PREMEDICATION IN HYPERIRRITABLE CHILDREN USING SUBANAESTHETIC DOSES OF INTRAMUSCULAR KETAMINE

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ABSTRACT

This study was conducted to highlight the role of intramuscular Ketamine in subanaesthetic doses as a premedicant in highly uncooperative children. Forty children between 1-7 years of age with the highest anxiety level as assessed pre-operatively, were divided into two equal groups. Children in group 'A' received 2 mg/kg and those in group 'B' received 4 mg/kg of intramuscular ketamine, 10 min before induction of anaesthesia. The degree of sedation was observed after 5 min and their response to separation from parents and response to venepuncture was assessed. They were also observed for their post-operative state. It was observed that the children in group 'B' had uniform and predictable sedation (100%) compared to 75% in group 'A'. Response to separation and intravenous access in group 'B' was more favourable (100%) compared to 65% and 75% respectively in group 'A'. Induction and recovery were smooth in both the groups. No incidence of emergence delirium was recorded in any group. It is concluded that preanaesthetic medication and route of administration in infants and young children should be individualised based on their different anxiety levels. Intramuscular ketamine in subanaesthetic dose of 4 mg/kg, is found to be an ideal premedicant in irritable and uncooperative group of paediatric patients.

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KEY WORDS: Intramuscular ketamine; Paediatric anaesthetic premedication.

Introduction

The well established goals of premedication include sedation, anxiolysis, amnesia, analgesia, antiemesis and antisialogogue effects. Oral premedication in a hypersensitive child can be more difficult than to induce GA. Older infants and small children become concerned about parental separation and strangers [1]. The most distressing event of the preoperative period is the moment of parting between the small frightened child and his equally upset parent. Traditional dosage of sedative drugs is based on weight of the child when it is their emotional condition that is being treated [2].

In regard to sedation, the concept must be accepted that each child has different fears and different anxiety levels. We should look the hyperanxious children so that they must be accorded special treatment. Psychic trauma of stormy induction can have lasting postoperative behavioral effects [3,4]. An attempt has been made to assess the role of subanaesthetic dose of intramuscular ketamine in hyperirritable children as a premedicant.

Material and Methods

After informed consent from the parents, 40 children between 1-7 years of age, weighing between 7-21 kg, in ASA physical status I and II were selected as follows. During pre-anaesthetic examination, their anxiety levels and behavior patterns were esti-

mated and recorded in a scale 0 to 3 as follows:-

Scale 0 - Relaxed, responsive, plays with others.

Scale 1 - Slight restless, cries on parental separation, satisfied when entertained.

Scale 2 - Quite restless, avoids attendants, resists examination.

Scale 3 - Cries, thrashes, completely unco-operative.

Children belonging to the anxiety levels of scales 2 and 3 were selected for the study and randomly allocated into two groups of 20 each. Patients were allowed clear fluids until 2 hours pre-operatively and mothers were permitted to be with them in the pre-operative room. About 10 min prior to induction, patients in groups 'A' were given intramuscular injection of 2 mg/kg of ketamine and those in group 'B' were given 4 mg/kg of ketamine, using 25 gauge needle.

All children were monitored with the pulse oximeter (Ohmeda RGM 5250) alongwith the respiratory rate every 1 min for 5 min and observed for signs of upper airway obstruction. Degree of sedation after 5 min was graded by using sedation scale (Table 1). Response to separation from parents and response to venepuncture was also evaluated (Table 1). After venepuncture intravenous atropine 20 µg/kg was given. Anaesthesia was induced with slow intravenous injection of 2.5% thiopentone determined by the loss of eyelash reflex. Following a dose of suxamethonium (1 mg/kg), laryngoscopy was done after assessing the salivary secretions trachea was intubated. Anaesthesia was maintained with nitrous oxide in oxygen and halothane, injection vecuronium and controlled ventilation. Residual neuromuscular block was reversed with appropriate dose of neostigmine and atropine. No analgesic was given intraoperatively and halothane titrated accordingly.

