Deep Sedation With Propofol by Nonanesthesiologists

A Prospective Pediatric Experience

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Background: The need to perform procedural sedation for children has increased in recent years, and so has the experience of nonanesthesiologists in this field. The use of propofol increases the success of satisfactory deep sedation, but it can produce rapid and profound decreases in level of consciousness and cardiorespiratory function. Data are needed to assess the safety of this drug outside an anesthesiology setting.

Objective: To assess safety and efficacy of procedural sedation with propofol in a pediatric ward of a tertiary-care pediatric teaching hospital with trained personnel and monitoring facilities.

Methods: Patients admitted to the hospital who needed invasive procedures underwent procedural sedation by the pediatric sedation unit with intravenous propofol. A training protocol was developed to educate nurses and residents.

Results: We performed 1059 procedures. Sedation was achieved in all procedures, and all but 1 were successfully performed. No patient required intubation. Transient desaturation resolving spontaneously occurred in 134 (12.7%) of 1059 patients. Major desaturation requiring a short course of ventilation occurred in 4 (0.8%) of 483 patients undergoing upper endoscopies, in 1 (0.3%) of 287 patients undergoing painful procedures, and in none of the 289 patients undergoing colonoscopies. Laryngospasm occurred in 10 (2.1%) of 483 patients undergoing upper endoscopies.

Conclusions: In this experience, the use of propofol with concurrent oxygen administration allowed sedations in children with no significant complications for colonoscopies and painful procedures. Complications in the group of upper endoscopies appear too high for recommending propofol in a sedation unit with residents in attendance. This protocol of procedural sedation by nonanesthesiologists allowed a significant increase in the number of procedures performed with sedation and saved anesthesiology resources.


Widespread availability of noninvasive monitoring, short-acting opioids and sedatives, and specific opioids and benzodiazepine antagonists have enabled clinicians to administer sedation safely for procedures in diverse settings.1–2 Intravenous ultra–short-acting agents (etomidate, methohexitol, propofol, remifentanil hydrochloride, and thiopental sodium) are an attractive option for procedural sedation, because the dosage can be rapidly titrated to produce the desired depth of sedation and recovery is very rapid. However, with these drugs, inadvertent overdosage and rapid swings in consciousness are more likely, with rapid and profound decreases in level of consciousness and cardiorespiratory function, especially when they are administered by clinicians with limited training and experience in their use.1–5 Therefore, further research is important to clarify the safety profile of these drugs and to determine the settings in which nonanesthesiologists may administer them. The aim of this prospective study was to assess the safety and efficacy of procedural sedation with propofol in the pediatric ward of a tertiary pediatric teaching hospital with trained personnel and monitoring facilities for a period of 36 months.

Methods

From September 1, 1999, with the agreement of the departments of pediatrics, anesthesia, gastroenterology, and oncology at the University Pediatric Hospital of Trieste, Trieste, Italy, a new sedation protocol was introduced, with the development of a pediatric sedation unit (PSU). A team was organized for pediatric sedation, consisting of a supervisor (the chief of the Anesthesia Department); a pediatric anesthesiologist; and nurses with training in pediatric sedation.

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Training of Personal

The personnel received preliminary instructions about the pharmacologic features of the agents commonly used during sedation (especially propofol), and everybody was trained to recognize the complications associated with sedation and anesthesia. Each resident was trained as planned in the postgraduate school in pediatrics. The residents were trained in cardiopulmonary resuscitation, bag-valve-mask (BVM) ventilation, and use of resuscitation drugs. They spent a 4-week training period in the operating room (OR) and pediatric intensive care unit, with an active experience in patient intubation (BVM ventilation and tracheal intubation at least 20 times), and then spent 8 months in the gastroenterology unit dedicated to sedation activity and gastroenterology.

For the first month, all the procedures in the PSU were performed jointly by the resident and the pediatric anesthesiologist as part of the training. After the month of training with the pediatric anesthesiologist, the residents ultimately performed the procedures independently. Since sedation performed by residents is not a routine standard of care, the pediatric anesthesiologist was always informed about the starting and finishing reports of the gastroenterologist, the oncologist, and the nurses from the departments.

For the first 180 patients, a questionnaire about satisfaction with procedure protocol was administered to the patients and/or parents. Since the answers to the first 180 questionnaires were impressively homogeneous, the collection of data was stopped.

