

Prolonged recovery and delayed side effects of sedation for diagnostic imaging studies in children. Malviya S. Voepel-Lewis T. Prochaska G. Tait AR, *Pediatrics*. 105(3):E42, 2000 Mar.

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Abstract: Although sedation-related adverse events in children in the hospital setting have been extensively reported, limited data are available regarding adverse events after discharge home. Despite nationally recommended discharge criteria, in busy outpatient settings, children may be sent home into the care of their parents after a brief recovery from sedation, placing them at risk for adverse events in an unmonitored setting. Previous studies have not addressed issues such as requirement for escalation of care after discharge or parental satisfaction with their child's sedation experience. This study was undertaken to evaluate the recovery and delayed adverse events after discharge of children who received sedation for magnetic resonance imaging or computed tomography. *Methods:* With approval from the institutional review board and written informed consent from a parent, children (<18 years old) sedated for magnetic resonance imaging or computerized tomography were studied. Sedative drugs were ordered at the discretion of the radiologist responsible for the procedure in accordance with institutional sedation guidelines and in consideration of the child's health status. Pediatric nurses in the diagnostic areas administered the sedative agent(s) and monitored children according to pre-established institutional guidelines. Demographics, sedative(s) administered, and adverse events including hypoxemia (decrease in SpO₂ by $\geq 10\%$ of baseline) and sedation events such as inadequate, failed, or excessive sedation, were documented on the institutional quality assurance tool. Children were discharged from the hospital when they met the following pre-established discharge criteria: return to baseline vital signs, level of consciousness close to baseline, and the ability to maintain a patent airway. The following day, parents were telephoned and questioned regarding the child's alertness, side effects, and whether medical follow-up had been sought. Parents also rated their overall satisfaction with the sedation experience. *Results:* Three hundred seventy six children comprised the sample. Eighty nine percent of children received chloral hydrate (CH; 64 \pm 13 mg/kg), and 11% midazolam (.15 \pm .13 mg/kg) as the primary sedative. There was an 8% incidence of failed sedation, and a 1.6% incidence of hypoxemia during the procedure. Three children required prolonged monitoring in the postanesthesia care unit before discharge; 1 child attributable to an allergic reaction, a second attributable to wheezing and oxygen desaturation, and the third attributable to prolonged sedation from CH and midazolam. These children were discharged home from the postanesthesia care unit without additional sequelae. Side effects after discharge included: motor imbalance (31%), gastrointestinal effects (23%), agitation (19%), and restlessness (14%). Agitation and restlessness lasted greater than 6 hours in more than one third of children who experienced these effects. CH was more commonly associated with imbalance compared with midazolam, and restlessness and prolonged imbalance were associated with younger age. Medical advice was sought after discharge for 15 (4%) children, 3 of whom required a visit to the emergency department for excessive or prolonged sedation. Each of these children had received CH as a sole sedative in recommended doses (61-77 mg/kg). In 1 of these cases, the procedure had been aborted because of inadequate sedation in the hospital, yet the child became difficult to arouse at home. Only 48% of children returned to baseline activity and behavior within 8 hours of the procedure; however, 89% were back to

baseline status within 24 hours. Notably, 5% of all children did not return to baseline activity until the second day after the procedure. Although not statistically significant, infants <12 months old experienced delayed recovery (ie, ≥ 24 hours) more frequently compared with older children. Sixteen percent of parents were dissatisfied with the sedation experience.

Inadequate/failed sedation and agitation after discharge contributed to parent dissatisfaction.

Conclusions: The data demonstrate that children may experience prolonged recovery as well as a significant incidence of delayed side effects after sedation for a diagnostic procedure.

Specifically, a high incidence of motor imbalance, agitation, gastrointestinal effects and restlessness after discharge was found. The findings highlight the importance of careful pre-sedation education and preparation of the patient and family regarding the potential for delayed recovery, anticipated side effects, and how to obtain medical follow-up if necessary. Future studies should focus on sedation methods that reduce sedation-related adverse events and promote the safety of sedated children.

Commentary: Dr. Malviya and her coworkers should be complimented for attempting this type of outcomes-based investigation of common sedation practices. Their study attempts to look deeper than the usual tabulation of how many procedures were actually successful and how many “near death” episodes occurred in a cohort – as is usually reported in sedation technique papers. Particularly interesting is the incidence of very prolonged sedation after chloral hydrate in a significant proportion of the infants in the study. The high percentage of parental dissatisfaction is also notable. The author’s suggestion for careful preparation and readily available follow-up is extremely appropriate.

From the standpoint of safety, the 1.6% incidence of significant hypoxia during these sedations begs the question: If thousands of these procedures were studied would we not likely find a “critical incident”? Clearly future investigations should compare the current standard therapy to other methods of sedation using the same endpoints that were investigated in this study.