In the recovery room patients were observed for emergence phenomena, responsiveness after 15 min, emotional state and need for airway support.

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TABLE 1
Evaluation scales and data

	Group 'A'	Group 'B'
Sedation scale		
1. Barely arousable, needs shouting/shaking	0	5 (25%)
2. Asleep, arouses with soft voice or light touch	1 (5%)	11 (55%)
3. Sleepy, less active	14 (70%)	4 (20%)
4. Awake	4 (20%)	0
5. Agitated	1 (5%)	0
Response to separation		
1. Calm	13 (65%)	20 (100%)
2. Apprehensive	5 (25%)	0
3. Crying	2 (10%)	0
4. Thrashing	0	0
Response to venepuncture		
1. No response	8 (40%)	17 (85%)
2. Winced	7 (35%)	3 (15%)
3. Whimpered	4 (20%)	0
4. Cried	1 (5%)	0
Post-operative sedation score		
1. Asleep	1 (5%)	3 (15%)
2. Drowsy	3 (15%)	10 (50%)
3. Awake and calm	11 (55%)	6 (30%)
4. Distressed/Crying	5 (25%)	1 (5%)

Results

Both the groups were similar with respect to age, weight and duration of anaesthesia (Table 2). Vital parameters after the injection of ketamine were maintained within the normal limits in both the groups. There was no evidence of upper airway obstruction in any patient. Most of the patients who initially whimpered during the injections of ketamine, were found to be calm and co-operative by about 3 min. Degree of sedation after 5 min was assessed (Table 1). 100% of patients in group 'B' were found to be sleepy/barely arousable with intact respiration, compared to 75% in group 'A'. One patient (5%) in group 'A' was found to be agitated.

TABLE 2
Demographic data and duration of anaesthesia (Mean $\pm$ SD)

	Group 'A'	Group 'B'
Age (Years)	4.6 $\pm$ 1.3	4.4 $\pm$ 1.7
Weight (Kg)	16.2 $\pm$ 2.8	18.4 $\pm$ 3.6
Duration of Anaesthesia	44 $\pm$ 19.8	41 $\pm$ 16.7

Response to separation was more predictable (100%) in group 'B' as compared in group 'A' (65%). Two children (10%) in group 'A' cried during separation. Similarly, response to venepuncture was more favourable in group 'B' (100%) compared to 75% in group 'A' (Table 1). There was no evidence of excessive salivary secretions during the laryngoscopy in any group. Induction and maintenance was smooth in both the groups of patients.

In the recovery room, responsiveness after 15 min showed, 65% of patients in group 'B' to be drowsy or asleep, compared to only 20% in group 'A' (Table 1). No incidence of emergence delirium was recorded in any patient. No case of haemodynamic instability or respiratory depression was noted during post-operative period.

Discussion

It has been estimated that with no parent present and no sedation, about 50% of infants more than 7 months old and small children cry at induction [5,6]. This figure may reduce to 10-25% with the commonly used oral premedicants [7] or with the presence of parents at induction [8]. Most of the oral sedative drugs commonly used produce quite variable and unpredictable results [2]. To make this group of 10-25% of paediatric patients more receptive to GA, various drugs and their routes of administration have been tried over the years, but the search for newer drugs and better techniques are still on. Inhalational induction is the commonly preferred methods in infants and small children but this is resented by irritable and hypersensitive children despite oral sedation. Forcing a mask induction on a frightened child can have lasting psychic trauma [2-4]. Unwillingness to undress, tearfulness, difficulty in separating from parents may be followed by autonomic hyperactivity, dysrhythmias, breath holding, hypersalivation and larygospasm underline initial effects of anaesthesia [1].

