Adverse cardiovascular and respiratory events during sedation of pediatric patients for imaging examinations.

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Abstract:

PURPOSE: To retrospectively identify factors associated with an increased risk of adverse cardiovascular or respiratory events during sedation of pediatric patients for imaging examinations. **MATERIALS AND METHODS:** All sedation information—including patient demographics, medications (doses and routes of administration), time required to sedate and before discharge, American Society of Anesthesiologists physical status classification, adverse events, and failed sedations—was maintained in a computerized database. A review of the data on all patients sedated between 1997 and 2003 for magnetic resonance imaging, computed tomography, and interventional radiology revealed associated adverse respiratory events in 70 patients. Adverse respiratory event was defined as oxygen desaturation of at least 5%, pulmonary aspiration, and need for airway resuscitation. Adverse cardiovascular events were defined as cardiac arrest and hemodynamic changes requiring medical therapy. Adverse events were compared between sedation regimens—which included fentanyl, chloral hydrate, pentobarbital, and midazolam hydrochloride—by using the Fisher exact test. Multiple logistic regression analysis was applied to identify potential predictors of adverse events. **RESULTS:** Among 16 467 sedations performed, 70 (0.4%) were associated with adverse respiratory events: 58 cases of oxygen desaturation, two pulmonary aspirations, 10 cases of airway resuscitation, and no cardiovascular events. Nearly 30% (n = 20) of the 70 patients who had an adverse event had a history of serious respiratory illness. Logistic regression analysis revealed that neither patient age, weight, sex, nor type of imaging procedure was associated with an increased risk of an adverse event. Use of a single sedation agent was associated with lower adverse event risk than was use of multiple agents (P < .001). **CONCLUSION:** Consideration should be given to using single agents, avoiding the use of multidrug sedation regimens, and recognizing that a history of pulmonary disease could be associated with an increased risk of adverse respiratory events despite a currently stable respiratory state.

Commentary:

This study comes from a group at Boston Children's Hospital that has been collecting data and monitoring their sedation practice for a long time. In the introduction of this paper, the authors describe the common sedation methods used in their imaging practice, including oral pentobarbital (a change from Chloral Hydrate that was used for years) for children under 1 year of age and IV pentobarbital for children older than 1 year of age. For the purposes of understanding this study, it should be pointed out that additional drugs - fentanyl and midazolam - are generally added to the IV pentobarbital patients when sedation is not adequate. The sedation is delivered by nurse sedation providers in the radiology department with oversight by radiologists who, in turn, have access to specialist consultation whenever needed. The study

methodology included recording events observed immediately during the sedation and a 24-hour follow-up with all patients. (While the data on respiratory and cardiovascular events is interesting, we eagerly await the reports on the data generated by the 24-hour follow-up phone calls as well.) In considering this data, it should be noted that the patients evaluated here were heavily weighted toward ASA I-II patients having MRI scans or CT scans.

This study is a great example of what can be done through carefully recording data on large numbers of sedation patients. Although the study is observational in nature and retrospective in analysis, large cohorts such as this clearly have significance in ferreting out safety concerns. For those involved in radiology sedation the study should be read in its entirety. In considering the results, we did not find it surprising that children given pentobarbital plus fentanyl had the highest rate of adverse respiratory events. Given the institutional methodology that uses this combination (for the most part) patients who first receive a full dose of pentobarbital and then receive fentanyl if they are difficult to sedate, we assume a population bias. We are not sure if these results necessarily indicate that the use of two drugs rather than one is inherently dangerous; but clearly, the combination of an opiate with a barbiturate would raise this concern. It was also fascinating to see that chloral hydrate (alone) had the second highest rate for inducing a respiratory event. In this case, we may be looking at a by-product of the fact that this drug (given the institutional protocols) tended to be used in younger patients. It is important, however, especially considering that this drug is still widely used and some providers have questioned the need for careful monitoring when it is employed. Finally, the fact that many of the respiratory events occurred in children with pre-existing respiratory pathology is not surprising, but it lends hard data to our institutional recommendation to shunt these cases to more expert providers.

In summary, we compliment the investigators on a tremendous amount of work that will clearly add to the collective knowledge about radiology sedation and improve care. Ongoing questions exist about the application of this data to other institutions and systems; but this study gives a great example of the type of data collection that would benefit almost any pediatric sedation program.