Intranasal dexmedetomidine for paediatric sedation for diagnostic magnetic resonance imaging studies

INTRODUCTION

Children undergoing radiological imaging studies often require sedation to avoid panic episodes and motion artifacts. According to the literature, up to 10% of all Magnetic Resonance Imaging (MRI) examinations cannot be completed or even started because of claustrophobia.[1] When medicamentous sedation for MRI is desired, Benzodiazepines are used in most MRI centres.[1] Dexmedetomidine (DEX) is a highly selective α2 adrenoceptor agonist that has sedative and analgesic effects. Intranasal DEX has shown to provide effective sedation when used prior to anaesthetic induction as premedication.[2]

Intravenous DEX has been shown to provide a reliable and effective sedation to children undergoing diagnostic computed tomography imaging studies.[3] Our prospective, Quasy experimental, pilot study aims to determine whether intranasal DEX 2 μgkg^{-1} offered effective sedation in children posted for diagnostic MRI studies.

METHODS

The study was approved by institutional ethics committee and written informed consent was taken from the parents/guardian of children, aged up to 10 years prior to MRI procedure. Standard NPO guidelines were followed. Exclusion criteria were: Age >10 years, General contraindications for MRI (i.e. cardiac pacemakers, neurostimulators, ferromagnetic implants etc), known allergy to DEX, presence of otorhynological diseases and children with major respiratory and cardiac diseases.

After securing venous access, all patients were administered with intranasal DEX 2 μgkg^{-1} using tuberculin syringe in the presence of parents, 30 minutes before scheduled MRI scan. The time of administration and reaction of children were noted. To avoid inter observer's bias, same anaesthesiologist was involved in all the assessments. Children were observed in the holding area with standard monitors applied. The degree of sedation was assessed at 15 and 30 minutes by using University of Michigan Sedation Scale (UMSS) [Appendix 1].[4] A sedation score of 2 and above was considered satisfactory. At 30 minutes, the child was separated from its parent and was taken to the procedure room. The response to the child- parent separation was noted. Children with scores less than 2 and children with sedation scores more than 2 who became uncooperative during the procedure were labeled as failed cases and received rescue sedation in the form of intravenous midazolam in titrated doses. MRI image quality of each examination was assessed using the following five grade scale: Grade 0 or 1: Was applied if the examination was of no or very little diagnostic usefulness because of extensive motion artifacts. Examination classified as grade 2: Allowed us to make the diagnosis, but some motion artifacts were still present. Examinations graded as 3 and 4: Included a good or excellent image quality, with no or almost absent motion artifacts. Recovery time and recovery score were noted according to Modified Aldrete recovery score.[5]

RESULTS

Twenty eight children between age group one month to ten years received DEX as per above protocol for diagnostic MRI studies, with average weight 10.7±7.8 kgs. Majority of MRI studies consisted of Brain Imaging; only 2 examinations were for imaging

Appendix 1: University of michigan sedation scale	
0	Awake and alert
1	Minimally sedated: Tired/sleepy, appropriate response to verbal conversation and/or sound
2	Moderately sedated: Somnolent/sleeping, easily aroused with light tactile stimulation or a simple verbal command
3	Deeply sedated: Deep sleep, arousable only with significant physical stimulation
4	Unarousable

of the abdomen. Mean sedation scores after 15 minutes and after 30 minutes were 1.17±1.6 and 2.60±0.9 respectively. Mean discharge time according to modified Aldrete score was 81.39±33.76 minutes. Among 28 children, 11 children had to be supplemented with intravenous midazolam and were deemed as failed cases indicating success rate of 60%. There were no adverse events of any kind [Table 1]. No sneezing or coughing episodes were observed during drug administration. All the children accepted parental separation well. Average screening image timing was 11 minutes.

DISCUSSION

A short-half life of DEX makes it easier to titrate and has less sedation related adverse events. Sedative effects of DEX are well documented when given as intravenous bolus, continuous infusion, or Intramuscular injections.[6]

In a study of buccally administered DEX the clinical sedative effect attained at 1.5±0.2 hours and the bioavailability was 82%.[6] It is likely that the bioavailability of intranasally administered DEX is similar, as both routes involve absorption via a mucous membrane.

When Intranasal DEX of 1 μgkg^{-1} was used for premedication in children, the median onset time of sedation was 25 minutes and the median duration was 85 minutes.[7] Mark D talon *et al*. found that Intranasal DEX (2 μgkg^{-1}) has an onset of action of approximately15 minutes when administered with a meter-dozed atomizer.[2] Bioavailability of atomized sprays has been found superior to administration by drops into the nose.[8] In our study scan was performed 30 minutes after drug administration.

MRI scanning requires a paediatric patient to be completely still for more than ten minutes. Mason *et al*. in their pilot study for paediatric sedation for CT studies using intravenous DEX 2 μgkg^{-1} concluded that DEX may provide a reliable and effective method of providing sedation.[3] In our study, we used intranasal DEX 2 μgkg^{-1} and no adverse events of any kind were noted. 40% of the children required rescue sedation in the form of intravenous midazolam.

Table 1: Demographic and performance characteristics of DEX

Age	1 month - 10 years
Weight (kg)	10.7±7.8
UMSS score after 15 minutes	1.17±1.6
UMSS score after 30 minutes	2.60±0.9
Discharge time (minutes)	81.39±33.76
Rescue sedation	11 cases

The limitations of this study are: Number of children recruited was small, observation period was less, no age wise comparison and dose–response relationships were not considered.

In conclusion, in an organized setting DEX may be useful agent for sedation of children undergoing MRI studies. Use of meter-dozed Atomizer device or concurrent use of Benzodiazepines may enhance the success rate. Further dose finding, large scale studies using Intranasal DEX for MRI examination should be explored.

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DOI: 10.4103/0019-5049.104588