Reporte de Casos
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Intravenous Sedation in Pediatric Dentistry

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Abstract: Anxiety, fear, and phobia related to dental treatment are present in a substantial portion of the population. As an effective protocol for anxiety control, sedation is currently widely used in dental practices, positively contributing to patient cooperation during treatment. In pediatric dentistry, apprehension toward dental care is mainly caused by the novelty and unfamiliarity of the environment, and in some cases, the use of sedative medications becomes necessary to ensure that treatment is efficient, expeditious, and safe. This study is a case report involving two pediatric patients who presented dental treatment phobia and underwent sedation in an outpatient setting under the supervision of an anesthesiologist. It was concluded that pharmacological sedation is a technique that should be considered in cases in which behavioral management strategies have been unsuccessful in controlling aversive behavior in pediatric patients with dental phobia. The incorporation of this technique enables safe and effective dental care.

Key words: Sedation. Behavioral control. Dental anxiety.

Sedación intravenosa en odontopediatría

Resumen: La ansiedad, el miedo y la fobia ante el tratamiento odontológico están presentes en gran parte de la población. Como método eficaz para controlar la ansiedad, actualmente se utiliza la sedación en los consultorios odontológicos, impactando positivamente en la cooperación del paciente. En odontopediatría, la aprensión durante el tratamiento se debe principalmente a que el entorno es nuevo y desconocido, y en ocasiones es necesario utilizar fármacos sedantes para garantizar que el tratamiento sea eficaz, rápido y seguro. Este estudio es un informe de un caso clínico en el que participaron dos pacientes pediátricos que tenían fobia al tratamiento odontológico y fueron sometidos a sedación en una clínica ambulatoria bajo la supervisión de un anestesista. Concluimos que la sedación farmacológica es una técnica que debe considerarse en los casos en que el manejo conductual no ha tenido éxito en el control de la conducta aversiva en pacientes pediátricos con fobia, y la incorporación de esta técnica permite una atención odontológica segura y efectiva.

Palabras clave: Sedación. Control del comportamiento. Ansiedad por el tratamiento dental.

Sedação endovenosa em odontopediatria

Resumo: A ansiedade, o medo e a fobia ao tratamento odontológico estão presentes em grande parte da população. Como método efetivo para controle da ansiedade, atualmente a sedação se faz presente nos consultórios odontológicos, atuando de forma positiva na colaboração do atendimento. Na odontopediatria o receio no atendimento é causado principalmente pelo fato do ambiente ser novo e desconhecido, e por vezes se faz necessário a utilização de fármacos sedativos, para que o atendimento seja eficiente, rápido e seguro. Este estudo é um relato de caso envolvendo dois pacientes pediátricos que apresentaram fobia ao tratamento odontológico e foram submetidos à sedação realizada em ambulatório sob supervisão de um médico anestesista. Concluímos que a sedação medicamentosa é uma técnica que deve ser considerada em casos onde não houve sucesso no manejo comportamental para o controle do comportamento aversivo em pacientes pediátricos que apresentam fobia e a incorporação dessa técnica possibilita um atendimento odontológico seguro e eficaz.

Palavras-chave: Sedação. Controle comportamental. Ansiedade ao tratamento odontológico.

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Introduction

Anxiety and phobia related to dental treatment are present in a substantial portion of the population and are often aggravated by the sounds and vibrations of rotary instruments, local anesthesia, and, most notably, negative dental experiences shared by family members and friends[1].

In pediatric dentistry, apprehension toward dental care may be caused by anxiety, ranging from mild to severe, or by dental phobia. Dental phobia is associated with an excessive and persistent fear of dental stimuli and results in significant distress. Anxiety, in contrast, corresponds to fear of dental procedures that may or may not be associated with phobia. Children and adolescents who suffer from dental phobia or dental anxiety may exhibit disruptive behaviors during dental examinations and treatments, extending from restlessness to episodes of rage[2]. The pediatric dentist must identify the child's psycho-emotional profile in order to propose a humanized treatment approach[3].

