Original Research Article

Comparison of intranasal dexmedetomidine and oral triclofos sodium for anesthesia in non operating room pediatric imaging procedure

Shalini Sardesai[1], Akanksha Nanda[2], Neha Panse[3*], Repaka Akhil Krishna[4]

[1]Professor, Department of Anaesthesia MBBS, MD, D4, Flat No.204, Lake town katraj pune-411046, Maharashtra, INDIA.
[2,4]Resident, Department of Anaesthesia, C 902, Elysium apartments, infront if euro school, kaspate vasti, Wakad-411057, Maharashtra,INDIA.
[3]Associate Professor, Department of Anaesthesia MBBS, MD, Alpine 2, Amit Bloomfield, (Ambegaon), Pune satara Highway, Near indrayani International School, Pune-411046, Maharashtra, INDIA.
Email: akanshananda001@gmail.com , spsardesai.sp@gmail.com, drnehaghule@gmail.com

Abstract

Background: Sedation for pediatric imaging procedures varies widely based on the procedure's demands and patient characteristics. This study compares the efficacy and safety of intranasal dexmedetomidine and oral triclofos for sedation in children undergoing imaging procedures such as MRI and CT scans. **Methods**: In a single-center, single-blinded randomized controlled trial, 60 children aged 2-11 years with ASA class 1-2 were randomized into two groups: intranasal dexmedetomidine (2 mcg/kg) and oral triclofos sodium (50 mg/kg). Exclusion criteria included known allergies to study drugs, significant comorbidities, and specific contraindications to sedation drugs. Sedation efficacy was assessed using standard sedation and behavioral scores, while safety was evaluated by recording adverse events and radiologist satisfaction scores. **Results**: The study found that intranasal dexmedetomidine provided more effective sedation compared to oral triclofos, as evidenced by higher sedation and lower wake-up behavior scores. There were no significant adverse effects reported in either group. Radiologists expressed a higher satisfaction rate with the sedation quality in the dexmedetomidine group compared to the triclofos group. Statistical analyses confirmed the significance of these findings with p-values <0.05. **Conclusion**: Intranasal dexmedetomidine is more effective and equally safe as oral triclofos for procedural sedation in pediatric imaging. These findings suggest a preference for intranasal dexmedetomidine due to its reliable sedation quality and minimal adverse effects. Future studies with a larger sample size and multi-center trials are recommended to further validate these results.

Keywords: Pediatric sedation, Intranasal dexmedetomidine, Oral triclofos, Imaging procedures, Safety and efficacy

***Address for Correspondence:**
Dr. Neha Panse, Associate Professor, Department of Anaesthesia MBBS, MD, Alpine 2, Amit Bloomfield, (Ambegaon), Pune satara Highway, Near indrayani International School, Pune-411046, Maharashtra, INDIA.
Email: drnehaghule@gmail.com

Received Date: 04/01/2025 Revised Date: 01/02/2015 Accepted Date: 11/02/2025

Access this article online

Quick Response Code:

Website: www.medpulse.in

INTRODUCTION

Goals of sedation are variable as per specific imaging procedure and aims at anxiety relief, pain control and control of excessive movement[1]. The target depth of sedation varies according to the imaging procedure (and modality), as well as the individual patient characteristics. For instance, CT scan allows for rapid image acquisition and needs moderate sedation. However, some children need to be asleep in order to tolerate complex or prolonged investigations such as MRI and nuclear medicine imaging, which may involve the child keeping still for up to 1 h. MRI can be particularly frightening because it is noisy and involves lying still in an enclosed space[2].Careful planning of S/GA is particularly important for these modalities. Rates of failure can be decreased dramatically when sedation is provided by a dedicated team, by implementing clear protocols [4,5] and when experienced anaesthesiologists themselves provide the S/GA[7].

