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Prolonged pre-procedure fasting time is unnecessary when using titrated intravenous ketamine for paediatric procedural sedation

Greg Treston
Emergency Department, Royal Darwin Hospital, Darwin, Northern Territory, Australia

Abstract

Background: Paediatric procedural sedation (PPS) is a common procedure in most general EDs. Many departmental guidelines suggest mandatory fasting times for children undergoing PPS, in an attempt to decrease the incidence of postoperative vomiting and (theoretically) aspiration pneumonitis, despite there being little or no evidence in the literature to support these mandatory fasting times.

Objectives: To prospectively address the relationship between preprocedure fasting time and intraprocedure or postprocedure vomiting in children aged 1–12 years undergoing procedural sedation with intravenous ketamine in the ED.

Methods: From January 1999 to May 2000 all children presenting to the Royal Darwin Hospital Emergency Department with a condition requiring ketamine PPS were enrolled for data collection after parental consent was obtained. Titrated intravenous ketamine was administered via protocol. Prospective ED procedural sedation data collection forms of 272 consecutive cases of titrated intravenous ketamine sedation were reviewed.

Results: Fasting time was accurately recorded on 257 (95%) data collection forms. There was no intraprocedure vomiting. Overall rate of postprocedure vomiting was 13.9%. No statistically significant association between decreased fasting time and increased incidence of vomiting was found. In fact, there was a trend towards increased incidence of vomiting with increased fasting time ($P = 0.08$). The rate of vomiting of those children fasted 3 h or greater preprocedure (20/127 or 15.8%) was over twice the rate of those fasted less than 1 hour (2/30 or 6.6%). Incidence of vomiting was significantly associated with increasing age ($P = 0.0007$). No clinically evident aspiration pneumonitis occurred.

Conclusion: Prolonged preprocedure fasting time did not reduce the incidence of postprocedure vomiting in this case series; to the contrary there was a increased incidence of vomiting with longer fasting times ($P = 0.08$). There was an increase in postprocedure vomiting with increasing age of the patients.

Key words: *emergency department, fasting, ketamine, paediatric, procedural sedation.*

Correspondence: Dr Greg Treston, Staff Specialist, Emergency Department, Redcliffe Hospital, Anzac Avenue, Redcliffe, Queensland, 4020, Australia. Email: greg_treston@health.qld.gov.au

Greg Treston, BMedSci, MBBS, DTMH(Lon), DIMCRCS(Ed), FACRRM, FACEM, Acting Director of Emergency Medicine.

Conflicts of interests: None

Introduction

Since the 1960s, Ketamine has been used widely as a sedative and anaesthetic agent.[1–11] Despite its widespread safe use in developing and undeveloped countries for more than 30 years, ketamine for paediatric procedural sedation remains infrequently used in many Australian EDs.[2,12,13] Reasons for this include fears of 'emergence delirium', aspiration pneumonitis in unfasted patients, laryngospasm, or over-sedation, as well as the perception by some that 'it's an anaesthetic drug for anaesthetists'.[14]

At the Royal Darwin Hospital Emergency Department the author and an emergency physician colleague developed a set of ED guidelines for the use of intravenous (IV) ketamine for paediatric procedural sedation, drawing on past experience with ketamine, and extensive literature review. Intravenous ketamine was established as the preferred agent for ED paediatric procedural sedation, and rapidly became popular with ED medical and nursing staff for that indication. It was decided to prospectively record the outcomes of all paediatric patients receiving intravenous ketamine by our departmental protocol in the ED for a period of 16 months, specifically looking for any complications or adverse outcomes that would shed light on the 'mythology' of ketamine use in the ED. Specifically, the focus of this data collection was to document the incidence of vomiting in paediatric patients receiving intravenous ketamine for procedural sedation, and the relationship of age and fasting status to incidence of vomiting.

