



Intranasal drugs for analgesia and sedation in children admitted to pediatric emergency department: a narrative review

Valeria Pansini^{1#}, Antonietta Curatola^{2#}, Antonio Gatto¹, Iaria Lazzareschi², Antonio Ruggiero³, Antonio Chiaretti²

¹Dipartimento di Pediatria, Fondazione Policlinico Universitario “A. Gemelli” IRCCS, Roma, Italia; ²Dipartimento di Pediatria, Fondazione Policlinico Universitario “A. Gemelli” IRCCS, Università Cattolica del Sacro Cuore, Roma, Italy; ³Pediatric Oncology Unit, Fondazione Policlinico Universitario “A. Gemelli” IRCCS, Università Cattolica Sacro Cuore, Rome, Italy

Contributions: (I) Conception and design: A Chiaretti, A Ruggiero; (II) Administrative support: A Curatola; (III) Provision of study materials or patients: A Curatola, V Pansini; (IV) Collection and assembly of data: A Curatola, V Pansini, A Gatto; (V) Data analysis and interpretation: A Curatola, V Pansini, A Gatto, I Lazzareschi; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

[#]These authors contributed equally to this work.

Correspondence to: Antonietta Curatola. Dipartimento Scienze della Salute della Donna, del Bambino e di Sanità Pubblica, UOC Pediatria, Fondazione Policlinico Universitario “A. Gemelli” IRCCS, Roma, Italy. Email: c.anto91@libero.it.

Abstract: Acute pain is one of the most common symptoms in children admitted to the Pediatric Emergency Department (PED) and its management represents a real clinical challenge for pediatricians. Different painful procedures can be very stressful for young children and their perception of pain can be enhanced by emotional factors, such as anxiety, distress, or anger. Adequate procedural sedation reduces anxiety and emotional trauma for the patient, but it reduces also stress for operators and the time for procedures. We have reviewed the literature on this topic and the drugs covered in these papers were: midazolam, fentanyl, ketamine, and dexmedetomidine. There are several routes of administering for these drugs to provide analgesia and anxiolysis to children: oral, parenteral, or intranasal (IN). Intravenous (IV) sedation, since it involves the use of needles, can be stressful; instead, IN route is a non-invasive procedure and generally well tolerated by children and it has become increasingly widespread. Some medications can be administered by a mucosal atomizer device (MAD) or by drops. The benefits of the atomized release include less drug loss in the oropharynx, higher cerebrospinal fluid levels, better patient acceptability, and better sedative effects. IN midazolam has a sedative, anxiolytic and amnesic effect, but without analgesic properties. Fentanyl and ketamine are mainly used for pain control. Dexmedetomidine has anxiolytic and analgesic properties. In conclusion, IN analgo-sedation is a simple, rapid and painless option to treat pain and anxiety in the PED requiring brief training on the administration process and experience in sedation.

Keywords: Analgo-sedation; intranasal (IN); mucosal atomizer device (MAD); Pediatric Emergency Department (PED)

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Introduction

Acute pain is one of the most common symptoms of children admitted to the Pediatric Emergency Department and its management represents an important clinical issue for physicians and healthcare providers. Different painful

procedures, such as laceration repair, extremities fractures, incision and drainage, but also simply the placement of an intravenous (IV) catheter, can be distressful to young children and their parents. Moreover, child's pain perception can be increased by some emotional factors, such as elevated anxiety, distress, anger and low mood. This can

make subsequent medical procedures and pain management more difficult (1).

Moreover, the undertreated pain could affect the child's mental health long-term, resulting in detrimental psychological effects, negative lasting memories and possibly exaggerated responses to future painful clinical episodes (2).

In this regard, pain management in pediatric age is often inadequate, despite the availability of consensus guidelines on this topic in emergency medicine (2). Different studies show that adults receive treatment for their pain much more than pediatric patients (3,4). This could be due to children's inability at times to verbally express their symptoms, but also to the fear of paediatricians to prescribe opioids to children, lack of formal training regarding opioid medication choice and the fear of adverse drug reactions (5-7).