Parental support is a major ally in shaping children's behavior; however, it is not always sufficient on its own. In such cases, the use of linguistic techniques, psychological support, and, ultimately, sedative pharmacological agents may be necessary to achieve efficient, expeditious, and safe dental care[2]. A non-cooperative patient can compromise the quality of treatment, lengthen treatment time, and increase the risk of injury to the child. Furthermore, many parents do not accept aversive behavior management techniques, such as protective stabilization, which makes sedation an important option for controlling anxiety and phobia.[4]

Therefore, highly anxious or phobic children may require targeted pharmacological support in addition to behavioral guidance strategies, including nitrous oxide sedation, intravenous sedation, or general anesthesia (Gao; Feng, 2023). As an effective protocol for anxiety control, sedation is currently widely used in dental offices, positively contributing to patient cooperation by reducing activity levels and aversive behaviors in certain patients. Sedation is recommended when all cognitive and behavioral management approaches have been unsuccessful[3]. According to the International Committee for the Advancement of Procedural Sedation, sedation practice consists of the administration of one or more pharmacological agents to facilitate a diagnostic or therapeutic procedure, aiming to achieve a state in which airway patency, spontaneous respiration, protective airway reflexes, and hemodynamic stability are preserved, while anxiety and pain are mitigated.[5]

For effective outpatient sedation without adverse events, the qualified and properly trained professional must have thorough knowledge of the pharmacodynamic, and pharmacokinetic effects of the medications used. In addition, a trained team must be present to monitor vital signs, ensuring patient safety. The selection of sedative agents and the

sedation approach is influenced by the type of procedure, patient comorbidities, temperament, and the clinician's preferences. The primary objectives of sedation include anxiolysis, analgesia, amnesia, safety, efficacy, and the ability to facilitate completion of the procedure.[5]

Understanding the recommendations for the use of sedative drugs is a crucial factor in sedation practice. Dental professionals must perform a comprehensive medical history, including assessment of previous medical conditions, allergies, and systemic diseases. Moreover, it is of paramount importance that the facility where the procedure is performed be equipped with an emergency kit (including adrenaline and an oxygen delivery system) to manage potential complications.[5]

Given the importance of the pediatric dentist's knowledge regarding pharmacological sedation methods for the control of dental anxiety and phobia, the present study aimed to report the successful use of sedative medications in an outpatient setting in two pediatric patients presenting dental phobia.

Case Series

The present study comprises two case reports of pediatric patients aged 3 and 4 years old who presented to the UDF dental school clinic for dental treatment and exhibited aversive behavior. Consequently, they were referred for dental care under pharmacological sedation. The study was initiated after approval by the Research Ethics Committee of Centro Universitário UDF (CAEE: 64332722.4.0000.5650), with written informed consent obtained from the legal guardians and authorization obtained from the patients.

Clinical Case 1

Patient L.A.S., a 3-year-and-10-month-old female, Caucasian, admitted with the chief complaint of "dental caries." The caregivers reported that the child was healthy and not taking any medication. Medical history revealed no allergies or sensitivities, no systemic diseases or conditions, and no neurological alterations.

Regarding oral health, the patient presented a moderate severity condition related to dental caries. The child had never received dental local anesthesia, and according to parental reports, "the child was very fearful, and they did not want her to experience suffering during dental treatment."

Clinical examination revealed dental caries in teeth 54, 55, 74, 75, and 85. Tooth 74 showed suspicion of dental caries with pulpal involvement. After an unsuccessful attempt at conventional clinical treatment due to lack of patient cooperation, treatment under sedation with the support of an anesthesiologist was recommended.

At the second appointment, the proposed treatment was conducted under sedation. Due to the child's lack of cooperation for venipuncture, an initial anesthetic induction plan using intranasal ketamine combined with dexmedetomidine (Precedex) was selected. Induction was performed with 34 mcg of dexmedetomidine and 17 mg of