Methods

From January 1999 to April 2000 eligible paediatric patients aged 1–12 years who required procedural sedation in the ED were prospectively enrolled. Eligible patients were identified upon presentation to the triage desk, and topical local anaesthetic cream (EMLA) was applied to intact skin over the planned site of IV access. The procedure was explained to the parent or caregiver, as was the likely effect of ketamine on the child. Verbal informed consent for the procedure was obtained from the parent or caregiver. Past medical history and fasting time were established and recorded. The child was weighed, and baseline observations of pulse rate, SaO_2, and respiratory rate were recorded on a standard data collection form. Ketamine (Ketalar, Ketamine HCl, Parke-Davis Ltd, Auckland, NZ) was drawn up as outlined in the ED protocol, and all necessary equipment for the procedure assembled. Paediatric resuscitation equipment was sited at the end of the bed for use if needed. An IV line was sited using the anaesthetized site, and procedural staff assembled. Staff included one nurse, one procedural physician (being an intern, resident medical officer, or registrar), and one supervising emergency physician or registrar skilled in advanced airway management of the paediatric patient. Parents were encouraged to be present for the procedure.

Oxygen 4–6 L/min via paediatric Hudson mask was commenced (if tolerated), and IV ketamine given as per protocol, commencing with 0.5–1.0 mg/kg. Pulse, respiratory rate and SaO_2 were recorded every 5 min for the duration of the procedure, and every 10 min during recovery. Patients were monitored for the occurrence of vomiting, apnoea, O_2-desaturation, seizure (or fitting/myoclonic movements), crying or delirium on emergence from sedation, hypersalivation and stridor. Patients were recovered in the normal 'walking wounded' area of the ED, with no use of a 'quiet, dark room'. Recovery was considered sufficient when the child could sit unaided, could converse as per normal (if of a verbal age) with parents, and/or could walk unaided. Parents were asked to complete a standardized questionnaire regarding the procedure, as was the emergency medical officer performing the procedure. The child was only discharged from the ED when recovery was sufficient (as outlined previously), and the parents were happy to take the child home. Time of discharge and time of clinical full recovery were noted on the data collection form.

All data collection forms were retained, and the results collated using Microsoft Excel, and stastical analysis performed by Mann–Whitney *U*-test and Cramer's *V*-test.

As the data collection utilized the ED's pre-existing procedural sedation protocol and involved no change in the treatment process, no ethics committee approval was sought.

Results

Completed prospective data collection forms were available for 272 consecutive patients. Of the 272 patients in the study group, 173 were male and 99 were female. Age groups were as noted in Fig. 1. The indications for procedural sedation are shown in Table 1.

Of the 272 patients, accurate fasting time data was recorded in 257 (95%). Of those 257 children, 30 (12%)

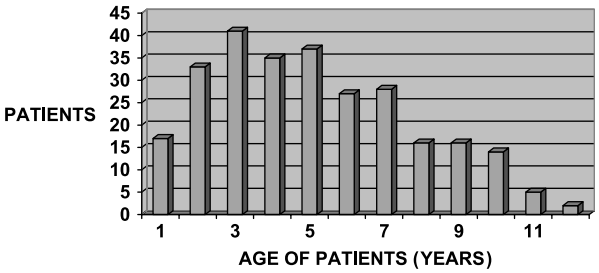

Figure 1. Age range of patient cohort.

Table 1. Indication for procedural sedation

Indication	*n* (%)
Laceration repair	135 (49.6)
Fracture reduction	76 (27.9)
Change of plaster	3 (1.1)
Removal of foreign body	30 (11)
Dressing change	17 (6.25)
Incision of abscess	8 (2.9)
Other	3 (1.1)

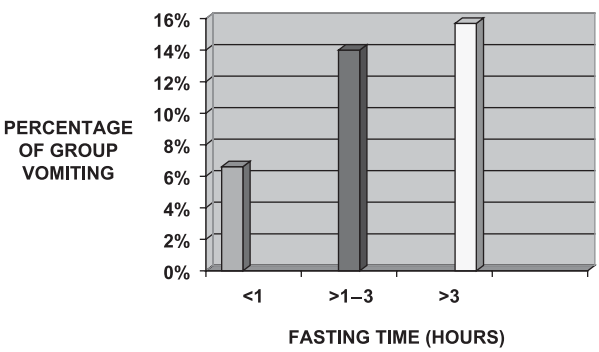

Figure 2. Incidence of vomiting related to fasting status.

were fasted for 1 h or less, 100 (39%) were fasted for 1–2 h, and 127 (49%) were fasted for 3 h or greater.

