Low-dose Intramuscular Ketamine for Anesthesia Pre-induction in Young Children Undergoing Brief Outpatient Procedures

Rasafet S. Hannallah, M.D.,* Ramesh I. Patel, M.D.†

The authors sought to determine whether intramuscular ketamine (2 mg/kg) would facilitate inhaled induction of anesthesia in those children who are uncooperative. Thirty-five children were anesthetized with halothane and nitrous oxide for insertion of tympanotomy tubes. Twenty of those children were deemed by the anesthesiologist to be uncooperative and received 2 mg/kg of ketamine im prior to induction of anesthesia. The onset time (time from ketamine administration until induction of inhaled anesthesia could be started) was 2.7 ± 0.3 min. The quality of the subsequent acceptance of inhaled induction with halothane was excellent in 61% of the patients and adequate in the remaining 39%. The recovery and discharge times were compared with those observed in 15 matched children who accepted induction of anesthesia via a mask without the use of ketamine. Recovery time was not prolonged, but home discharge was delayed by an average of 15 min in the ketamine group (P < 0.04). Low-dose im ketamine was found to be an acceptable pre-induction drug in young children who are uncooperative for an inhaled induction of anesthesia. (Key words: Anesthesia: pediatric. Premedication: ketamine.)

INHALED INDUCTION of anesthesia is not always acceptable to unpremedicated children. A stormy induction may result in unpleasant memories following anesthesia. A drug is needed that is easy to administer, induces sedation rapidly, makes the induction of inhaled anesthesia acceptable to the infant and young child, and does not result in prolonged postanesthetic sedation following short operations. We examined the sedating effect and time to acceptance of breathing via a mask following the use of low-dose im ketamine (2 mg/kg) in young children undergoing brief outpatient procedures. Recovery and discharge times were compared with those observed in a similar group who had undergone inhaled induction of anesthesia with nitrous oxide, oxygen, and halothane.

Methods

The protocol was approved by the institutional review board, and parents were informed about the study. Thirty-five unpremedicated children 1–9 yr of age scheduled for bilateral insertion of tympanotomy tubes under general anesthesia were studied. In 20 children who were judged to be uncooperative by the anesthesiologist, anesthesia was induced by injecting 2 mg/kg of ketamine (100 mg/ml) in the deltoid muscle using a 25-g, ½ inch needle. Onset time was defined as the time from ketamine injection until the child became sedated enough to accept a combination of 70% N₂O and up to 3% halothane delivered via a face mask held close to but not touching his face. The quality of the subsequent inhaled induction was rated as excellent if the child did not object to the inhaled gases, adequate if there was slight resistance or the child turned his head away from the smell but without pushing the mask away, or unacceptable if the child continued to cry or pushed the mask away. In the remaining 15 patients who were cooperative with breathing via a mask, induction was accomplished by inhalation of N₂O and halothane. Anesthesia was maintained with N₂O, O₂, and halothane delivered via face mask in all cases. The recovery time was defined as the interval from discontinuation of the anesthetic gases until the child met the Aldrete Post-Anesthesia Recovery Room (PARR) discharge criteria.† The discharge time was the time required for the child to meet the following criteria for release from the hospital: alert and oriented, stable vital signs, ambulation with minimal assistance (when appropriate for age), and ability to tolerate clear liquids with only minimal nausea and vomiting. A phone call was made to the parents 24 h postoperatively to inquire about postdischarge complications and/or complaints. Parents were asked specific questions about vomiting, bad dreams, loss of appetite, dizziness, stomach upset, and excessive sleepiness. The recovery and discharge times in patients who received im ketamine were compared to those recorded in the children in whom both anesthesia induction and maintenance were accomplished by the inhalation of N₂O and halothane. This comparison was analyzed by a two-sample t test.

Results

The mean age and weight of the patients are shown in table 1. Because only children who cooperated with breathing via a mask were assigned to the halothane group, they all had excellent inductions of anesthesia. Although children who did not initially cooperate with breathing via a mask, and therefore received ketamine, cried or whimpered during the injection, they became
carn and cooperative 2.7 ± 0.3 min later. Their eyes re-
ained open, and nystagmus was frequently present. Ex-
cessive salivation was not observed. The quality of the
subsequent halothane induction in the children who re-
cieved ketamine was judged excellent in 61% of cases and
adequate in the remaining 39%. There were no unac-
ceptable inductions following ketamine administration.
The anesthesia times were shorter and the discharge times
longer in the ketamine group (table 1). There were no
incidents of any behavioral changes or psychologic dis-
turbances that were observed by parents within 24 h of
surgery.

