

Rectal Thiopental Sodium for Sedation of Pediatric Patients Undergoing MR and Other Imaging Studies

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PURPOSE: To determine the efficacy and safety of rectal thiopental sodium as a sedation agent for pediatric imaging. **METHODS:** Four hundred sixty-two infants and children were sedated with rectal thiopental sodium for MR, CT, or nuclear imaging in 1992 and 1993. Patients received screening histories and physical examinations before sedation, and parents gave informed consent. Sedated patients were monitored by pulse oximetry and direct observation. Twenty-four-hour telephone follow-up to assess delayed side effects was performed successfully in 325 patients. **RESULTS:** Examinations were successfully completed in 96% of patients. The average time from drug administration to sedation was 12.2 minutes. The average time from sedation to discharge from radiology was 71.1 minutes. Eleven percent of patients had desaturation below the pulse oximetric baseline easily treated with oxygen and head positioning. Twenty-four-hour telephone follow-up in 325 patients revealed a 34% incidence of minor rectal irritation and diarrhea, sleepiness, nausea and vomiting, or ataxia. **CONCLUSIONS:** Rectal thiopental sodium is a safe and effective drug for pediatric sedation.

Index terms: Drugs; Magnetic resonance, in infants and children; Patients, sedation

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Safe and effective sedation is important in obtaining high-quality imaging studies in infants and children. Sedation practices vary considerably among hospitals (1). Some more commonly used agents include oral chloral hydrate, intravenous pentobarbital, "cardiac cocktail" (meperidine, promethazine, and chlorpromazine), various benzodiazapines and narcotics, and general anesthesia (2-7). Although chloral hydrate has a low incidence of complications, the onset of sedation is prolonged, and failure rates as high as 20% have been reported (2). Cardiac cocktail has a variable onset because of intramuscular administration, and a prolonged sedative effect occurs. Intravenous pentobarbital is very effective but in our experience causes prolonged sedation.

Intravenous thiopental sodium has been used for years as an induction agent in the operating suite. The use of rectal thiopental as sedation for pediatric imaging is not as well known and has been studied in only a small group of patients (8, 9). We report our recent experience with rectal thiopental sodium sedation for pediatric imaging in a large group of patients.

Materials and Methods

During 1992 and 1993, 462 infants and children were sedated with rectal thiopental before pediatric imaging. Ages ranged from 3 months to 12 years. The selection of patients for rectal sedation was nonrandom and based on criteria including patient age and clinical status. Infants younger than 3 months were not sedated with rectal thiopental because of frequent rectal evacuation of the agent in these patients. Patients with allergies to barbiturates and those with clinical contradictions to rectal manipulation were excluded, as were children with fever, acute respiratory illness, or known airway obstruction. Uncooperative children older than 4 years were not sedated rectally because of the risk of rectal injury. All other children were considered candidates for sedation with rectal thiopental. All patients were fasted and, when possible, sleep deprived before the imaging examination. Written consent for sedation was obtained from the parents or guardians in each

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case. Each child had a screening history and physical examination with particular attention to airway status performed by a radiology nurse. Thiopental sodium was administered from a prefilled calibrated syringe (Abbott Laboratories, North Chicago, Ill) by a radiology nurse. Initial dosage was 25 mg/kg into the distal rectum. A second dose of 15 mg/kg was given if the child was awake 20 minutes later. No absolute total dose limit was used, although a total dose of greater than 40 mg/kg was not given. The package insert recommends that a total dose of 1 to 1.5 g in children weighing more than 75 lb not be exceeded. All patients were monitored with pulse oximetry and close observation by radiology nurses. Baseline pulse oximetric reading and any deviation of oxygenation from the baseline was recorded. Any drop of pulse oximetric reading from baseline was considered desaturation and treated with oxygen and head positioning if necessary. Sedated patients were not discharged from the radiology department until awake. Sedation was considered successful if the requested examination was completed without a return visit to radiology. Twenty-four hour telephone follow-up was attempted in each patient. Parents were questioned about delayed effects of rectal sedation, including rectal irritation or discharge, prolonged sleepiness, nausea or vomiting, and stumbling (ataxia). The patients who were not successfully sedated with thiopental returned for further imaging on another day, with intravenous pentobarbital for sedation.