How to cite this article: Shalini Sardesai, Akanksha Nanda, Neha Panse, Repaka Akhil Krishna. Comparison of intranasal dexmedetomidine and oral triclofos sodium for anesthesia in non operating room pediatric imaging procedure. *MedPulse International Journal of Anesthesiology.* February 2025; 35(2): 01-06.

The oral administration of sedative drugs is an economic and oldest method of sedation, sometimes used an alternative to injectable medications[8].The use of triclofos in infants and children undergoing painless diagnostic procedures including MRI has been studied, with evidence of efficacy and safety[9]. However, there is a dearth of data comparing it with newer non-injectable medications[10]. Intranasal route is a non-invasive novel drug administration and absorption method, bypassing the first-pass metabolism. Moreover, absorption rates and blood levels are better than oral administration[11]. Compared to intravenous administration, the intranasal route shows decreased serum concentrations with lower plasma peaks and a reduced incidence of adverse effects[12,13].

Dexmedetomidine, a selective alpha-2 adreno-receptor agonist, has sedative, anxiolytic, and analgesic properties. It does not depress the respiratory centre, making it a good replacement for the above medications. It also induces sedation which parallels natural sleep.[14,15] However, there is lack of data comparing intranasal use of dexmedetomidine and oral triclofos as procedural sedation in children undergoing imaging procedures

MATERIAL AND METHODS

The prospective single center single blinded randomized control were performed in accordance to the good clinical practice guidelines and approved by ethics committee of our hospital. We included in the study, sixty children aged from 2years-11years with ASA 1-2 who were scheduled for MRI/CT scan in the radiology department.

Using the random number table method they were divided into Group1: Intranasal dexmedetomidine 2mcg/kg(n=30) and Group 2: Oral triclofos sodium 50mg/kg (n=30) the control group after written informed consent from their respective parents/guardians.

Children aged 2-10 years, referred for plain CT/MRI scan (not >60 min) under sedation. With ASA grade 1 or 2 were included in the study. Children having allergy to study drug, airway pathology/obstruction/anticipated difficult airway,congenital heart disease, bradycardia < 60 or know arrhythmia/AV block,Known Renal dysfunction Creatinine Clearance < 30% or known Liver dysfunction (Elevated LFT's), Significant rhinorrhea,metallic implants, claustrophobia, presence of pacemakers were excluded .Imaging studies involving oral or IV. contrast were also excluded.

SEDATION: A preoperative visit was made on the day prior to procedure. All cannulation sites were noted and all routine investigations were done. Parents were explained about the concerned technique and informed consent taken. Parents were instructed to remove any metal containing ornament on child. Parents were instructed to keep the child fasting for 4-6 hours for solid food and 2 hours for clear fluids.

On the day of prior to procedure child was shifted along with one of the parents to pre procedure room.

Baseline HR,RR,Spo2,BP were recorded. All the resuscitation and monitoring equipment were kept ready before administration of study drug, for management of any adverse reactions. On the very day of sedation the child was reassessed by the anaesthesiologist .

Thirty minutes prior to the start of procedure children were shifted to preoperative room and all ASA standard monitors were applied.

Group 1 received 2mcg/kg intranasal dexmedetomidine in NS of Total volume not >0.5ml was dripped into both the nostrils using 1 ml tuberculin syringe with child in recumbent position.

Group 2 received 50mg/kg of Triclofos sodium orally. The heart rate, systolic BP, diastolic BP, Spo2,respiratory rate, sedation and anxiety levels were measured before administration of study drug and every 5 minutes until children are transferred to CT/MRI suite.

After shifting to MRI suite all standard monitors were applied and oxygen supplementation was started. During MRI/CT scan, if the sedation level comes below 3 or baby moves inj. fentanyl 0.3-0.5 mcg/kg titrated to desired effect was given following which sedation and behavior scores were evaluated by the observer using the same scoring system.