Selection of Patients

From January 1, 2000, to December 31, 2002, procedural sedation was offered to all children admitted to the pediatric, gastroenterology, and oncology wards for invasive procedures (ie, colonoscopy, upper endoscopy, lumbar puncture, bone marrow aspiration, liver biopsy, arthrocentesis, muscle biopsy, skin biopsy, intestinal washout, and paracentesis). Children excluded were those with common contraindications to sedation6 (Table 1) and with American Society of Anesthesiologists (ASA) classifications III and IV (Table 2). The residents performed the patient history and physical examination. Since the PSU was performing deep sedation/general anesthesia, anesthesia guidelines were chosen. In accordance with the ASA guidelines, clear fluids were not allowed for 3 hours; infant formula and nonhuman milk, for 6 hours; and solids, for 8 hours.7 An intravenous 20- to 22-gauge line (Inspy by Vialon; Becton Dickinson, Madrid, Spain) was inserted, usually on the back of the hand, after application of a eutectic cream mixture of local anesthetics (lidocaine and prilocaine in an emulsion base) (EMLA cream; AstraZeneca, Milan, Italy). When already present (mostly in children in the oncology ward), a central venous line was used. EMLA cream was applied also to the site of painful procedures (ie, bone marrow aspiration, lumbar puncture, and joint puncture) to decrease perception of pain and possibly the depth of sedation. Parents were encouraged to stay close until the child was asleep.

Definition of the Protocol

Intravenous atropine sulfate was administered (0.01 mg/kg before starting propofol infusion) as a premedication in all subjects to reduce the risk for laryngeal irritation due to salivary secretion (even if propofol does not cause hypersecretion) and the risk for bradycardia induced by pain reflexes (especially during colonoscopy).

Propofol was injected slowly, for at least 2 minutes, with an induction dose of 2 mg/kg in children 8 years or younger and 1 to 2 mg/kg in older children; the repeated dose was 0.5 to 1 mg/kg (or a continuous infusion at 6-9 mg/kg per hour when a long procedure was foreseen). Propofol was diluted with lidocaine hydrochloride, 1 mg for 10 mg of propofol for the first syringe in all children without a central line. The nurses prepared propofol with an aseptic technique just before each procedure, and the residents were aware of the risk for infection. A 20-mL syringe was used for children weighing more than 20 kg, a 10-mL syringe for those weighing more than 10 kg, and a 5-mL syringe for smaller patients to reduce the risk for overdose. During the procedures, a continuous infusion of pediatric glutathione solution (Isolyte P) (for children 5 years or younger) or Ringer lactate (for children older than 5 years) was administered at the normal maintenance rate for weight and age.

Table 1. Common Contraindications to Sedation

<table>
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<th>Condition</th>
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<tr>
<td>Airway problems, including any actual or potential obstruction (eg, snoring or stridor, blocked nose, small mandible, and large tongue)</td>
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<td>Apneic spells related to brain damage or previous drug treatment</td>
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<td>Respiratory disease, including hemoglobin-oxygen saturation of less than 94% in room air, respiratory failure (high respiratory rate, oxygen treatment), inability to cough or cry</td>
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<td>High intracranial pressure (drowsiness, headache, vomiting)</td>
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<td>Epilepsy, including recent convulsions, previous exacerbations of seizures by sedation, resuscitation during a convulsion within previous month</td>
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<td>Risk for pulmonary aspiration of gastric contents, including abdominal distention, vomiting, appreciable volumes draining from a nasogastric tube</td>
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<td>Severe metabolic, hepatic, or renal disease requiring fluids or glucose supplementation or peritoneal dialysis or hemodialysis</td>
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Table 2. ASA Classification

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<th>Category</th>
<th>Definition</th>
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<tr>
<td>I</td>
<td>Healthy patient in need of invasive procedure for localized disease</td>
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<tr>
<td>II</td>
<td>Patient with mild/moderate systemic disease (eg, high blood pressure, well controlled by therapy)</td>
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<tr>
<td>III</td>
<td>Patient with severe systemic disease (eg, complicated diabetes mellitus)</td>
</tr>
<tr>
<td>IV</td>
<td>Patient with life-threatening systemic disease (eg, irregular angina, hepatic or renal failure)</td>
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<tr>
<td>V</td>
<td>Seriously ill patient with poor prognosis (eg, heart attack with cardiogenic shock)</td>
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<tr>
<td>E</td>
<td>Patient requiring emergency surgery (this code is added to category V when the patient needs an urgent procedure)</td>
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Abbreviation: ASA, American Society of Anesthesiologists.
All endoscopies and painful oncologic procedures were performed in the routine lateral position, which further provides better airway patency and drainage of secretions with less likelihood of stimulating laryngospasm.