The ideal pre-anaesthetic medication for a frightened child should meet the requirement of adequate sedation, analgesia and amnesia. Drugs currently used cause respiratory depression and none provide uniform balance of sedation, analgesia and amnesia [2,10]. Hyperanxious children may be unmanageable with routine measures like reassurance, sedation etc and may need special treatment that will prevent excessive psychic shock or post-operative personality changes. To the best of the author's knowledge no separate study on hyperirritable children has been conducted so far.

Early morning sedative should not be denied that decreases pre-operative hunger, thirst and apprehension. Oral diazepam 0.2-0.3 mg/kg can be given (2), though this was not given to avoid interference in the results. Short fasting time in this study further minimises the distress on these children. Clear fluids up to 2 hours pre-operatively are found to be safe and decrease irritability [11]. In fact this oral premedication may suffice for children having anxiety scale 0 and 1.

Oral premedication in unco-operative children apart from being inadequate and slower in onset, may also have poor compliance due to unpleasant taste and child may refuse or partly spit out. Increasing the dose causes excessive and prolonged post-operative drowsiness which is not appreciated by many [12]. It is more humane to give sedating dose of ketamine by intramuscular injection than to struggle with a distressed

and crying child. Due to its quick onset of action it also overcomes the difficulty of deviation from expected time of operation. The pain and fear of injection can be partly alleviated by topical local anaesthetic cream (EMLA).

Separation from parents can be very distressing for a child. Vetter [3] was unable to show a significant difference in degree of distress at the time of pre-operative parental separation between children receiving an oral benzodiazepine premedication and those receiving a placebo. But intramuscular ketamine in subanaesthetic dose promptly sedates the child and helps in smooth separation as was evident in this study. Hannalah and Patel successfully used low dose intramuscular ketamine as premedication in those children who initially refused to co-operate with the mask induction [14]. But by that time distressed children had already undergone the trauma of parental separation and unfamiliar environment. The potential risk of post-operative personality changes also remains. On the otherhand, in this study, the hyperirritable children have already been identified at the time of pre anaesthetic check up and thus premedicated with intramuscular ketamine as the first line drug.

Intravenous atropine prior to induction is recommended as secretions in tracheobronchial tree are stimulated by ketamine and is dose related [15]. It also prevents occasional reflex bradycardia due to tracheal intubation and suctioning, traction on eye muscles and viscera apart from bradycardia due to suxamethonium and halothane [16].

Though oral ketamine premedication has been tried in children [17,18] but it has not gained popularity presumably due to bitter taste (therefore has to be mixed with cola drink with doubtful compliance), longer onset of action and larger doses required for adequate sedation, hence chances of increased salivary secretions and potential risk of laryngeal spasm. The response to venepuncture was favourable only in 50-67% of their cases with the highest dose of 6 mg/kg, compared to 100% with intramuscular ketamine of 4 mg/kg in current study.

Intravenous or intramuscular administration of subdissociative doses of ketamine in adult provide a balanced sedation without causing respiratory depression, emergence phenomenon or significant change in blood pressure and heart rate [19-21]. Similar results were found in children in this study. Added advantage of amnesia and analgesia with ketamine are of greater benefit to children intra-operatively and post-operatively. Prompt awakening in children leads to acute

discomfort. Ketamine premedication keeps the child sedated post-operatively without any respiratory depression or suppression of protective reflexes as was confirmed by this study.

In summary, intramuscular ketamine in subanaesthetic doses is found to be appropriate in selected group of hyperirritable children. In a dose of 4 mg/kg, it causes quick sedation, smooth separation and induction and adequate post-operative analgesia and sedation with active protective reflexes. A controlled study with a larger number of children will establish its efficacy as a first line premedicant in un-co-operative children. Identification of children as per their anxiety levels during preanaesthetic evaluation is stressed, in order to determine the type and dosage of premedication.