The radiologist was requested to grade his satisfaction score based on likert scale for the sedation of the child for the procedure. It was subjective score graded from 1to 5, 1 being highly satisfied and Grade 5 being highly dis-satisfied.[16]

Behaviour scores at the time of awakening was also being evaluated using a 4 point wake up score. For statistical analysis, sedation scores were categorized satisfactory (3-4) and unsatisfactory >5 as suggested by Yuen V *et al* 2008[17]

Behaviour scores were considered satisfactory (<2) and unsatisfactory (>3).

EVALUATION SCALE

Sedation Scores

1. Does not respond to mild prodding shaking
2. Responds only mild prodding or shaking
3. Responds only after is called loudly or repeatedly
4. Lethargic response to name spoken in normal tone
5. Appear asleep but respond readily to name spoken in normal tone
6. Appear alert and awake, response readily to name spoken in normal tone

Behavior Scores

1. Calm and cooperative

2. Anxious but reassurable
3. Anxious and not reassurable
4. Crying or resisting

Wake-Up Behaviour Scores

1. Calm and cooperative
2. Not calm but could be easily calmed
3. Not easily calmed, moderately agitated or restless
4. Combative, excited, disoriented

The monitored values were recorded in standard anaesthesia chart of our institute.

STATISTICAL METHOD: Data collected from study were statistically analysed with IBM SPSS 20 version. To describe about data descriptive statistics frequency analysis used, percentage analysis were used for categorical variables between the groups, percentage variable used for categorical variable for continuos variable mean and standard deviation were used. To find out the significant difference between the bivariate samples in paired groups sample T-test used for normal data and for independent variables between the groups (Dexmedetomidine and triclofos sodium) unpaired sample t-test for normal data was used. To find the significance in categorical data Chi-square test was used, In all above statistical tools the probability value <0.05 is considered as significant level.

RESULTS

The group of pateints in which intranasal dexmedetomidine was used as sedation for CT/MRI scan are labeled as group 1 and the group in which Chloral hydrate was used are labeled as group 2.Most of the cases from both groups have age between 3-9 yrs. The patients in Group 1 had mean age 5.73yrs ± 2.42 years whereas the pateints in group 2 had mean age of 5.76 ±2.19 years. The age of pateints in both group were not significantlly different (p>0.05)

Among 30 children in Group 1,16 were males and 14 females whereas in Group 2,seventeen were males and 13 females. There is no statistical significance difference between the two groups in gender distribution.

Scanning procedures done on children Group I and Group II is presented in Figure 1. In Group I, 17 CT scan and 13 MRI were done whereas in Group II, 21 CT scan and 9 MRI were done on children in the respective groups.

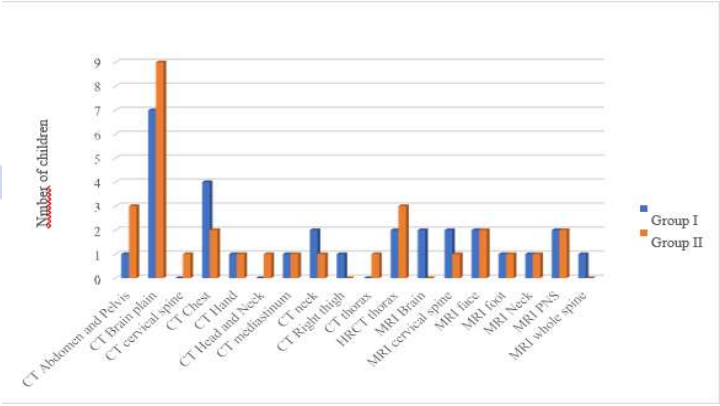

Figure 1

Comparison of sedative scores were done in both the groups at different time points. Group I had the larger sedative scores than the Group II and the difference was statistically significant ant every time point.