The benefits of providing adequate procedural sedation for children include decreasing patient anxiety and emotional trauma, decreasing parental emotional discomfort, and completion of the procedure (8), reducing stress for operators and shortening the time of procedure duration.

There are different routes of drug administration to provide analgesia and anxiolysis to children: oral, parenteral or intranasal (IN) route. Oral administration has a slower onset of action and is related to the cooperation of the child (9). The parenteral route requires intramuscular administration or placement of an IV catheter, which can be painful and anxiety for the child and require a person who is able to quickly and effectively place an IV catheter (9). However, this is a safe route that can provide rapid and almost immediate analgesia. IN administration is easy, non-invasive and usually well tolerated by children, while the drugs intranasally delivered have a rapid onset of action and high bioavailability (10).

Different drugs have been used for procedural IN sedation in pediatric age.

Midazolam is a γ -aminobutyric acid (GABA) receptor inhibitor and it is the most frequently used premedication in paediatrics (11,12), due to its sedative, anxiolytic, and amnesic effect. It can be administered intranasally; however, it hasn't analgesic properties and may be associated with side effects, such as paradoxical reactions, restlessness, and behavioural changes (13,14). In the last years, attention on other drugs with analgesic and sedative properties is increasing, particularly on fentanyl, ketamine and dexmedetomidine, which can be also administered by the IN route.

Absorption of intranasally administered drugs depends

on anatomical properties, as well as specific properties of the drug involved. About the 3-5% of surface area in the nasal cavity is covered by the olfactory epithelium, that can offer direct access to the central nervous system (CNS) (15).

The time that a drug is in direct contact with the nasal mucosa affects how much it is absorbed (16). The drug absorption occurs within 30 minutes from the IN administration; then the remaining drug may be eliminated by the mucociliary apparatus (17). Volumes of 0.3 mL or less for nostril are easily tolerated; larger volumes are contraindicated as the drug ends up in the nasopharynx. Besides, drug absorption depends also on properties of drug involved, such as its molecular weight, lipophilicity, and electrical charge (16).

There are two ways to administer IN medications: by dripping or atomization. The first doesn't require other equipment in addition to a syringe but a compliant child is necessary. In the last years, the mucosal atomizer device (MAD) is the most used IN delivery device that breaks medications into smaller, easily absorbed particles and administers them in a relatively rapid fashion (18).

We present the following article in accordance with the Narrative Review reporting checklist (available at <http://dx.doi.org/10.21037/atm-20-5177>).

Methods

We made a review of the literature about this topic using PubMed with various search terms. The keywords used were: intranasal, intranasal sedation, intranasal analgesia, intranasal fentanyl, intranasal midazolam, intranasal dexmedetomidine, intranasal ketamine, pain and emergency care. We included randomized controlled trials (RCTs), prospective studies, observational studies and retrospective studies involving patients aged 0 to 18 years, who received IN administration of different analgesic and sedative drugs. The exclusion criteria were: reviews, case reports, case series, studies involving patients older than 18.

Results

We have reviewed and included in this paper more relevant clinical studies, in particular retrospective and prospective studies and RCTs. The data of RCT are summarized in *Table 1* and those of prospective and retrospective studies in *Tables 2,3*. These studies had a variable duration between 6 months and 3 years and the median number of subjects enrolled was 90.