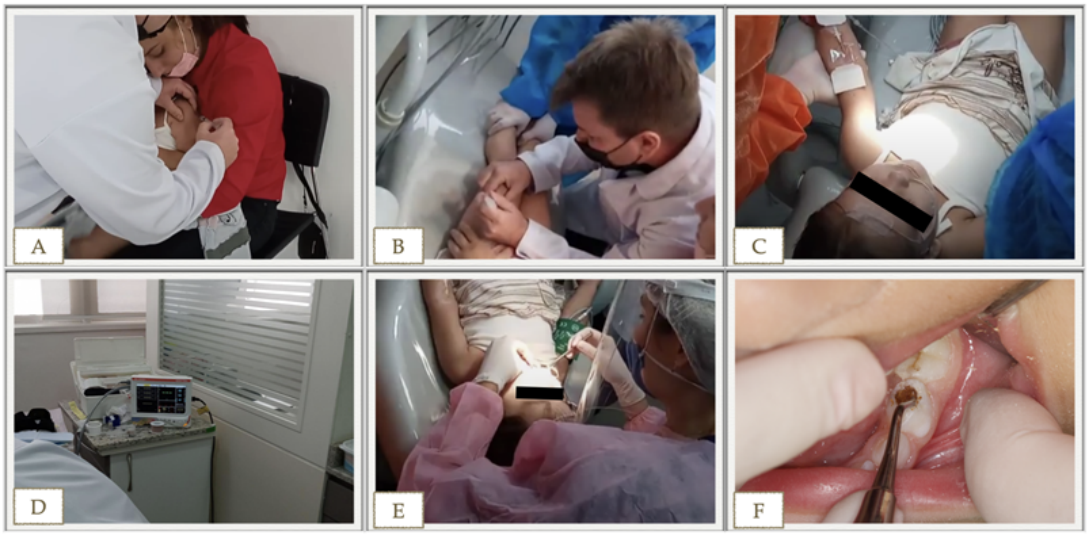

Figure 1. *A: Intramuscular administration of sedative; B: Intramuscular administration of midazolam in the left lower limb; C: Patient after placement of intravenous access and nasal cannula; D: Monitoring of vital signs; E and F: Performance of dental procedures with the patient under sedation.*

ketamine administered intranasally using a nasal atomization device.

After 30 minutes, the patient remained awake and non-cooperative for both dental treatment and venous access. Therefore, the anesthesiologist decided to administer a second dose of Precedex and ketamine via the intramuscular route in order to facilitate the procedure. Eventually, A dose of 17 mg of ketamine and 17 mcg of dexmedetomidine was administered.

After 10 minutes, an improvement in the level of sedation was observed; however, venous access and the dental procedure were still not feasible. A third anesthetic dose was administered to achieve an adequate anesthetic plane. At this point, 2.5 mg of intramuscular midazolam was administered.

Five minutes after administration, the patient reached an ideal anesthetic plane, allowing venous access to be established in the left upper limb using a 24G intravenous catheter. Subsequently, 250 mL of 0.9% saline solution was initiated, and intranasal oxygen was administered via nasal cannula at a flow rate of 1–2 L/min at the beginning of the procedure.

During the procedure, it was possible to temporarily discontinue oxygen flow without compromising ventilation or oxygen saturation. However, at certain moments, hyperextension of the patient's chin region was required to maintain airway patency and prevent respiratory compromise.

The procedure was completed successfully without complications and lasted approximately 1 hour and 30 minutes. The patient regained consciousness approximately one hour after completion of the procedure.

As postoperative side effects related to the anesthetic medications, the patient

experienced two episodes of nausea and vomiting, requiring administration of the antiemetic medication bromopride.

Throughout sedation, it was possible to perform the entire dental treatment using a minimally invasive technique.

Clinical Case 2

Patient T.A.M., a 4-year-and-10-month-old male, Caucasian, presented with the chief complaint of "dental aesthetics." The caregivers reported that the child was under neurological follow-up and was not taking any medications. Medical history revealed no allergies or sensitivities, no systemic alterations, no previous hospitalizations or surgeries, and no history of blood transfusion. Regarding oral health, the patient exhibited active caries lesions in multiple teeth, including cases with endodontic involvement. The caregivers reported that the child had previously abandoned dental treatment due to lack of cooperation. The family also reported infrequent dental visits and difficulty with oral hygiene practices.

The patient required dental treatment involving multiple restorative procedures in teeth 63, 71, 81, and 85, placement of acetate crowns on teeth 51, 52, 61, and 62, as well as endodontic treatment of tooth 74 with placement of a stainless-steel crown. After an unsuccessful attempt at conventional clinical treatment and behavioral conditioning during a previous appointment due to lack of cooperation, outpatient treatment under intravenous sedation performed by an anesthesiologist was recommended.