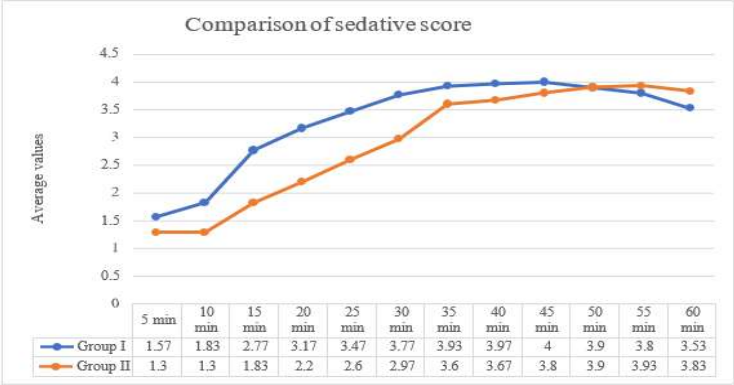

Figure 2

Comparison of behavior scores were done in both the groups at different time points. Group I had the larger behavior scores than the Group II and the difference was statistically significant ant every time point except at 30 min.

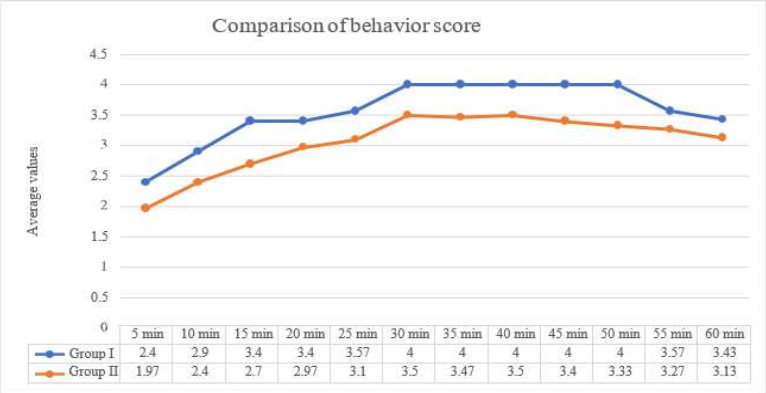

Figure 3

Wake up behavior score

Children in Group I had wake up behavior score 3.63 ∓ 0.61 whereas children in Group II had wake up behavior score 3.00 ∓ 1.02. The Group I had wake up behavior score more than the Group II and it was statistically significant.

Table 1: Wake up behavior score

Wake up behavior score	Group I	Group II	P value
Mean	3.63	3.00	
SD	0.61	1.02	**0.005**

Radiologist satisfaction score.

In Group I, radiologists were satisfied with 25(83.33%) cases whereas in Group II radiologists were satisfied with 21(70%) cases. Radiologists were more satisfied with Group I than the Group II.

Table 2: Radiologist satisfaction score.

Radiologist Satisfaction Score	Group I		Group II		Total	P-value
	N	%	n	%		
Satisfied	25	83.33	21	70	46	0.222
Not Satisfied	05	16.67	09	30	14	
Total	30	100	30	100	60	

DISCUSSION

To the best of our knowledge,this is one amongst the initial trial comparing the efficacy of oral triclofos and intranasal dexmeditomidine in parallel for procedural sedation in children undergoing non operating room imaging procedures.

We concluded that intranasal dexmeditomidine provided better sedation than the oral triclofos and the difference was statistically significant at every time point. A systematic review by Poonai N *et al* reported a similar sedation efficacy of 84.1% (66.7% to 98%) using intranasal dexmeditomidine at different dosages (1–4 mcg/kg) for procedural sedation[9].