For the first 2 years of the study, the PSU chose to not administer oxygen in children undergoing endoscopies unless required for desaturation or apnea. This choice was made to avoid the risk for undetected hypoventilation disguised by oxygen delivery and to make residents more aware of the risks for respiratory depression. After the second year, since a significant number of mild and short-lived episodes of hypoxemia was experienced, residents administered oxygen (6 L/min) by mask close to the face to anticipate hypoxemia. For children undergoing painful procedures, mostly those with cancer, a deeper level of sedation was initially foreseen, and supplemental oxygen during the procedure was given from the beginning of the study.

**LEVEL OF SEDATION AND MONITORING**

The sedation end point was generally deep sedation. Nevertheless, patients were allowed to drift back and forth along a continuum, ranging from moderate to deep sedation to general anesthesia, with the goal of a balance between the maximum of comfort and safety. General anesthesia was not the average sedation end point, but the residents were free to increase the depth of sedation as needed. Deep sedation was defined for a sedation limit as a sluggish response to a light glabella tap or a loud auditory stimulus. The level of general anesthesia was defined as any episode of unresponsiveness to touch or voice lasting between 2 controls (≤5 minutes). The maximum transiently acceptable depth of sedation was defined as general anesthesia for patients retaining only a reflex withdrawal to pain. During the procedures, the resident was in charge of constant monitoring of the patient (position of the head and neck, breathing, respiratory sounds, paradoxical respiratory movements, cyanosis, heart rate, monitoring of arterial oxygen saturation [SaO2], blood pressure measurement, and check for level of sedation every 5 minutes) with the help of one of the 2 nurses (also in charge of preparing the drugs and the suction and oxygen-delivering devices with appropriate masks). At the end of the procedure, at least 10 minutes of observation occurred, before the patients were transferred back to the ward, to check for any adverse events, since this period is known to be one of risk. Before patients were moved back to the ward, vital signs had to be normal, with SaO2 saturation within the reference range without oxygen administration and a level of sedation inferior to that of general anesthesia.

Once in their rooms, the patients were monitored by means of SaO2 by the nurses and the residents in the ward (all personnel involved in the observation of the children; they all received instructions about the correct position and the meaning of saturation and were encouraged to call in case of any doubt or problem. Patients were discharged from the hospital after complete recovery, which was defined as the presence of vital variables within reference limits, full wakefulness, the ability to drink or eat, and the ability to walk normally. The decision as to whether the patient was ready for discharge was made by the resident in charge of the sedation. Time-based records were used for the entire sedation period, and notes in the patient’s medical chart were recorded during further observation in the ward.

**EQUIPMENT AND SETTING**

The procedures were performed with a positive pressure oxygen delivery system (≤15 L/min) that could be used to provide continuous positive airway pressure by mask, 2 sets of functional suction apparatus with appropriate suction catheters, sphygmomanometer, and blood pressure cuffs (Dinamap Plus; Critikon Company, Tampa, Fla), pulse oximetry (512 Novametrix; Novametrix Medical Systems Inc, Wallingford, Conn), an emergency kit with resuscitation medications, and neuromuscular blocking agents. All the material required for intubation and a cardiac defibrillator were present as well. Routine capnography (Nellcor EC-4 NPB;73 Nellcor Puritan Bennett Inc, Pleasanton, Calif) with nostrils for oxygen delivery (Microstream Nellcare; Nellcare Puritan Bennett Inc) was introduced in the last 3 months. The same monitoring facilities and emergency kit were present in the ward.

The sedations occurred in the endoscopy room in the Gastroenterology Department; the PSU personnel move room to room only for painful procedures involving patients of the Oncology Department. The pediatric, gastroenterology, and oncology wards are all located on the same floor of the hospital, on the floor above the operating theater and intensive care unit of our third-level pediatric teaching hospital.

**EMERGENCY PERSONNEL**

The availability of the pediatric anesthesiologist with experienced advanced life support skills was almost immediate (in the ward), and the emergency team of the Anesthesia Department (1 physician and 1 nurse) was available on call as well. These personnel are available on call for all the needs of the hospital during the day and are able to carry out standard emergency procedure within a few minutes.

