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Rectal methohexitone induction in pediatric outpatients: physostigmine does not enhance recovery

Rectal methohexitone (25 mg·kg⁻¹) was used to induce anaesthesia in 15 unpremedicated children scheduled to undergo bilateral myringotomies as outpatients. Induction time ranged from 4 to 11 minutes. In the recovery room, all children received a slow intravenous injection of physostigmine (60 µg·kg⁻¹), or saline in a double blind randomized fashion. The use of physostigmine did not significantly decrease the recovery room stay as compared to placebo (34 vs. 43 minutes). Vomiting and soiling were two side-effects associated with the use of physostigmine.

The use of rectal methohexitone has been recommended for induction of anaesthesia in young unpremedicated children. This technique is especially appropriate in a child who becomes uncooperative with attempted induction by mask, and in whom intravenous access is difficult to establish.

Goresky and Steward¹ reported that, compared to intravenous thiopentone, there was no significant

prolongation of recovery with this technique following short surgical procedures (25 ± 5 min). Many anaesthetists are still reluctant, however, to use this technique in the outpatient when the surgical procedure is extremely brief (ten minutes or less). In this situation, any residual postoperative somnolence can be a significant factor delaying discharge from the hospital. Availability of an effective, safe antidote to barbiturate sedation would greatly enhance the acceptability of rectal methohexitone as an induction agent for day surgery patients. Physostigmine, a centrally and peripherally acting anticholinesterase, has been reported to produce a non-specific arousal effect that reverses postoperative somnolence induced by a variety of depressant and anesthetic agents,² including barbiturates.*

We designed a double blind randomized prospective study to examine the following:

1. The recovery time following the use of rectal methohexitone induction in outpatients undergoing myringotomies. This procedure was chosen because of its extremely short duration (usually less than ten minutes), and the absence of any significant postoperative discomfort that may affect awakening.

2. Whether the intravenous administration of physostigmine in the post-anaesthesia recovery room would expedite recovery and shorten hospital stay in the same group of patients.

Informed consent was obtained from the parents of 15 children (1–3 years old) scheduled to undergo bilateral myringotomy as outpatients. The study was approved by the institutional review board. All

Key words

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ANAESTHETICS: rectal, methohexitone;

ANTAGONISTS: physostigmine.

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*Stullken EH, personal communication. Bowman Gray School of Medicine, Winston-Salem, North Carolina.

TABLE I Recovery room score

Consciousness	
fully awake	2
arousable	1
not responding	0
Movement	
moving purposefully	2
moving involuntarily	1
not moving	0
Ventilation	
can cough or cry	2
breathing easily	1
airway required attention	0

From Steward.³

the children were healthy (ASA physical status I), and did not receive any preanaesthetic medications. Anaesthesia was induced with a ten per cent solution of methohexitone administered rectally in a dose of 25 mg·kg⁻¹ and maintained with N₂O/O₂ in a 2:1 ratio, plus halothane 1.5 per cent concentration using a face mask and Jackson-Rees system. Induction time was determined from the time of methohexitone installation until the child accepted the anaesthesia mask. No other supplemental agents were administered. Monitoring consisted of a precordial stethoscope, blood pressure monitoring, electrocardiograph and temperature recording. When surgery was completed, the children were transported to the post-anaesthesia recovery room (PARR) where the progress of recovery was objectively evaluated using Steward's post-anaesthesia recovery scoring system³ (Table I). With this system the minimum score obtainable is zero for a sleeping child who is not responding, not moving and requires attention to the airway. The maximum score of six applies to the child who is fully awake, moves purposefully, and is either crying or can cough on command. The study protocol called for exclusion of any child who arrived in the PARR already awake – defined as a score of 5 or 6.

As soon as the child showed signs of early recovery, scoring at least one point on the recovery score, a solution containing either physostigmine in a dose of 60 µg·kg⁻¹ or saline, was injected intravenously by one of the investigators over a period of 60 seconds in a double-blind randomized fashion. This dose of physostigmine represents a µg·kg⁻¹ equivalent to the total 4 mg dose suggested by Bernards⁴ in adults. Because of at least one

TABLE II Short stay recovery unit discharge criteria

A state of consciousness appropriate to the developmental level.
Absence of respiratory distress.
Appropriateness and stability of vital signs.
Ability to swallow, cough or demonstrate a gag reflex.
Ability to ambulate consistent with the developmental age level.
Absence of nausea, vomiting, and dizziness, preferably including ability to retain oral fluids.

report⁵ suggesting that atropine/physostigmine mixture had no analeptic effect on patients who had received diazepam, we elected to inject physostigmine slowly without atropine. Atropine was kept immediately available to be administered if the heart rate dropped more than 20 bpm from pre-injection value. Recovery scores were recorded at 5, 15, 30, and 45 minutes in the PARR, and at 60, 90, 120, and 180 minutes in the Short Stay Recovery Unit (SSRU). The time until PARR and SSRU discharge criteria were met was also noted. To be released home from the SSRU, our policy stipulates that the child must meet all of the SSRU discharge criteria listed in Table II.