We preferred a dosage of 2 µg/kg for intranasal dexmeditomidine. Previous Studies on intranasal dexmedetomidine for sedation during medical imaging in young children suggested a dosing ranged between 2 to 4 µg/kg, without a clear difference between imaging modalities (CT: 2.5–3 µg/kg[17,19,22]; MRI: 2–4 µg/kg[18,20,21,23,24]), suggesting long duration procedure needing higher dose, whereas Jackson used a weight-based (15 kg threshold) in applied dosing strategy. An assessment of all retrieved information suggests that dose decisions for clinical protocol development depend, partially, on the level and type of efficacy/safety targeted outcome variables (effective sedation versus time to discharge and side effects). A lower dose (2 µg/kg, MRI) resulted in no side effects, with additional dosing in 40% of patients[21]. Along the same line, a 2.5 µg/kg dose (CT) resulted in the necessity of additional dosing in 33% of patients[17]. Higher doses (3–4 µg/kg) were more effective when the need for additional dosing was used as an outcome[18] but likely result in a prolonged recovery time (4.3 h)[19], as author did not document a difference in

recovery time (Aldrete score) between the 3 and 4 µg/kg groups[18].

Besides a wide range in dosing, the literature does not conclusively suggested a definitive dose for intranasal dexmedetomidine. The use of nebulization and instillation was divided proportionally among the reviewed studies. Two studies that opted for instillation concluded that nebulization is the preferable because it is assured that nebulized particles cover a larger surface area compared to nasal drops, resulting in improved bioavailability[18,21].

Studies using instillation method conclude that dexmedetomidine nasal drops being colorless, tasteless, offers no mucosal irritation symptoms, strong dose control, little physiological interference, and high acceptance among children,[19,20] so the success rate of sedation is high owing to faster absorption owing to rich capillary vascular supply of nasal mucosa, the availability of nasal drops at the site of action increases A very small amount of drug in nasal drops can reach a high blood concentration, with rapid action, high bioavailability and less toxic side effects. Studies have shown that the onset and recovery time of dexmedetomidine nasal drops are faster than chloral hydrate hence we opted nasal dripping method of administration in our study.[21]

Comparison of behavior scores showed the larger behavior and wake up behavior score scores in intranasal dexmeditomidine than the oral triclofos group and the difference was statistically significant ant every time .These finding were consistent with the previous findings of Reynolds J *et al*. who compared intranasal dexmedetomidine and oral chloral hydrate for sedated auditory brainstem response exams.[21]

The sedation with oral triclofos at times can be highly variable with sedative effects for up to 24 h[18]. This wide variability in the duration of sedation might be due to the erratic gastric absorption and the unclear mechanism of action of the drug.

Although oral triclofos is a time-tested drug, its efficacy in children is variable. It is a phosphorylated derivative of chloral hydrate (ethanol derivative). Triclofos is converted and metabolized in liver to trichloroethanol; this acts on brain and decreases time taken to fall asleep. Its oral solution is well absorbed and proves effective within 30 min in doses of 25–75 mg/kg. However its undesirable effects like salivation, vomiting, abnormal movement and delirium limits its usage[19,20]

In contrast, administration of intranasal dexmiditomidine is much more reliable, considering the smaller volume of medication and the absence of any irritant property of the drug. The effects of dexmedetomidine via the intranasal route are thought to be a consequence of the drug traversing the nasal mucosa and entering the blood stream avoiding first-pass metabolism. The other possible action is through the nose-brain pathway wherein the drug enters the CNS directly across the nasal mucosa or through the olfactory nerves[21]. These points favor the use of intranasal dexmiditomidine over orally administered triclofos. In our study also we used nasal dexmed drps and the patients were comfortable.

It is noteworthy that most of the children in our study group completed the imaging procedures successfully, In Group I, radiologists were satisfied with 83.33% cases whereas in Group II radiologists were satisfied with 70% cases.In a recent systematic review, the success rate of intranasal dexmiditomidine was shown to vary from 30 to 100% depending on the dose of the drug and type of procedures requiring sedation[10]. However, the procedure used in the present study was CT and MRI, and the overall success rate should have been lower in contrary to what we observed. One explanation could be that the children in our study group were younger and the dose used was higher compared to most of the other studies if we take the mean age into account. But a definite conclusion could only be derived from pharmacokinetics and pharmacodynamics study only, which was not a part of the present study.