REFERENCES

1. Greenberg JA, Devis PJ. Premedication and induction of anaesthesia in paediatric surgical patients. *Anaesthesiology clinics of North America*. 1996; 14(4):781-802.
2. Smith RM. Preparing children for operation. In: *Anaesthesia for infants and children*, 4th ed. St. Louis: The CV Mosby company. 1984;87-108.
3. Beeby DG, Morgan Hughes J. Behaviour of unsedated children in the anaesthetic room. *Br J Anaesth*. 1980;52:279-81.
4. Eckenhoff JE. Relationship of anesthesia to post-operative personalities changes in children. *American Journal of Diseases in Childhood*. 1953;86:587-91.
5. Brown TCK, Mackenzie IM. Anaesthesia for infants and children. In: Prys-Robert and Brown BR, editors. *International Practice of Anaesthesia*. Vol 2, 1st ed. Oxford: Butterworth, 1996; 2/104: 1-14.
6. Mitchell V, Grange C, Black A and Train J. A comparison of midazolam with trimeprazine as an oral premedicant for children. *Anaesthesia* 1997;52:416-21.
7. Anderson BJ, Exarchos H, Leek and Brown TK. Oral Premedication in children : a comparison of chloral hydrate, diazepam, apizolam, midazolam and placebo for day surgery. *Anaesth Intens care*, 1990;18:185-93.
8. Hannalah RS and Rosales IK. Experience with parent's presence during anaesthesia induction in children. *Can Anaesth Soc J* 1983;30:286-9.
9. Barte PL, Stanley TH. Pharmacology of intravenous narcotic anaesthetics. In: Miller RD, editor, *Anaesthesia*. 2nd ed. New York; Churchill Livingstone, 1986;780-95
10. Way WL, Tower A. Pharmacology of intravenous non narcotic anaesthetics. In; Miller RD. editor. *Anaesthesia* 2nd ed. New York: Churchill Livingstone. 1986;799-808.
11. Schreiner MS, Triebwasser A and Keon TP. Ingestion of liquids compared with pre-operative fasting in paediatric out patients. *Anesthesiology* 1990;72:593-7.
12. Peter CG, Brunton JT. Comparative study of Lorazepam and trimeprazine for oral premedication in paediatric anaesthesia. *Brit J Anaesth*, 1982;54:621-3.
13. Vetter TR. A comparison of midazolam, diazepam and pla-

- cebo as oral anaesthetic premedicant in younger children. *Clin. Anaesth* 1993;5:57-9.
14. Hannalah RS, Patel RI. Low dose intramuscular ketamine for anaesthetic preinduction in young children undergoing brief out patient procedures. *Anaesthesiology*, 1989;70:598-600.
 15. Clarks RSI. Intravenous anaesthetic agents. Induction and maintenance. In: Wylie and Churchill Davidson editors. *A practice of Anaesthesia*, 6th edition. London: Edward Arnold. 1995:91-103.
 16. George M. Anaesthesia for infants and children. In: Wylie and Churchill Davidson, editor. *A practice of Anaesthesia*, 6th edition. London: Edward Arnold. 1995:673-89.
 17. Gutstein HB, Johnson KL, Heard MB, Gregory GA. Oral ketamine preanaesthetic medication in children. *Anaesthesiology*. 1992;76:28-33.
 18. Roy S, Rudra A, Ghosh BR. Oral ketamine as preanaesthetic medication in children: A dose response study. *J Anaesth. Clin pharmaco* 1994;10:277-9.
 19. Slogoff S, Allen GW, Wessels LV, Cheney DH. Clinical experience with subanaesthetic ketamine. *Anaesth Analg*. 1974;53:354-8.
 20. Liang HS, Liang HG. Minimising emergence phenomenon: Subdissociative doses of ketamine in balance surgical anaesthesia. *Anaesth Analg*. 1975;54:312-6.
 21. Sadove MS, Shdlman M, Hatano S, Ferold N. Analgesic effects of ketamine administered in subdissociative doses. *Anaesth Analg*. 1971;50:452-7.