Results

Four hundred sixty-two patients were sedated; 445 (96%) of 462 sedations were successful, defined as adequate to complete the requested examination without the need for a return visit to the radiology department. Seventy-one (15%) of 462 patients required second doses of medication. The average time from administration of the first dose to beginning of the scan was 12.2 minutes. The average time from administration of the first dose to discharge from the radiology department was 71.1 minutes. Fifty-two (11%) of 462 patients had transient drops in pulse oximetric readings below the baseline values. All desaturations were successfully treated with oxygen therapy and head positioning. No patient required placement of an artificial airway or transfer from the radiology department. There were no respiratory arrests. Twenty-four-hour telephone contact was successful in 325 (70%) of 462 patients; 215 (66%) of 325 parents reported no observed delayed side effects from rectal sedation; 110 (34%) of 325 reported delayed side effects, including rectal irritation or discharge in 64 (58%) of 110, prolonged sleepiness in 15

(14%) of 110, nausea or vomiting in 17 (15%) of 110, and stumbling (ataxia) in 14 (13%) of 110. None of the patients with rectal discharge or irritation required visit to a physician for treatment. The other symptoms generally resolved 1 to 4 hours after the examination.

Discussion

Sedation is frequently necessary to obtain motion-free imaging studies in children younger than 6 years of age. Although even young children may cooperate for computed tomographic scanning, the much longer scan times and more confining position required for magnetic resonance imaging increases the need for sedation. In our practice, 10% of children are sedated for computed tomography, but 40% for magnetic resonance.

The ideal pediatric sedative would be reversible and easy to administer, provide consistent and reliable sedation, and have minimal side effects and a rapid recovery. At the current time, no agent fulfills all these requirements. The most commonly used agent, chloral hydrate, is safe and easy to administer, but in generally accepted doses (50 to 100 mg/kg orally) in our experience has an unpredictable onset and unreliable sedative effects. Intramuscular drug administration is painful, and the onset of sedation is often delayed and unpredictable. Intravenous barbiturates such as pentobarbital are very effective with rapid onset, but establishing intravenous access is not always easy or well tolerated. In addition, the sedative effect of pentobarbital may linger for hours, making neurologic examinations difficult in patients being imaged because of central nervous system disorders. General anesthesia is routinely used for magnetic resonance imaging in several pediatric hospitals but is expensive and, in our experience, interrupts the imaging schedule. The overall frequency of complications associated with sedation is not known, but several cases of respiratory arrest and death in sedated children have occurred (10).

Thiopental sodium is a highly lipid soluble agent with a short half-life (11). The drug is metabolized in the liver. The plasma half-life is 3 minutes. The drug is stored in fatty tissue, which can lead to prolonged duration of action in the case of overdose. It is dispensed in a prefilled calibrated syringe (Fig 1) and is administered by injection into the distal rectum. Administra-

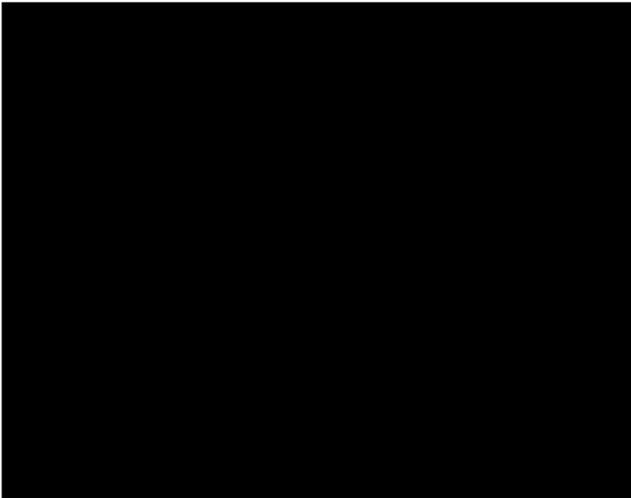


Fig 1. Graduated dispensing syringe used for administration of rectal thiopental sodium. The plastic hub lock (*black arrow*) helps prevent overdosage. The syringe contains 2400 mg of the drug. The hub has notches designating 100-mg increments.