In animal studies, it has been shown that dexmedetomidine is neuro-protective[30,31]. This again favors the use of intranasal dexmiditomidine as a safer alternative to chloral hydrate derivative (Triclofos).

The limitations of the present study is that blinding of investigator and participants was not possible because of the nature of interventions. However, the outcome assessor and statistician analyzing the data were blinded.

CONCLUSION

Intranasal dexmedetomidine provides better and safe sedation as compared to oral triclofos for non operating room imaging procedures of young children. However, further studies with large sample size from multiple centres needs to be conducted to strengthen the conclusions of our study.

REFERENCES

1. Barnes S, Yaster M, Kudchadkar SR (2016) Pediatric sedation management. Pediatr Rev 37:203–212
2. Gupta A, Dalvi NP, Tendolkar BA (2017) Comparison between intranasal dexmedetomidine and intranasal midazolam as premedication for brain magnetic resonance imaging in pediatric patients: a prospective randomized double blind trial. J Anaesthesiol Clin Pharmacol 33:236–24
3. Largo-Pineda CE, Arenas-Correa ID, Ángel-González GJ, Vélez-Arango JM, Calvo- Betancur VD, Arango-Zapata AN (2017) Adverse events in paediatric patients taken to magnetic resonance imaging under sedation or anaesthesia. Rev Colomb Anestesiol 45:8–14