Incidence of vomiting relative to fasting status

Percentages of each fasting group who vomited at the end of the procedure are shown in Figure 2. Of children fasted longer than 3 h, 2–3 h and 1 h, 15.7% (20 of 127), 14% (14 of 100) and 6.6% (2 of 30) vomited postprocedure, respectively. There was a non-significant trend to increased incidence of vomiting with increased fasting times ($P = 0.08$, Cramer's V-test).

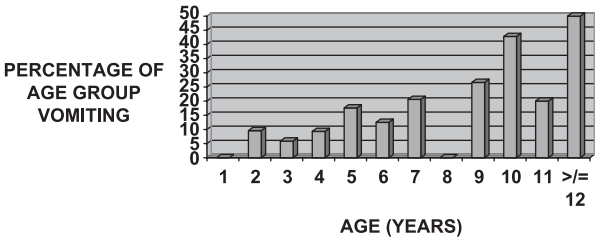

Figure 3. Incidence of vomiting related to age of patients.

Incidence of vomiting relative to age of child

Vomiting was more frequent in older children, with observed frequency of vomiting in each age group shown in Figure 3. There was a linear increase in rates of vomiting as age of the patients increased, with 0% of 1-year-olds, 20.6% of 7-year-olds, and 50% of those aged 12 years, vomiting. Analysis using the Mann–Whitney U-test for increasing age related to increased incidence of vomiting resulted in a tied P-value of 0.0007.

Incidence of vomiting relative to dose of ketamine

The average dose of ketamine used was 1.25 mg/kg. Vomiting was not related to dose of ketamine, being the same (1.25 mg/kg) in those who experienced vomiting postprocedure and in those who did not.

Discussion

Paediatric minor orthopaedic and surgical procedures present a great challenge to the ED. The child is confused and frightened, the parents often distraught, and the ED environment usually busy and impersonal, despite everyone's best efforts. It is well documented that physicians underestimate and undertreat children in pain.[15–19]

As well, failure to provide adequate analgesia and sedation to a suffering child has been labelled 'substandard and unethical medical practice.[19] Many techniques have been used to facilitate minor procedures: from 'brutacaine',[20] fentanyl or midazolam intravenously, intramuscularly, or via most available orifices,[21–23] nitrous oxide,[24,25] phenergan or Vallergan (either as sole agents or in 'cocktails'), and ketamine via a variety of routes and with a variety of adjunctive medications.[1–7,10,11,20,21,26]

Safe procedural sedation is a requisite skill for emergency physicians,[27] and IV ketamine is used for a number of reasons. First, it is considered that IV access is a very safe adjunct in a sedated paediatric patient, should any problems arise, it is comforting to have secure IV access. Intravenous access is recommended by the Australasian College for Emergency Medicine, American College of Emergency Physicians, American Society of Anaesthetists, and the American Academy of Pediatrics in paediatric procedural sedation,[28–31] and by the Australian and New Zealand College of Anaesthetists for any patient undergoing procedural sedation.[32] Second, IV agents give us the luxury of titrating doses of ketamine to achieve a desired end-point of sedation/analgesia, a widely recommended practice.

Ketamine's safe use in thousands of patients has been widely reported, making it a good choice for procedural sedation in the hands of nonanaesthetists.[1–7,10,11,33,34] The intravenous dose of ketamine used in previous studies varies widely (from 0.25 to 11 mg/kg), but more recent studies consistently use a lower dose than older studies. Our guidelines for ketamine use allowed the treating physician to adjust the dose as necessary for the procedure, while minimizing the total dose used, in an effort to decrease any dose-related side effects.

Vomiting is said to occur in 0–33% of paediatric patients given ketamine (usually with midazolam and/or atropine) for minor procedures.[7] Our figure of 13.9% is not unusual and is in line with many recent reports of both small[4,5] and larger[6,35] studies. What is of interest is that in our patients, vomiting was related to neither dose of ketamine (average of 1.25 mg/kg in both vomiting and non-vomiting patients), nor a shorter fasting time. Indeed, 30 patients were fasted for < 1 h and 100 for < 3 h, with rates of vomiting of 6.6% and 14%, respectively. There were 127 patients fasted for ≥ 3 h, with a rate of vomiting of 15.8%. In a busy ED where timely turnover of patients is needed to keep the department functioning smoothly, the need for a 6–8 h fasting time would exclude almost all paediatric patients from ketamine procedural sedation (indeed any form of deep sedation), as patients would occupy a treatment cubicle for many hours prior to sedation.

