offered by intramuscular medication may be all or in part negated by the battle, and ensuing trauma associated with injections prompted us to seek an oral preanesthetic medication to safely and reliably replace the intramuscular injections of morphine, pentobarbital, and atropine.

The ideal oral medication should taste good, produce predictable effect, be delivered in a small volume, and result in no adverse side effects. An orange-flavored suspension was formulated that contained an opiate, meperidine, and a sedative, pentobarbital. For the study to be blinded, no placebo injections were given, and the results were not clouded by the issue of whether or not an injection was given; atropine was administered intramuscularly to all patients in the study. We describe the results of a prospective, randomized, double-blind study comparing the pharmacologic effects of injectable *versus* oral preanesthetic medication in healthy pediatric inpatients older than 1 yr.

Methods

Eighty healthy (ASA physical status 1 or 2) children older than 1 yr were studied following the hospital's Committee for the Protection of Human Subjects approval of the protocol. The protocol was explained to the parent(s) and, when appropriate to the child, and in-

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formed consent was obtained. Patients were randomized by the pharmacy to one of two groups. Patients in the oral group received 3.0 mg/kg of meperidine and 4.0 mg/kg of pentobarbital orally and two injections each containing 0.01 mg/kg of atropine. Patients in the intramuscular group received an identically colored and flavored placebo drink and two injections. One injection contained 0.10 mg/kg of morphine and 0.02 mg/kg of atropine, and the second contained 4.0 mg/kg of pentobarbital. The volumes (per kilogram) of the oral preparation and both of the intramuscular injections were the same in both groups. The preanesthetic medication was administered at an estimated 60–90 min prior to induction of anesthesia. Immediately before receiving the medication, patients older than 2 yr were asked to evaluate their own anxiety using a pictoral test.[3] The behavior and level of anxiety of all patients were evaluated by a nurse observer during the administration of the preanesthetic medication.[4] The effect of the medication was evaluated by one of the investigators in the preoperative holding area, on induction of and emergence from anesthesia in the operating room, and on admission to and discharge from the recovery room. The child's state of consciousness and attitude were assessed. The elapsed time from administration of the preanesthetic medication to each evaluation was recorded.

Anesthetic management was at the discretion of clinicians caring for the patients. We examined our data for the presence of significant ($P < 0.05$) differences between the two groups using chi-square analysis, the Fisher exact probability test for nonparametric data, and one-way analysis of variance for continuous data.

Results

Complete evaluations were collected for 67 patients: 38 received the intramuscular and 29 the oral medication. Thirteen patients were excluded because of incomplete evaluations caused by schedule and personnel changes. Age, weight, sex, and the incidence of previous hospitalizations and prior anesthetics were similar in the two groups. The time interval from administration of medication to arrival in the holding area, induction of anesthesia, anesthetic emergence, and arrival to and discharge from the recovery room were not statistically different (table 1). No differences were found in the patient's anxiety level as assessed by the patient or the patient's nurse at the time of administration of the preanesthetic medication (table 2).

Thiopental inductions and the intraoperative administration of opioids occurred with similar frequency in the two groups. Both groups of patients had similar amounts of secretions at all evaluation locations.

Patients given the oral medication were significantly more drowsy in the holding area and more cooperative at the time of induction than the children given intramuscular medication (table 3). No other differences were found in level of consciousness or attitude between the two groups at the other evaluation locations. There were no adverse side effects observed from either premedication. There were no complications from anesthesia or surgery in any patient.

TABLE 1. Patient Characteristics and Time Intervals

Characteristic	IM	PO
N	38	29
Male/female	19/19	20/19
Mean age (SD) (yr)	7.9 (5.3)	7.9 (4.6)
Mean weight (SD) (kg)	27.3 (16.2)	31.5 (18.7)
Mean interval (SD) (min) from premedication to:		
Holding area	70 (40)	57 (35)
Induction	103 (41)	89 (39)
Emergence	245 (89)	222 (79)
RR arrival	252 (88)	227 (78)
Mean duration of recovery room stay (SD) (min)	80 (25)	83 (22)

No differences were statistically significant.

Discussion

This study demonstrates that an oral preanesthetic medication can be as effective as intramuscular medication in producing the desired perioperative effects without adverse side effects. The oral preparation could be judged

TABLE 2. Patient Anxiety and Behavior prior to Premedication

Characteristic	IM	PO
Anxiety* (at time of receiving premedication)		
None	9	9
Uneasy	6	5
Scared	4	8
Resistant	6	2
Vigorous resistance	1	0
Out of contact	10	2
Behavior* (at time of receiving premedication)		
Total cooperation	10	7
Verbal protest	5	10
Barely cooperative	5	2
Uncooperative	4	0
Mild restraint	2	3
Vigorous restraint	7	2
Mean pictoral anxiety (SD) [(0–1) no anxiety to very anxious]†	0.36 (0.38)	0.33 (0.36)

No differences were statistically significant.
* Chi-square test.
† t test.

TABLE 3. Effect of Premedication (% occurrence)

Observation	IM (n = 38)	PO (n = 29)
Holding area		
State of consciousness*		
Excited	2	3
Awake	47	17
Drowsy	29	59
Asleep	2	21
Attitude		
Resistant	5	7
Anxious	16	3
Cooperative	79	90
Induction of anesthesia		
State of consciousness†		
Excited	5	0
Awake	42	24
Drowsy	32	55
Asleep	21	21
Attitude		
Resistant	11	3
Anxious	18	7
Cooperative	71	90

* $P < 0.001$.
† $P < 0.01$.

to be better given the fact that children given the oral medication were more sedate in the preoperative holding area and more cooperative at the time of induction of anesthesia. Given that both groups received injections, the possibility exists that whatever anxiety existed in the oral group could be attributed to the fact that they had been given an injection and not to a failure of the study medications. Certainly, if one considers the elimination of injections as desirable, the oral combination is preferable.

In this study atropine was given by injection to both groups because utilizing a placebo injection was not acceptable to the institutional review committee. However, 0.02 mg/kg of atropine given orally has previously been shown to be equally effective.[5]

Following completion of this study, we substituted oral for intramuscular medication in surgical inpatients older than 1 yr. The oral preparation adopted contains 3.0 mg/kg of meperidine, 4.0 mg/kg of pentobarbital, and 0.02 mg/kg of atropine dispensed in a total volume of 0.35 ml/kg. Similar to all preanesthetic medications, this preparation takes time to produce the desired effects. Our experience suggests that a minimum of 30–45 min prior to induction is needed to achieve the desired effect. If less time is available, this medication probably should not be used. Other preinduction medications with a more rapid onset and that are given *via* other needleless routes (rectal or nasal[6]) should be considered.

There has been only one case of clinically significant aspiration pneumonitis in the first 20,000 patients receiving this oral preanesthetic medication. This incidence is lower than that reported in the literature for children given intramuscular or no preanesthetic medication[7] and suggests that the oral intake as described might actually be beneficial. An additional investigation of the effect of this oral preparation on gastric volume and acidity is warranted.

Oral preanesthetic medication has been formulated that meets the special circumstances that arise in treating pediatric day surgery patients.[5] The degree of sedation produced must be less, and diazepam was used instead of pentobarbital. It is not only acceptable but desirable to match the conditions produced by intramuscular medication for inpatients. This study, by presenting data documenting that an oral preanesthetic medication can be as efficacious as intramuscular medication in pediatric inpatients, allows for the elimination of intramuscular injections for all but the few pediatric patients who cannot or refuse to swallow medications.

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