For sedation induction, intramuscular pre-anesthetic medication consisting of ketamine 35 mg and dexmedetomidine (Precedex) 35 mcg was administered. The patient underwent

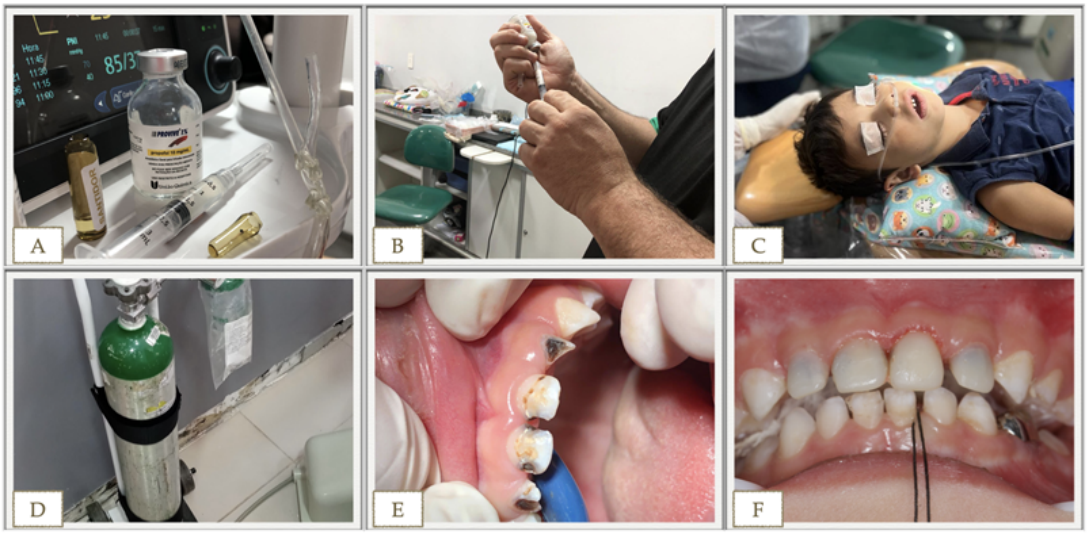

Figure 2. *A: Monitoring of vital signs; B: Medication preparation; C: Patient after placement of intravenous access and nasal cannula; D: Oxygen administration; E: Initial clinical aspect of the teeth; F: Final clinical aspect of the maxillary anterior teeth.*

full monitoring, including electrocardiography (ECG), non-invasive blood pressure measurement, pulse oximetry, and continuous vital sign assessment.

Venous access was established in the left upper limb using a 20G intravenous catheter. Oxygen was administered via nasal cannula at low flow (1–2 L/min, as needed). Intravenous sedation was achieved using the following medications: midazolam 2 mg + 1.5 mg, ketamine 10 mg, dexmedetomidine 10 mcg, and propofol administered in four doses of 15 mg each.

The procedure was completed successfully without complications and lasted approximately 4 hours and 30 minutes. The patient regained consciousness immediately after discontinuation of the medications and exhibited no adverse effects. Discharge was granted once the patient was fully awake and oriented.

Table 1: *Medications used in sedation protocols[6].*

Medication	Pediatric Use Status	Dose	Route of Administration	Main Adverse Effects
Ketamine	No pediatric studies available. Off-label use.	IM: up to 9–13 mg/kg; onset in 3–4 min, duration 12–25 min. IV: 0.5–1 mg/kg/dose.	IV, IM, oral, intranasal	Emergence delirium, hallucinations, nightmares
Dexmedetomidine (Precedex)	No pediatric studies available. Off-label use.	1–2 mcg/kg as a single dose, 30–60 min before induction	Intranasal	Hypotension, hypertension, bradycardia, fever, vomiting
Midazolam	Recommended for selected pediatric cases. Off-label use.	IM: 0.05–0.15 mg/kg (5–10 min before procedure). IV: 0.05–0.1 mg/kg. Rectal: 0.3–0.5 mg/kg.	IV, IM, oral, rectal (children)	Restlessness, agitation, hyperactivity, anxiety, irritability
Propofol	Recommended for selected pediatric cases. Off-label use.	Induction (3–16 yrs): 2.5–3.5 mg/kg IV (20–30 s). Maintenance (2 mo–16 yrs): 125–300 mcg/kg/min IV.	IV	Respiratory depression, reduced CO_2 response, hypoxia, propofol infusion syndrome