Table 1 Randomized controlled trials for treatment of acute pain with intranasal drugs

Authors	Year	Subjects	N ^o of subjects	Dose	Procedures	Conclusions
Patel <i>et al.</i>	2018	4 to 9 yrs	44	IND 2 or 2.5 mcg/kg; OD 4 or 5 mcg/kg	Dental services	D is a safe and effective agent for PS and IND is better than OD
Li <i>et al.</i>	2019	1 to 12 yrs with suspected ASD	278	IND 3 mcg/kg; OMDZ 0,2 mg/kg	Head CT scan and/or ABR examination	IND + OMDZ vs. IND solo: > sedation success rate, without increase in AE
Oriby	2019	2 to 6 yrs	76	IND 2 µg/kg + OK 3 mg/kg; INM 0.2 mg/kg	Dental rehabilitation	IND + OK vs. INM: more satisfactory and rapid onset of sedation, > postoperative analgesia, < postoperative shivering
Miller <i>et al.</i>	2018	3 to 24 months	280	IND 2.5 mcg/kg; OPENT 5 mg/kg	TTE	IND is comparable to OPENT sedation without increase the risk of important AE. IND appears to be an effective “rescue” sedative for both failed OPENT and IND sedation
Yuen <i>et al.</i>	2019	/	196	OCH 50 mg/kg; IND 3 mcg/kg	CT	IND is comparable to OCH for sedation
Sathyamoorthy <i>et al.</i>	2019	>5 yrs and >20 kg (difficult children)	75	OMDZ 0.5 mg/kg (max 15 mg); IND 2 mcg/kg (max 100 mcg)	Dental procedures	IND vs. OMDZ: > success rate in sedation and parental separation
Quinn <i>et al.</i>	2018	3 to 17 yrs, <64 kg	22	INK 1 mg/kg vs. of INF 1.5 µg/kg	Musculoskeletal injury and abdominal pathologies	INK = INF in relieving pain post 20' after administration; INK < INF in relieving pain post 10' after administration
Frey <i>et al.</i>	2019	8 to 17 yrs	90	INK 1.5mg/kg vs. INF: 2 µg/kg	Acute extremity injuries	INK = INF in relieving pain; INK had an increase in minor and transient AE
Seiler <i>et al.</i>	2019	2 to 16 yrs	402	INF 1.5 mcg/kg	Procedural analgosedation	N ₂ O 70% + INF vs. N ₂ O 70% solo: no difference in sedation depth and relieving pain, but < incidence of vomiting
Reynolds <i>et al.</i>	2017	4 to 17 yrs	87	INK 1 mg/kg; INF 1.5 mcg/kg	Extremities fractures	INK = INF in relieving pain; INK had an increase in minor AE
Sado-Filho <i>et al.</i>	2019	<7 yrs	84	INK 4 mg/kg + INMDZ 0.2 mg/kg; OK 4 mg/kg + OMDZ 0.5 mg/kg; OMDZ 1 mg/kg	Dental treatment	K + MDZ vs. only MDZ : more effective
Nielsen <i>et al.</i>	2013	0.8 to 17 yrs, weight >10 kg	50	INSUF 0.5 mcg/kg + INK 0.5 mg/kg (nasal spray)	Insertion of PVA, removal of chest tube, cleaning of minor burns, and dressing change of abscess	INSUF + INK: rapid onset of analgesia with few AE

D, dexmedetomidine; MDZ, midazolam; K, ketamine; IND, intranasal dexmedetomidine; OD, oral dexmedetomidine; OMDZ, oral midazolam; CT, computerized tomography; AE, adverse events; OK, oral ketamine; OPENT, oral pentobarbital; TTE, transthoracic echocardiography; OCH, oral chloral hydrate; INK, intranasal ketamine; INF, intranasal fentanyl; OK, oral ketamine; INSUF, intranasal sufentanil; INM, intranasal midazolam.