4. Mason KP (2010) Sedation trends in the 21st century: the transition to dexmedetomidine for radiological imaging studies. Paediatr Anaesth 20:265–272
5. Subramaniam P, Girish Babu K, Lakhotia D (2017) Evaluation of nitrous oxide-oxygen and triclofos sodium as conscious sedative agents. J Indian Soc Pedod Prev Dent 35:156–16
6. Zhang W, Wang Z, Song X, Fan Y, Tian H, Li B (2016) Comparison of rescue techniques for failed chloral hydrate sedation for magnetic resonance imaging scans–additional chloral hydrate vs intranasal dexmedetomidine. Paediatr Anaesth 26:273–279
7. Krauss B, Green SM (2006) Procedural sedation and analgesia in children. Lancet 367:766–780
8. Mandell GA, Cooper JA, Majd M, Shalaby-Rana EI, Gordon I (1997) Procedure guideline for pediatric sedation in nuclear medicine. Society of Nuclear Medicine. J Nucl Med 38:1640–1643
9. Poonai N, Spohn J, Vandermeer B, Ali S, Bhatt M, Hendrikx S *et al* (2020) Intranasal dexmedetomidine for procedural distress in children: a systematic review. Pediatrics 145:e2019162
10. Zhang Y, Zhang R, Meng HY, Wang MX, Du SZ (2020) Efficacy and safety of intranasal dexmedetomidine premedication for children undergoing CT or magnetic resonance imaging: a systematic review and meta-analysis. Zhonghua Er Ke Za Zhi 58:314–318
11. American Society of Anaesthesiologists physical status classification. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3106380/. Accessed 28 Jul 2022
12. Validation of the Pediatric Sedation State Scale | American Academy of Pediatrics. https://pediatrics.aappublications.org/content/139/5/e20162897. Accessed 7 Aug 2022
13. Hattori Y, Fukatsu H, Ishigaki T (2007) Measurement and evaluation of the acoustic noise of a 3 Tesla MR scanner. Nagoya J Med Sci 69:23–28
14. Cozzi G, Monasta L, Maximova N, Poropat F, Magnolato A, Sbisà E *et al* (2017) Combination of intranasal dexmedetomidine and oral midazolam as sedation for pediatric MRI. Paediatr Anaesth 27:976–977
15. Behrle N, Birisci E, Anderson J, Schroeder S, Dalabih A (2017) Intranasal dexmedetomidine as a sedative for pediatric procedural sedation. J Pediatr Pharmacol Ther 22:4–8
16. Baier NM, Mendez SS, Kimm D, Velazquez AE, Schroeder AR (2016) Intranasal dexmedetomidine: an effective sedative agent for electroencephalogram and auditory brain response testing. Paediatr Anaesth 26:280–285
17. Tug A, Hanci A, Turk HS, Aybey F, Isil CT, Sayin P *et al* (2015) Comparison of two different intranasal doses of dexmedetomidine in children for magnetic resonance imaging sedation. Paediatr Drugs 17:479–485
18. Chokshi AA, Patel VR, Chauhan PR, Patel DJ, Chadha IA, Ramani MN (2013) Evaluation of intranasal Midazolam spray as a sedative in pediatric patients for radiological imaging procedures. Anesth Essays Res 7:189–193
19. Knoester PD, Jonker DM, van der Hoeven RTM, Vermeij TAC, Edelbroek PM, Brekelmans GJ *et al* (2002) Pharmacokinetics and pharmacodynamics of midazolam administered as a concentrated intranasal spray. A study in healthy volunteers. Br J Clin Pharmacol 53:501–50
20. Jung SM (2020) Drug selection for sedation and general anesthesia in children undergoing ambulatory magnetic resonance imaging. Yeungnam Univ J Med 37:159–168
21. Reynolds J, Rogers A, Capehart S, Manyang P, Watcha MF (2016) Retrospective comparison of intranasal dexmedetomidine and oral chloral hydrate for sedated auditory brainstem response exams. Hosp Pediatr 6:166–171
22. Sulton C, Kamat P, Mallory M, Reynolds J (2020) The use of intranasal dexmedetomidine and midazolam for sedated magnetic resonance imaging in children: a report from the Pediatric Sedation Research Consortium. Pediatr Emerg Care 36:138–142
23. Kim HJ, Shin WJ, Park S, Ahn HS, Oh JH (2017) The sedative effects of the intranasal administration of dexmedetomidine in children undergoing surgeries compared to other sedation methods: a systematic review and meta-analysis. J Clin Anesth 38:33–39
24. Iirola T, Vilo S, Manner T, Aantaa R, Lahtinen M, Scheinin M *et al* (2011) Bioavailability of dexmedetomidine after intranasal administration. Eur J Clin Pharmacol 67:825–831
25. Yuen VM, Irwin MG, Hui TW, Yuen MK, Lee LHY (2007) A double-blind, crossover assessment of the sedative and analgesic effects of intranasal dexmedetomidine. Anesth Analg 105:374–380
26. Fantacci C, Fabrizio GC, Ferrara P, Franceschi F, Chiaretti A (2018) Intranasal drug administration for procedural sedation in children admitted to pediatric Emergency Room. Eur Rev Med Pharmacol Sci 22:217–222
27. Kogan A, Katz J, Efrat R, Eidelman LA (2002) Premedication with midazolam in young children: a comparison of four routes of administration. Paediatr Anaesth 12:685–689
28. Liu H, Sun M, Zhang J, Tian Q, Yu Q, Liu Y *et al* (2019) Determination of the 90% effective dose of intranasal dexmedetomidine for sedation during electroencephalography in children. Acta Anaesthesiol Scand 63:847–852
29. Chen H, Yang F, Ye M, Liu H, Zhang J, Tian Q *et al* (2020) Intranasal dexmedetomidine is an effective sedative agent for electroencephalography in children. BMC Anesthesiol 20:61
30. FDA Drug Safety Communication: FDA review results in new warnings about using general anesthetics and sedation drugs in young children and pregnant women. FDA, 2019. https://www.fda.gov/drugs/drug-safety-and-availability/fda-drug-safety-communication-fda-review-results-new-warnings-about-using-general-anesthetics-and. Accessed 20 Aug 2022
31. Koo E, Oshodi T, Meschter C, Ebrahimnejad A, Dong G (2014) Neurotoxic effects of dexmedetomidine in fetal cynomolgus monkey brains. J Toxicol Sci 39:251–262

Source of Support: None Declared
Conflict of Interest: None Declared