**OUTCOMES AND DEFINITION OF COMPLICATIONS**

We recorded the percentage of procedures successfully performed, the incidence and type of adverse events, and the number of calls for the pediatric anesthesiologist or the emergency team until discharge. Two different observers, the physician in charge of the sedation and a nurse from the Gastroenterology Department, monitored outcomes and complications. The risk for underreporting was further reduced by involving the pediatric gastroenterologist and the oncologist in the audit. A secondary outcome was the time of engagement of the OR spared by the PSU.

Minor desaturation was defined as any drop in SaO2 to less than 94%, with prompt recovery in spontaneous breathing with or without oxygen supplementation and without apnea. Major desaturation was defined as any drop in SaO2 or apnea needing a course of ventilation. Residents were trained to start BVM ventilation in case of apnea, defined as absence of breath for more than 10 seconds and whenever SaO2 dropped below 85% without prompt reversal with oxygen administration. Laryngospasm was defined clinically as evidence of stridor (with or without clinical signs of airway obstruction) and on a need-to-treat basis (BVM or continuous positive airway pressure ventilation). Blood pressure changes were defined as a drop in mean arterial pressure; hypotension was defined as a measurement below age-based criteria.

**RESULTS**

During the 36-month study period, the PSU performed 1059 procedures. In cases involving a single sedation for multiple procedures (ie, lumbar puncture plus bone marrow aspiration or upper endoscopy plus liver biopsy), only the longest procedure was recorded.

Data about the population involved in the study are shown in Table 3.
Among patients older than 14 years, 206 (38.9%) of 530 patients preferred to undergo the procedure while awake. No parents requested that the procedure be performed in the ward for each year are shown in Table 4. No patients required intubation. The incidence of children transiently experiencing the level of sedation defined as general anesthesia at any time was 91% (reached in 963/1059 patients). Procedures lasted from a minimum of 5 minutes to a maximum of 47 minutes (upper endoscopy plus colonoscopy with multiple biopsies). The mean±SD duration times were 10.0±3.0 minutes for upper endoscopies, 24.0±4.5 minutes for colonoscopies, and 8.0±2.0 minutes for painful procedures.

The average propofol dose required for each procedure is shown in Table 5. Continuous infusion for long-lasting procedures was seldom used (12 patients only), since the residents usually chose to administer repeat small boluses of propofol when needed, on evidence of the patient’s discomfort. All patients were aroused in a mean±SD duration of 8.0±2.0 minutes for painful procedures. The average propofol dose required for each procedure is shown in Table 5. Continuous infusion for long-lasting procedures was seldom used (12 patients only), since the residents usually chose to administer repeat small boluses of propofol when needed, on evidence of the patient’s discomfort. All patients were aroused in a mean±SD duration of 8.0±2.0 minutes for painful procedures.

After calculating an average time of 30 minutes of engagement of the operating theatre for each procedure, we can estimate a saving of about 119 hours in 2000, 193 hours in 2001, and 231 hours in 2002.

**COMPLICATIONS**

The rate of respiratory complications for each year and kind of procedure is shown in Table 6 and Table 7. In most cases, the drop of SaO2 was mild and transient, with prompt recovery spontaneously or with oxygen supplementation. The incidence of more important desaturation was higher in patients before routine oxygen supplementation (SaO2 <88% in 52 [12.0%] of 432 patients), less frequent in those with oxygen supplementations...
Spasm was also treated empirically with inhaled epinephrine (unrelated to sedation). The prolonged laryngospasm during upper endoscopy was treated with oxygen, BVM or continuous positive airway pressure, and suctioning of secretion, and by deepening the level of anesthesia in 40 seconds. Laryngospasm was treated with oxygen, BVM and intravenous corticosteroids to reduce the hypothetical vocal cord edema due to trauma from the endoscope. The symptoms had almost completely resolved when the emergency team arrived. During the bleeding from esophageal varices, the endoscopist controlled the bleeding (by perilesional injection of epinephrine), and the pediatric anesthesiologist administered an infusion of saline, albumin, and blood to quickly stabilize the patient.

In 8 cases, a moderate drop in SaO2 (range, 88%-92%) was observed just after the end of the procedure. All of these patients maintained spontaneous breathing and supplemental oxygen was administered by the residents for a few minutes. During the additional period of observation in the ward, oxygen supplementation in spontaneous breathing was briefly necessary only for 5 children because of an SaO2 below 93%.