Table 2 Prospective studies for treatment of acute pain with intranasal drugs

Authors	Year	Subjects	N° of subjects	Dose	Procedures	Conclusions
Nemeth <i>et al.</i>	2019	0 to 17 yrs	100	INMDZ 0.5 mg/kg; INF 2 mcg/kg; INK 4 mg/kg	APT for fractures, burns and scalds	A protocol for analgesedation using INF, INK, INMDZ, alone or in combination, was effective and safe
Yenigun <i>et al.</i>	2018	2 to 14 yrs	63	IVPARA 10 mg/kg ×3/day; INK 1.5 mg/kg ×3/day; INF 1.5 mcg/kg ×3/day	Postoperative pain relief after tonsillectomy	INK or INF vs. IVPARA: more effective for postoperative analgesia
Alp <i>et al.</i>	2019	9–36 months	217	INMDZ 0.2 mg/kg; INK 4 mg/kg; OCH 50 mg/kg	TTE	INMDZ = INK = OCH in sedation success rate; INMDZ has the most rapid onset of sedation; INK has the shortest duration of sedation
Malia <i>et al.</i>	2019	0 to 18 yrs	112	INMDZ: 0.4–0.5 mg/kg	Laceration repair	INMDZ: high parent and provider satisfaction score; short NPO of both solids and liquids are safe

TTE, transthoracic echocardiography; OCH, oral chloral hydrate; INK, intranasal ketamine; INF, intranasal fentanyl; INMDZ, intranasal midazolam; APT, acute pain therapy; IVPARA, intravenous paracetamol.

Table 3 Retrospective studies for treatment of acute pain with intranasal drugs

Authors	Year	Subjects	N° of subjects	Dose	Procedures	Conclusions
Yang <i>et al.</i>	2018	88% <5 yrs; 12% >5 yrs	17,948	IND 2 mcg/kg + INK 1 mcg/kg	Color Doppler ultrasound, pulmonary function, and EEG, MRI, ECG, ABR, fundus examination, CT	IND + INK: acceptable effectiveness of procedural sedation, low rates of adverse events
Tenney <i>et al.</i>	2019	5.5 to 20.5 years (with epilepsy)	26	IND 2 mcg/kg (after sleep deprivation)	MEG	IND + sleep deprivation: excellent sedation
Liu <i>et al.</i>	2018	0 to 3 yrs	2,304	IND 2 mcg/kg + INK 1 mg/kg	TTE	IND + INK: effective sedation with an acceptable safety profile
Ryan <i>et al.</i>	2019	<18 yrs	546	INF 2 mcg/kg (max 100 mcg) INMDZ 0.2 mg/kg (max 10 mg)	Laceration reparation	INF + INMDZ: safe and effective analgesedation

IND, intranasal dexmedetomidine; CT, computerized tomography; ABR, auditory brainstem response; INK, intranasal ketamine; EEG, electroencephalography; MRI, magnetic resonance imaging; ECG, electrocardiography; MEG, magnetoencephalography.

Table 4 Dose of drugs administered intranasally

Drug	Dose per KG body weight	Effect
Fentanyl	1.5–2 µg/kg	Analgesic
Midazolam	0.2–0.5 mg/kg	Sedative
Ketamine	0.5–4 mg/kg	Analgesic and sedative
Dexmedetomidine	0.5–4 µg/kg	Analgesic, sedative and anxiolytic

All studies describe the use of different drugs, which analgesic and sedative effects, administered IN route in emergency settings in pediatric age. These are used for the management of acute pain in children subjected to different procedures, such as laceration repair, extremities fractures, incision and drainage, dental services, but also simply the placement of an IV catheter or diagnostic imaging execution.

The medication studied in all these papers were: midazolam, fentanyl, ketamine and dexmedetomidine. The dose of every

single drug dispensed nasally is summarized in *Table 4*.

Fentanyl

Fentanyl is a potent opioid with a quick onset of action along, with minimal sedation and impact on hemodynamic stability; it is effective for the management of acute moderate to severe pain in pediatric patients (9). It is well absorbed by the nasal mucosa because it has very high lipophilicity and low molecular weight (19). Generally, this drug is administered nasally at the dose of 1.5–2 µg/kg. Yenigun *et al.* conducted a prospective study to demonstrate the major efficacy of IN fentanyl and ketamine, compared to IV paracetamol, for postoperative pain relief after pediatric tonsillectomy (20).