Most other ED-based ketamine studies note that while vomiting may occur, aspiration rarely occurs, if at all.[6,7,10,27,36] Clinically evident aspiration is said to occur with a frequency of one in 373 in 'emergency' paediatric anaesthesia cases,[37] most if not all, of which have had a 4–6 h period of fasting prior to the procedure. There is no evidence that a decreased fasting time results in an increased incidence of aspiration pneumonitis when using ketamine for paediatric procedural sedation,[27,37,38] and there is some evidence from pooled data[7] that a fasting time greater than 4 h results in an increase in the rate of emesis, from 7% to 12%. Interestingly this data mirrors our finding that the rate of emesis in our study group increased from 6.6% in those fasted < 1 h to 15.8% in those fasted ≥ 3 h. When using ketamine sedation, airway reflexes are preserved, further reducing the risk of aspiration. There is evidence to suggest that, even with general anaesthesia, there may be less postprocedure vomiting with a decreased preprocedure fasting time.[39–41]

With this in mind we chose to record the fasting time, rather that enforcing an arbitrary fasting time. None of the patients in our study who vomited experienced any desaturation, nor was there any clinical evidence of aspiration syndrome (cough, audible wheeze, O_2-desaturation or respiratory distress). Most children simply sat up, stated they felt dizzy or 'funny', and then vomited once into a waiting emesis bowl, after which they resumed conversing and/or interacting with parents, apparently little disturbed by the recent vomiting. In no case was the vomiting during the therapeutic procedure, nor was suctioning of the oropharynx needed. Parents were warned that vomiting might occur, so when it did they were quite accepting of this. In short, while vomiting did occur in 13.9% of patients, it was short-lived, occurred in the recovery period, and resulted in no change in the treatment process.

These results should be viewed in comparison to the expected rate of post-general anaesthesia (GA) vomiting for paediatric ambulatory or day surgery. Various rates of post-GA vomiting have been recorded, from 4%[42] to 50%,[43] although it is noted that the referenced study with low rate of post-GA vomiting excluded vomiting in the recovery room (occurring in 15%) as a complication! Two large studies involving paediatric anaesthesia were noted to report rates of postoperative vomiting of 35% of 989 day-surgery patients[44] and 30% of 29 220 patients.[45] It would appear that our rate of 13.8% is less than half the accepted and published rate of postprocedure vomiting for ambulatory paediatric anaesthesia, making ketamine sedation an attractive option to GA if the sole aim is to reduce emesis.

Postoperative vomiting is also known to be related to both obesity and prolonged duration of anaesthesia,[46]

neither of which is common with paediatric procedural sedation with IV ketamine. According to the American Society of Anaesthesiologists 'there is insufficient published evidence to address the safety of any perioperative fasting period'.[38] Despite this, lengthy preoperative fasts are recommended prior to any form of procedural sedation. Most cases of aspiration from large series[37] occurred during laryngoscopy or during intubation, neither of which is performed during procedural sedation when using intravenous ketamine in the ED, casting doubt on the applicability of such recommendations to emergency physicians.

Conclusion

Vomiting occurred in 13.9% of patients in our study. There was an age-related increase in the incidence of vomiting after procedural sedation with IV ketamine ($P = 0.0007$). Vomiting occurred exclusively in the recovery period, never during the procedure, and resulted in no change in the treatment process. No clinically detectable aspiration occurred, no airway manoeuvres nor oropharyngeal suctioning were required secondary to vomiting. In this study a shorter fasting time was associated with a statistically non-significant decreased incidence of vomiting ($P = 0.08$). Titrated intravenous ketamine is an excellent choice of sedation for the paediatric patient in the ED: logic, common sense and outcome-based evidence should guide its use, rather than 'medical mythology' and dogma restrict its use.

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