Pain along the intravenous line after propofol injection was the most frequent adverse effect. It was reported on injection in 460 (48.0%) of 958 procedures (excluding patients with central venous catheters), despite simultaneous lidocaine infusion.

A decrease in mean arterial blood pressure from baseline values occurred in 720 (68.0%) of 1059 cases, with a mean decrease of 16 mm Hg (range, 0 to -34 mm Hg). The maximum decreases in blood pressure were generally observed at 5 and 10 minutes after the beginning of the procedure. In all the cases, decrease in blood pressure was transient and not associated with abnormal perfusion or other clinically significant signs. Heart rate remained substantially stable, and no case of bradycardia was observed. According to age-defined criteria, 137 (12.9%) of 1059 patients showed low blood pressure (systolic or diastolic) at any time. No precise indications were established about treatment of hypotension, and residents were free to administer bolus fluids. This occurred in 32 (3.0%) of 1059 patients, mostly patients with cancer (29/32). Transient myoclonus was observed in 31 (2.9%) of 1059 patients.

One patient with Shwachman syndrome and abnormal electroencephalographic findings but no history of seizures underwent a bone marrow puncture and experienced a brief tonic-clonic seizure and opisthotonos a few seconds after the infusion of propofol. The episode lasted 10 seconds and spontaneously subsided.

One patient experienced generalized repeated seizures 3 hours after a lumbar puncture with infusion of methotrexate without concomitant corticosteroid infusion. The oncologist recognized the origin of the event.
in the antineoplastic drug, and the patient underwent fur-
ther sedations with propofol without complications.

Three patients experienced repeated vomiting, and
another 4 experienced an unpleasant awakening with agi-
tation. No patient experienced hangover, ataxia, or other adverse effects.

SATISFACTION OF PATIENTS
AND THEIR FAMILIES

The questionnaire was given to the first 180 patients and
completed by 112 parents of young children and by 62 patients older than 12 years.

Satisfaction and a request for the same sedation in
any eventual subsequent procedure were indicated in the questionnaires by 100% of parents of young children and by 93.8% of adolescents who responded to the question-
naire on their own.

Some of the parents of small children (8.1%) experi-
enced a sensation of distress while watching their child lose consciousness. Fifteen percent of parents of younger children and 5% of adolescents expressed the desire for an oral premedication.

COMMENT

The critical issue addressed by this study concerns the
use of propofol by nonanesthesiologists and non–in-
tensive care unit personnel. In the real world, deep seda-
tion is usually required to achieve anxiolysis and immo-
bilization necessary for painful pediatric procedures,9
and the risk for oversedation is very high.5,12 The PSU
defined oversedation as any episode of unresponsiveness
to touch or voice lasting up to 5 minutes, and many would consider such sedation depth to be general anesthesia. As reported by Dial et al,10 our data confirm that transient oversedation is almost unavoidable whenever a high degree of immobilization is required. Nevertheless, the safety record of our series is good, and in the literature a similar level of complications is re-
ported when propofol is compared with other sedatives of more widespread use such as midazolam hydrochloride and opioids.11–13

Deep sedation has been compared with walking on a tightrope, and the primary causes of morbidity associ-
ated with sedation or analgesia are drug-induced respi-
atory depression and airway obstruction. In our expe-
rience, the absolute number of episodes of desaturation
was quite high when the drug was used without concur-
rent administration of oxygen. Nevertheless, most of these episodes were mild, short-lived, and easily managed by trained nonanesthesiology personnel, with prompt recov-
ery of spontaneous breathing. Moreover, the inci-
dence of mild episodes of desaturation appeared to be
partly avoidable by preventive oxygen administration. The incidence of episodes of desaturation requiring a short
course of ventilation was very low, and the residents eas-
ily managed all these cases. According to the literature, the incidence and severity of desaturation appear to be
related to selection of patients (inaccurate estimation of
airway patency), infusion rate of the drug, ability to de-
tect signs of hypoventilation, and degree of immobility
required.10 Most of these variables can be managed with
good training and by the use of experienced personnel.