Besides, in literature different clinical trials compared the use of IN fentanyl *vs.* IN ketamine for the pain reduction due to fractures in children. All concluded that fentanyl provides effective analgesia as well as ketamine in relieving pain 20 minutes after administration. Quinn *et al.* demonstrated that IN fentanyl was superior to IN ketamine in relieving pain at 10 minutes (21). However, IN ketamine had a greater risk of adverse events (AE) than fentanyl, even if they are negligible and transient (22). Reynolds *et al.* stated that the number of AE was 2.2 times higher in the ketamine group than in the Fentanyl group, even if no serious adverse event (SAE) was observed. The most common side effect of ketamine was bad taste in the mouth, dizziness and sleepiness, while those of fentanyl were sleepiness, bad taste in the mouth and itchy nose (23).

Ryan *et al.*, in a retrospective study, proved the most efficacy and safety of IN fentanyl used in combination with IN midazolam during laceration repair and no serious AE reported (24).

In 2019, Nemeth *et al.* (25) developed a protocol for acute pain therapy (APT) and urgent analgesia/sedation (UAS) in PED. The median time onset of drug action was 5 minutes. Fentanyl was most frequently used for APT, with pain scores decreased by a median of 4 points, while s-ketamine/midazolam was most frequently used for UAS. They did not report any serious AE.

Despite the proven sedative efficacy of IN fentanyl and the poor side effects, many physicians still have various concerns about its use in emergency departments. In 2018, Arnautovic *et al.*, in a retrospective study, evaluated physician comfort and knowledge regarding the use of IN fentanyl for pain management in patients with long-bone fractures. They concluded that despite the implementation

of a clinical IN fentanyl pain pathway, their pediatric ED continued to have frequently missed opportunities to administer IN fentanyl (26).

Seith *et al.* (27) in 2012, administered a continuous flow of nitrous oxide of 50% to 70% via a full-face mask in association IN fentanyl (dose of 1.5 µg/kg). A nitrous oxide (N₂O) alone agent has been associated with higher levels of emesis, but in combination with IN fentanyl, the incidence of vomiting is reduced.

In 2019, Seiler *et al.* (28) proved that there were no differences with regard to the analgesic efficacy, sedation depth and rate of AE of procedural analgo-sedation (PAS) in patients treated with N₂O 70% with and without IN fentanyl.

Midazolam

Midazolam is a sedative that helps achieve anxiolysis and amnesia and it has been shown to be both safe and efficacious for pre-procedural sedation in the PED (8). It can be administered orally, nasally, rectally, IV or intramuscularly (IM). Shapiro *et al.* (29) showed that midazolam spray offers relief to children anxious about minor medical procedures, such as insertion of a needle in a subcutaneously implanted intravenous port, venous blood sampling and venous cannulation.

The dose of IN midazolam used in the different studies ranges between 0.2 and 0.5 mg/kg (8,18,30,31).

A triple-blind, randomized, controlled trial conducted by Joji Sado-Filho in 2019 (31), reported that the ketamine-midazolam combination appeared to be more effective in managing the behaviour of non-cooperative children, during dental treatment, in comparison to midazolam alone.

Besides, Brown *et al.* showed, in a retrospective study, that in children with autism spectrum disorders in ED, the most common sedatives used were IV ketamine and IN midazolam (32).

The most common adverse effects reported following IN midazolam is irritation in the nose, a bitter taste in the mouth and vomit. However, Midazolam can determine also respiratory and circulatory depression, but these side effects are not frequent when it is used alone.

Alp *et al.* (33) compared IN ketamine, IN midazolam, and oral chloral hydrate for children undergoing transthoracic echocardiography and concluded that all three agents provide adequate sedation, but IN midazolam has a more rapid onset of sedation while IN ketamine has a shorter duration of sedation.

Besides, in literature, there are no particular indications on the timing of lasting from solids and liquids to keep children in view of the IN administration of sedative drugs.