Discussion

The number of sedation procedures performed outside the traditional operating room environment has increased over recent decades[7]. Safe sedation in children requires a systematic approach that includes supervision by professionals qualified in anesthesia, pre-sedation assessment, appropriate medication selection, adequate fasting, careful balance of sedation depth, consideration of risks in patients unable to fast for emergency procedures, focused airway examination, understanding of pharmacokinetic and pharmacodynamic effects, drug interactions, proper training for patient rescue, age and airway size–appropriate equipment, venous access, and post-procedure monitoring. Sedation protocols must be structured to ensure patient safety principles and to reduce morbidity.[7]

In general, during medical and dental treatments, children are exposed to anesthetic, sedative, or analgesic agents to relieve pain associated with invasive procedures. The ideal anesthetic and sedative technique for pediatric patients should be individualized, providing rapid onset, safety, and minimal discomfort[5]. Sedation is recommended as a last resort, after failure of linguistic approaches and protective stabilization techniques. The patients included in the present study fit this profile, as it was impossible to perform dental procedures due to severe dental phobia. Parents reported high satisfaction with the sedation approach and stated they would recommend it for other children.

In view of these behavioral management difficulties and with the aim of reducing the demand for operating rooms for relatively simple procedures, outpatient sedation has become a viable alternative[7]. Another relevant aspect is that the financial cost of sedation performed in a dental office is considerably lower when compared to sedation in a surgical center.

Advances in the pharmaceutical industry have led to the availability of several sedative agents for different purposes and patient profiles. However, the use of these drugs in pediatrics remains controversial due to the limited number of studies addressing their use in children; consequently, some medications are administered off label.[7]

The medications used for sedation in the present study were ketamine, dexmedetomidine (Precedex), midazolam, and propofol. It is important to emphasize that all patients included in this study were older than three years of age.

Ketamine (ketamine hydrochloride) was used for sedation in both patients. In the first patient, it was administered intranasally and intramuscularly, whereas in the second patient it was administered intravenously and intramuscularly. This medication produces dissociative anesthesia and is the only agent capable of providing intense analgesia at subanesthetic doses. It is characterized by potent analgesia, sedation, and amnesia while preserving spontaneous ventilation; therefore, it is considered an appropriate drug for inducing anesthesia in pediatric patients during brief painful procedures or emotionally distressing interventions[8]. The combination of ketamine with other sedatives or analgesics is favorable in reducing adverse effects and improving the quality of sedation.[9]

Karacaer et al. (2018) evaluated ketamine combined with remifentanil versus ketamine combined with propofol for sedation in patients undergoing colonoscopy. Seventy children were recruited and randomly assigned to one of the groups. Only one child in the ketamine–remifentanil group experienced respiratory arrest during induction, which was managed with positive-pressure ventilation, and was excluded from the study. Thus, 69 children aged 2 to 16 years completed the study. No statistically significant differences were observed between groups regarding age, weight, sex, duration of colonoscopy, or recovery time. However, patients in the ketamine–remifentanil group achieved better sedation scores compared to those in the ketamine–propofol group.[10]

Dexmedetomidine (Precedex) was also administered to both patients, intranasally and intramuscularly in the first case, and intramuscularly and intravenously in the second case. This drug is a potent, highly selective, and specific alpha-2 adrenergic agonist with sedative and analgesic effects. When administered via the nasal mucosa, dexmedetomidine offers an easy and non-invasive route with high bioavailability (81.8%). Intranasal administration provides superior pre-anesthetic sedation compared with other agents. Its benefits include a reduced incidence of postoperative nausea and vomiting, nasal irritation, and the need for rescue analgesics.[11]

Despite the pronounced dose-dependent analgesia and sedation produced by this drug, mild ventilatory depression may occur. In the present study, patients received supplemental oxygen via nasal cannula throughout the procedure. Dexmedetomidine is contraindicated in individuals with hypersensitivity to any excipient in its formulation.[11]

Midazolam may be administered as an adjunct to opioids, propofol, and/or inhalational anesthetics during anesthesia maintenance and provides reliable sedation and anxiolysis in children. It is effective for sedation during regional anesthesia and for short therapeutic procedures. In both cases presented, the drug was administered intravenously. Midazolam is the most commonly used oral preoperative medication in children. Its adverse effects include fatigue and drowsiness, and it should be avoided in patients with chronic pulmonary disease. It may also cause decreased motor coordination and impairment of cognitive function. The drug is contraindicated in cases of hypersensitivity to its components and in infants younger than six months[12]. Conway et al. (2021) conducted a systematic review on the use of midazolam in children and adults prior to procedures and concluded that there is insufficient high-quality evidence to determine whether midazolam provides more effective sedation than other medications. However, patients appear to prefer sedation with midazolam over receiving no sedation at all. For this reason, sedation with midazolam may be offered when clinically appropriate.[13]