From our preliminary data, the use of propofol in a
non–intensive care unit setting with previously trained personnel in an appropriate environment and with concur-
rent oxygen administration appears to guarantee satisf-
actory sedation. Although our study series is too small
to detect a difference in the rate of adverse events, rare
during standard practice, it did not show important com-
plications for colonoscopies and painful procedures. Fur-
thermore, our preliminary data seem to indicate that
trained personnel can recognize hypoventilation promptly and treat desaturation episodes successfully, confirm-
ing the advantages of the drug in terms of easy dose ti-
tration and quick recovery.14–17

On the other hand, the safety profile of propofol se-
dation for upper endoscopy is not so good, and our ex-
perience could not prove its use to be absolutely safe in
this setting. In some cases, it may be impossible to pass
the endoscope without reaching a level of general anes-
thesia for laryngoscopy. The rate of laryngospasm, al-
though quite low in the absolute, is nonetheless too high
to be considered safe, and the occurrence of major de-
saturation in upper endoscopy, requiring assisted ven-
tilation, is higher compared with colonoscopies and pain-
ful procedures. Moreover, most of the indications for
gastroscopy could result in a delayed gastric emptying
with an increased risk for inhalation. Therefore, it is not
appropriate to perform upper endoscopy with propofol
in a sedation unit with residents in attendance. On the
contrary, as far as colonoscopies and painful proce-
dures are concerned, the incidence of laryngospasm was
extraordinarily low. Decrease in mean arterial pressure
was always transient and not associated with abnormal perfusion or other clinically significant signs, as re-
ported in the literature.2,8,12

The most frequent adverse effect was pain during
propofol infusion, which actually distressed many pa-
ients. The incidence of pain might have been lower with
a higher (but still safe) dose of lidocaine (2% rather than 1%).18 In this kind of experience, the constant availabil-
ity of anesthesiology support remains mandatory.9

In this study, we made great efforts to develop high
standards of safety, in terms of personnel training, to en-
sure the development of the skills required (eg, selection
of patients, infusion rate velocity, ability to maintain
airway patency, ability to recognize hypoventilation, and
ventilation skills) and an environment with safety guar-
antees (eg, monitoring and treatment facilities and anes-
thesiology support). This experience offered the resi-
dents a unique opportunity to practice the use of sedative
and enhance their skills monitoring patients and prov-
iding life support, with an amazing professional gain.
Nevertheless, residents exceeded the intended target of seda-
tion at some time in more than 90% of cases. Therefore,
the risk for oversedation appears almost a rule when se-
dation is performed by attending physicians and when the
depth of sedation is titrated to the maximum comfort of
the patient and a good degree of immobility.9,10

Before the start of this experience, most of the inva-
sive procedures were performed in the OR with the sup-
port of anesthesiologists. Since anesthesiology resources
The need to perform procedural sedation for children has increased in recent years, but anesthesiology resources are limited. Deep sedation is usually required to achieve anxiolysis and immobilization necessary for painful pediatric procedures. Propofol is an attractive option for procedural sedation in children, but the safety profile of this drug in a nonanesthesiology setting has not been defined. This study shows that trained nonanesthesiology personnel can safely use propofol in a defined setting with significant savings of anesthesiology resources.

were limited, not all procedures could be conveniently performed under sedation. Moreover, there was significant loss of time due to the difficulties in scheduling the OR because of emergencies and surgery activity.

The development of a PSU in the ward made it possible to significantly increase the number of procedures performed, along with possible savings of time for the Anesthesiology Department. The time spent by the Anesthesiology Department and by the pediatric anesthesiologist in training the residents must be taken into account in the cost-benefits ratio, despite the fact that the training in the Anesthesiology Department is part of the standard rotation of residents in our school of pediatrics.

The absolute number of procedures and the percentage of procedures performed with sedation have increased significantly since the study was commenced (Table 4). With less demand on the OR schedule, we were more readily able to accommodate those patients who definitely needed an anesthesiologist. Moreover, other patients have benefited from being able to plan more independently the timing of procedures because of the increased availability of an OR. The savings related to OR engagement are possibly overestimated, because some of these procedures would once have been performed without sedation and therefore would not have had an impact on the OR. Nevertheless, these patients chose to receive sedation when the possibility was offered without any limitation based on scheduling or OR engagement.

The responses to the questionnaires indicated significant convenience for patients and parents. The children do not leave the ward, but fall asleep and wake up with their parents nearby. Furthermore, they are no longer subjected to delays due to problems in the OR, and fasting times are more easily respected.

The use of propofol by pediatric residents with defined training and the availability of prompt anesthesiology resources did not result in important complications for colonoscopies and painful procedures. Furthermore, they allowed a significant increase in the number of procedures performed with sedation. Although far more data are needed to assess the safety of propofol outside an intensive care environment, we believe that further studies in this direction will be promising and worthwhile.

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