However, in 2018, Malia *et al.* (30) in a prospective, observational study, showed that short nil per os (NPO) of both solids and liquids are safe for the use of IN midazolam, with a median time of 172.5 min for liquid and 194 min for solids.

Ketamine

Ketamine is a phencyclidine derivative with sedative and analgesic effects (34). It can cause cardiovascular effects, such as hypertension, tachycardia, but preserves cardiac output and therefore is often used in patients with hypovolemia or haemodynamic disorders (35). Ketamine is usually administered intravenously (IV) or IM, but it may also be administered intranasally (36). The oral, sublingual and rectal route may be possible but have poor bioavailability (37). IN ketamine is a safe and fast-acting sedation drug in children, takes effect after approximately 5–10 min and preserves respiratory activity (38). Unlike opioids, ketamine administration does not release histamine, which can promote nasal itching and congestion. This feature makes it a perfect sedative for asthmatics (39).

As already stated, the association of ketamine and midazolam appears to be more effective in managing the behavior of uncooperative children (31).

Besides, IN ketamine provides adequate analgesia similar to fentanyl in relieving moderate to severe pain in children. However, ketamine has more AE that are minor and transient, like a bad taste in the mouth, dizziness and sleepiness (21–23).

Nielsen *et al.* (40) studied the association of ketamine with sufentanil administered intranasally. The combination provides rapid onset of analgesia for a variety of painful procedures with few adverse effects, no desaturation and no change in heart rate.

Furthermore, combined with dexmedetomidine, IN ketamine seems to be an effective and safe sedative, with no severe adverse reaction, in particular during diagnostic examinations, as color-doppler ultrasound, pulmonary function, EEG, MRI, ECG, ABR, fundus examination, CT scan and transthoracic echocardiography (35,41).

Dexmedetomidine

Dexmedetomidine is a highly selective alpha-2 adrenergic

agonist with sedative, anxiolytic, and analgesic properties. It can be administered by the intravenous, intramuscular, oral or IN route. IN dexmedetomidine is becoming useful, especially for short procedures that require the child to be sedated. It is odorless and tasteless, and no published study on this drug reported neither nausea nor vomiting. Dexmedetomidine induces sleep similar to natural sleep. Thus, even with high dose IN dexmedetomidine, external stimuli may easily awake patients. Dexmedetomidine can be used in varying doses, from 0.5 to 4 µg/kg, depending on the level of sedation required. A higher dose produces a deeper level of sedation, which may improve procedural success. Dexmedetomidine has minimal respiratory depression and acceptable cardiovascular effects, such as hypertension, hypotension, and bradycardia (42). As the level of sedation, a decrease in heart rate is also dose-dependent (43). A case report describes a healthy pediatric patient who developed symptomatic bradycardia lasting two hours after IN dexmedetomidine sedation (44).

Furthermore, in some studies, dexmedetomidine has neuroprotective properties, reducing apoptosis in animals and humans (45–48).

According to Patel *et al.*, dexmedetomidine may perform safe and effective sedation in children, and the IN route is far superior to the oral administration (49). IN dexmedetomidine is more rapidly absorbed in blood stems compared to the oral form, and it preserves the airway reflexes and respiratory drive (13).

IND has the same sedation power for imaging study if compared to oral chloral hydrate; in addition, IND has fewer gastrointestinal adverse effects during drug administration, less hypotension and hypoxia requiring oxygen therapy, but more bradycardia (50).

In 2019, Sathyamoorthy *et al.* (51), comparing IND to oral midazolam in difficult children, subjected to dental procedures, concluded that IND provides a higher success rate in sedation and parental separation. Otherwise, according to Li *et al.* (52), the combination of IND and oral midazolam has a higher sedation success rate than the IND solo for CT and/or ABR study in children with autistic spectrum disorders, without an increase in adverse effects. Some studies investigated the association of IN dexmedetomidine and ketamine. In 2019, Oriby (53) compared the effects of combined IN dexmedetomidine and oral ketamine versus IN midazolam as sedative premedication for children undergoing dental rehabilitation procedures. He found that the combination has a significantly more satisfactory and rapid onset of sedation,

with more postoperative analgesia and less postoperative shivering in comparison with IN midazolam.