All patients were observed for a minimum of three hours to determine if sedation recurred. We called the parent at home within 24 hours of anaesthesia to determine the child's status. Data were analyzed using the two-sample t-test.

Results

All fifteen children arrived in the PARR with a score of less than five, and were included in the study. Eight children received physostigmine, and seven received saline within five minutes of admission to PARR. The two groups were comparable in age and duration of anaesthesia and surgery. Induction time ranged from 4–11 minutes in both groups (Fig. 1). There were no significant differences in the recovery scores (Fig. 2) between the patients who received physostigmine and those who received placebo at any time during the immediate or delayed recovery periods. Patients who received physostigmine met PARR discharge criteria within 34 minutes and met the SSRU discharge criteria within 197 minutes following termination of surgery. Comparable results for the placebo group results were 43 and 151 minutes respectively (Table III). These difference are not statistically significant ($p > 0.3$).

There was no slowing of the heart rate with the injection of physostigmine in any patient, and no

FIGURE 1 Methohexitone induction time.

atropine was used. Five children soiled their diapers in the PARR, and four vomited in the SSRU. All these were patients who had received physostigmine. The difference between the physostigmine and the placebo group is statistically significant for soiling ($p < 0.037$), but not for vomiting ($p > 0.1$).

Discussion

We draw two conclusions from this study. First, following even very brief surgical procedures (9–12 minutes duration) recovery following rectal methohexitone induction was not prolonged and patients met discharge criteria from the PARR within 43 minutes. This is comparable to the recovery times reported by Goresky and Steward in their group of patients,¹ and lends additional support in favour of the use of rectal methohexitone, when indicated, even in day surgery patients.

Second, intravenous physostigmine did not

TABLE III Recovery time (mean $\pm$ standard deviation)

Time until discharge criteria were met	Physostigmine	Saline
PARR	34(± 11) min	43(± 19) min
SSRU	197(± 62) min	151(± 38) min

enhance recovery in our experimental group. While physostigmine's ability to reverse somnolence induced by anticholinergic drugs represents a specific antagonistic action, its reported ability to reverse postoperative somnolence induced by other depressant agents probably represents a non-specific arousal response.

It has been suggested that the effect of physostigmine on the state of consciousness is produced by modifying brain cholinesterase levels,² or by increasing afferent input to the central nervous system. The effect is known to be variable even in related groups of drugs. For example, while physostigmine was found to produce awakening from diazepam sedation,⁶ it failed to reverse any of the clinical effects of such sedatives as lorazepam,⁷ despite the fact that both drugs are benzodiazepines. One can only speculate that the failure to demonstrate such a response in our patients may be due to the fact that our patients recovered fairly rapidly on their own, so that a speedier recovery could not be detected or that physostigmine does not have an analeptic effect on methohexitone-induced somnolence.

Vomiting and/or soiling are two undesirable side effects which appeared to be associated with the use of physostigmine. Vomiting was responsible for the slightly longer stay in the SSRU of patients who received physostigmine, since our discharge criteria require all patients to tolerate oral fluids with minimal nausea and vomiting prior to discharge.

In summary, we conclude that recovery from a methohexitone induction for a brief surgical procedure is rapid and compare favourably with Goresky and Steward's recovery times following intravenous induction.³ Though no further reduction of recovery time seems to be produced following physostigmine administration, recovery time from rectal methohexitone is sufficiently rapid to recommend it where otherwise indicated for pediatric patients undergoing outpatient surgery.

FIGURE 2 Recovery score comparison between the physostigmine and saline control groups.

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Résumé

Le méthohexitone ($25 \text{ mg} \cdot \text{kg}^{-1}$) par voie rectale a été utilisé afin d'induire l'anesthésie chez 15 enfants non-prémédiqués, cédulés pour myringotomies bilatérales en externe. Le temps d'induction s'étend de 4 à 11 minutes. Dans la salle de réveil, tous les enfants ont reçu une injection intraveineuse lente de physostigmine ($60 \mu\text{g} \cdot \text{kg}^{-1}$), ou de solution physiologique à double insu et d'une façon randomisée. L'utilisation de la physostigmine n'a pas diminué significativement le temps de séjour en salle de réveil comparativement au placebo (34 vs 43 minutes). Les vomissements et le salissement des couches étaient deux effets secondaires associés à l'usage de la physostigmine.