tion high into the rectum is ineffective because of portal drainage of the upper rectum, with rapid hepatic drug inactivation. Sedation is achieved by generalized central nervous system depression. The drug is rapidly absorbed into the systemic circulation from the distal rectum with onset of sedation in 5 to 10 minutes. Uptake is not affected by presence of stool. Most side effects are related to respiratory depression and were generally minimal and easily treated in our patients. Idiosyncratic reactions have been reported. Although not occurring during the period of this study, we have seen moderately severe respiratory depression in 2 infants sedated with rectal thiopental of approximately 1400 patients sedated with this agent since 1991. One of these patients was subsequently found to have marked adenoidal enlargement compromising the airway, and the other had achondroplasia with severe foramen magnum stenosis and resultant apnea. In both of these patients oxygenation dropped into the 50s after thiopental administration; they were successfully treated with oxygen and oral airway placement without tracheal intubation. The infant with large adenoids was uneventfully sedated and imaged with thiopental sedation after adenoidectomy. The infant with achondroplasia was subsequently imaged under general anesthesia.

Because repeat dosage can lead to accumulation of the drug in fatty tissues, a total dosage of about 40 mg/kg is not exceeded in our prac-

tice. The package insert recommends a total dose no greater than 1 to 1.5 g in patients weighing more than 75 lb. The mild rectal irritation and diarrhea apparently related to rectal thiopental administration were generally acceptable to parents and to referring physicians. We avoid rectal drug administration in patients with known or suspected rectal trauma and in patients with severe thrombocytopenia. Infants younger than 3 months were not sedated with rectal thiopental because they tend to expel the drug from the rectum. The importance of proper sedation techniques cannot be overemphasized (12, 13). Trained personnel are essential. A complete "crash cart" as well as suction and oxygen equipment must be available in the immediate imaging area. A directed, current history and physical examination should screen for conditions that might affect airway status or cardiopulmonary reserve. Medication history may reveal possible drug interactions. Back-up emergency assistance must be available. Mechanical monitoring should include at least continuous pulse oximetry, although continuous electrocardiography, blood pressure, and capnography would be optimal (14). Finally and most importantly, one trained person not involved in scanning should continuously observe the patient (or the monitor when the child is out of sight in the bore of a magnet).

Parents and young children are often familiar with rectal administration of medication and with rectal insertion of a thermometer and often find rectal sedation less threatening than the intravenous route. The successful use of another short-acting barbiturate, methohexital, for pediatric sedation has been previously reported (15). Those authors, however, reported a lower incidence of effective sedation than that found with thiopental in our series, particularly for magnetic resonance imaging. In addition, our ordering clinicians, particularly neurosurgeons, neurologists, and emergency physicians who perform neurologic examinations on these patients shortly after imaging studies are performed, prefer rectal thiopental sedation to intravenous pentobarbital because of the relatively brief period of central nervous system depression seen with thiopental sedation.

In this series of 462 infants and children undergoing sedation with rectal thiopental, onset of sedation was rapid, averaging 12 minutes from drug administration to beginning of scanning. Sedation was successful in 96% of seda-

tions, and patients were ready for discharge from radiology on average 71 minutes after drug administration. The incidence of both acute and delayed side effects is acceptable to us, our referring clinicians, and the parents. In our experience, parents whose children have been successfully sedated with both intravenous agents and rectal thiopental almost universally request rectal sedation.

The ideal sedative drug for pediatric imaging with a high degree of efficacy and lack of significant side effects is not yet available. Rectal thiopental sodium has become the most commonly used sedative agent in our department over the last several years in patients older than 2 months of age because of the ease of administration, reliably rapid onset of sedation, safety, and patient and parent acceptance.

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