A retrospective observational study conducted by Liu *et al.* (35) assessed the effectiveness and the security of IN dexmedetomidine combined with IN ketamine as sedation for young children during transthoracic echocardiography. They found a sedation success rate of 96% and an onset time of sedation of 15.7 min (IQR, 10–23 min). Similar values are found by Yang *et al.* (41), who retrospectively analyzed a sample of 17,948 pediatric patients undergoing procedural sedation with a combination of IN dexmedetomidine and ketamine. The association has a sedation success rate of 93%, with 15 min (IQR, 15–20 min) time for onset and a median sedation time of 62 min (IQR, 55–70 min). The lower rates of AE, in particular, bradycardia or hypotension, than those in previous studies of dexmedetomidine sedation (54–55) may be related to the combined use of ketamine. Some studies reported there was less hypotension when ketamine was added to dexmedetomidine (56,57).

Discussion

Many procedures, both for diagnostic purposes, such as urine sampling and lumbar punctures, and therapeutic purposes, such as intravenous insertion, wound/burn management and orthopaedic trauma can cause pain, anxiety and stress to the child admitted to the Pediatric Emergency Room. Furthermore, some diagnostic exams, like echocardiography, CT scan, MRI, require the child to don't move. In this setting, the procedural sedation has become a helpful tool for the clinician trained for managing analgo-sedation, and a good ally for the child and his parents, reducing children's pain and suffering, and parent's worries. Intravenous sedation, as it involves the use of needles, can be stressful itself. For that reason, in recent years the use of the IN route is becoming more widespread as it is essentially painless and effective. Some drugs may be administered by a mucosal atomizer dispositive (MAD) or by drops. When available, the use of a MAD is preferable, since drops are primarily deposited on the ciliary surface with excess runoff down the throat. The advantages of atomized delivery include less drug loss to the oropharynx, higher cerebrospinal fluid drug levels, better patient acceptability and improved sedative effects (58,59). In literature are not particular indications on the timing of lasting from solids and liquids for children in view of the administration of sedative drugs intranasally. However,

if possible, it is always preferable to keep the child on an empty stomach in the previous 2–3 hours.

IN midazolam is the most commonly used and studied sedative drug in pediatric patients. It has sedative, anxiolytic, and amnesic effects, but no analgesic properties, so it can be used for minor medical procedures. IN administration can cause nasal irritation and bitter taste in the mouth, while other side effects, such as respiratory and circulatory depression, are infrequent. In literature, there are many data also about other drugs administered intranasally, such as fentanyl, ketamine, and dexmedetomidine. Fentanyl and ketamine are used especially for their pain controlling action. It's been demonstrated that they both provide effective analgesia in children with moderate to severe pain when administered intranasally. The advantage of using ketamine lies in the fact that, unlike opioids, it does not release histamine, avoiding nasal itching and congestion. A relatively new drug studied in IN pediatric procedural sedation is dexmedetomidine. It has some properties that make it a tempting option. IN dexmedetomidine is odourless and tasteless, has minimal respiratory depression and acceptable cardiovascular effects; it is sedative, anxiolytic, and analgesic and some studies showed her neuroprotective effect, reducing apoptosis both in animals and humans (45–48).

However, a multimodal analgesic regimen provides better pain control and functional outcome in children and cooperation (60).

Conclusions

IN analgo-sedation is a simple, rapid and painless option to prevent and treat the pain and anxiety in the Pediatric Emergency Department. It needs a brief training about the administration method and experience in sedation. The choice of the right drug depends on the contraindications and the type of procedure the child must undergo. We hope that our review could contribute to spread the acknowledgement about IN sedative drugs and to increase their use in every child who must undergo to some stressful or painful procedure.

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