Discussion

Several approaches claim to achieve cooperation of
children during inhalation induction of anesthesia. Rectal
administration of methohexital has gained wide ac-
ceptance since the early report of its successful use by Goretsky
and Steward. Following a dose of 25 mg/kg (10% so-
lution), most children fall asleep in 6–11 min. Even fol-
lowing short surgical procedures, this dose does not sig-
ificantly delay immediate or late recovery. Rectal
methohexital, however, is most suitable for children 1–3
yr of age. Many older children may be more upset by
introducing the drug into their rectums than by an in-
jection. The onset time is considerably longer with rectal
methohexital than that of im ketamine, which makes the
technique less practical in a child who decides to refuse
an induction of anesthesia via a mask at the last minute.

Although the use of im injections is generally undesir-
able as a routine practice in pediatric anesthesia, it may
be indicated in uncooperative patients. When a struggling
child refuses the mask and cannot be managed by an iv
induction of anesthesia because of lack of accessible veins,
a small sedating im injection of ketamine appears to be a
safe and humane alternative to induce sleep.

The experience with im induction in children has thus
far been limited to the use of full induction doses of
methohexital or ketamine. Methohexital is an effective im in-
duction agent in children. A dose of 6 mg/kg injected
deep into the muscle has been reported to induce sleep in
less than 5 min in patients from 1 to 3 yr of age. When
only a single dose was used, recovery was rapid and com-
plete. Methohexital, however, is an alkaline solution and
requires deep im injection, which can be painful. Although
no local reactions or subsequent soreness at the injection
site were reported, the technique is unpopular with young
children. Ketamine, however, is well recognized as a suc-
cessful drug to use for induction of anesthesia, and it can
be injected im in a small volume. These doses (5–10 mg/
kg), however, result in lengthy recovery time, and often
patients are unable to take oral fluids for many hours
after surgery. However, the use of a smaller induction
dose (5 mg/kg), followed by a thiopental, nitrous oxide,
oxygen and muscle relaxant technique is associated with
only minimal prolongation of recovery time. When chil-
dren are given a low dose of ketamine, hallucinations and
nightmares do not appear to be a problem. Krantz re-
ported no instances of unpleasant dreams or emergence
phenomena following administration of 2–2.5 mg/kg of
im ketamine used for brief (<5 min) outpatient procedures
in children. No such findings were observed in our pa-
teints either. Detailed psychologic testing was not em-
ployed in either study, however. Recovery time averaged
13 ± 7.6 min, which is satisfactory for outpatient anes-
thesia. Because excessive salivation was not observed with
low-dose im ketamine, the routine administration of atro-
pine is not necessary.

Transmucosal administration of short-acting narcotics is
also an effective way of producing preoperative sedation in
pediatric patients. Only a few analgesics have thus far
been evaluated. Although successful use of oral trans-
mucosal fentanyl (15–20 µg/kg) as well as nasal sufentanil
(1.5–3 µg/kg) have been reported, much additional ex-
perience is still needed before the ultimate place of these
techniques is firmly established.

This study was designed to examine the response to
ketamine in children who did not originally accept in-
duction of anesthesia via a mask. Although the lack of
randomization does not bias our reporting of recovery
and discharge times in the study groups, this fact makes
it meaningless to compare the quality of induction with
that observed in children who cooperated with inhaled
anesthesia in the first place. One obvious bias of design
in this study is that we believe that it is better to use an
im injection in the child who refuses to cooperate with a
mask induction rather than proceed with a forced
"smothering" inhaled induction of anesthesia. The valid-
ity of this assumption or comparing the acceptance of im
ketamine to other available methods of induction is not
addressed in this paper.

In summary, our results show that low-dose im keta-
mine is an acceptable pre-induction agent in young chi-
It is especially useful in pediatric patients who do not cooperate with other methods of induction. The onset time is short. Even following very brief surgical procedures, the recovery time is not prolonged when compared to pure inhaled techniques. Even though the total discharge time is statistically longer than when halothane without ketamine is used, the actual delay is minimal. There were no emergence or postanesthetic reactions. Although this technique is not recommended as a routine induction method in all children, it deserves more frequent consideration in the management of “difficult” pediatric patients.

References