Propofol is recommended for the induction and maintenance of anesthesia during procedures and for deep sedation. In the present study, only the second patient received propofol, which was administered intravenously. Propofol is a short-acting general anesthetic agent with an onset of action of approximately 30 seconds and a half-life of 30 to 60 minutes[14]. We observed that propofol was more efficient due to its

short sedation duration and rapid recovery profile. At the end of the procedure, the second patient was discharged awake and fully conscious, unlike the first patient, who regained consciousness approximately one hour later. Propofol is contraindicated in certain situations, including hypersensitivity, children under three years of age, and patients with respiratory tract infections, diphtheria, or epiglottitis.[14]

Conclusion

Pharmacological sedation is an important technique for controlling aversive behavior in pediatric patients with dental phobia, and its incorporation enables safe and effective dental care. This technique should be performed by physician anesthesiologists, who are responsible for continuous patient monitoring throughout the procedure. Nevertheless, dental surgeons must be knowledgeable about the medications used, including the indications and contraindications of the drugs most commonly employed for sedation in children and adolescents, as well as when and how to appropriately recommend this technique.

Conflicts of Interest

The authors declare no conflicts of interest.

References

1. Fiorillo, Luca. "Conscious sedation in dentistry." Medicina 55.12 (2019): 778.
2. Gao, Feng, and Yujia Wu. "Procedural sedation in pediatric dentistry: a narrative review." Frontiers in Medicine 10 (2023).
3. American Academy of Pediatric Dentistry. "Behavior guidance for the pediatric dental patient." The Reference Manual of Pediatric Dentistry. Chicago, Ill.: American Academy of Pediatric Dentistry (2020): 292-310.
4. Patel, Monica, et al. "Parental attitudes toward advanced behavior guidance techniques used in pediatric dentistry." Pediatric dentistry 38.1 (2016): 30-36.
5. Green, S. M., et al. "Procedural sedation: providing the missing definition." Anaesthesia 76.5 (2021): 598-601.
6. Stoelting RK, Hillier SC. Pharmacology and physiology in anesthetic practice. 4th ed. Philadelphia: Lippincott Williams & Wilkins; 2006
7. Coté, Charles J., et al. "Guidelines for monitoring and management of pediatric patients before, during, and after sedation for diagnostic and therapeutic procedures." Pediatrics 143.6 (2019).
8. Drummond, G. B. "Comparison of sedation with midazolam and ketamine: effects on airway muscle activity." British journal of anaesthesia 76.5 (1996): 663-667.
9. Novak, Helena, Pia Karlsland Åkeson, and Jonas Åkeson. "Sedation with ketamine and low-dose midazolam for short-term procedures requiring pharyngeal manipulation in young children." Pediatric Anesthesia 18.1 (2008): 48-54.
10. Karacaer, Feride, et al. "Remifentanil-ketamine vs. propofol-ketamine for sedation in pediatric patients undergoing colonoscopy: a randomized clinical trial." Revista Brasileira de Anestesiologia 68 (2018): 597-604.

11. Jun, Jong Hun, et al. "The effects of intranasal dexmedetomidine premedication in children: a systematic review and meta-analysis. Les effets d'une prémédication intranasale de dexmédétomidine chez l'enfant: revue systématique et méta-analyse." Can J Anaesth 64.9 (2017): 947-961.
12. Manso, Maria A., et al. "Efficacy of oral midazolam for minimal and moderate sedation in pediatric patients: A systematic review." Pediatric Anesthesia 29.11 (2019): 1094-1106.
13. Conway, Aaron, et al. "Midazolam for sedation before procedures in adults and children: a systematic review update." Systematic Reviews 10.1 (2021): 1-12.
14. Lundström S, Twycross R, Mihalyo M, Wilcock A. Propofol. J Pain Symptom Manage. 2010 Sep;40(3):466-70. doi: 10.1016/j.jpainsymman.2010.07.001. PMID: 20816571.

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