CLINICAL REPORT

Ketodex, a combination of dexmedetomidine and ketamine for upper gastrointestinal endoscopy in children: a preliminary report

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Abstract A combination of dexmedetomidine and ketamine for upper gastrointestinal endoscopies (UGIE) was studied in 46 children aged 2–12 years over a 6-month period. Dexmedetomidine 1 μg/kg and ketamine 2 mg/kg were given as a bolus over 5 min. Heart rate (HR), mean arterial pressure (MAP), oxygen saturation (SpO_2), and sedation scores were noted before induction as baseline and then every 5 min until recovery. The duration and ease of the procedure, time to recovery, and adverse effects, if any, were also recorded. UGIE could be performed with ease in 41 of the 46 cases. The HR, MAP, and SpO_2 did not change significantly from the baseline. No airway intervention was required in any patient. There was no laryngospasm or shivering in any of the children, and one, four, and 11 children had hiccup, vomiting, and increased salivation, respectively. The Pediatric Anesthesia Emergence Delirium score was <4 in all except for two cases. The results of this case series show that this drug combination not only promises to be clinically effective but also safe for UGIE in children. Further randomized controlled trials with standard sedation protocols will be required to draw definite conclusions.

Introduction

Dexmedetomidine and ketamine have been used as a combination for procedural sedation with considerable success in the past [1–4]. We have coined the term 'Ketodex' for this drug combination and have studied its clinical effects and safety for upper gastrointestinal endoscopies (UGIE) in children.

Case report

With parental consent and approval of the Hospital Ethics committee, 46 children with American Society of Anesthesiologists (ASA) I–II, aged 2–12 years, scheduled for elective UGIE during the period from June to December 2011, were studied. An intravenous access was established in all cases after application of EMLA cream, but no premedication was given. Dexmedetomidine 1 μg/kg and ketamine 2 mg/kg were given as a bolus over 5 min. Heart rate (HR), mean arterial pressure (MAP), oxygen saturation (SpO_2), and the level of sedation (as per the Ramsay Sedation scale) [5] were recorded every 5 min until recovery. Additional ketamine 0.5–1 mg/kg was used when required. The endoscopic procedure was allowed to proceed if the sedation score was 4. Oxygen was given via nasal cannula at a rate of 3–4 l/min.

The endoscopist assessed the ease of performing the procedure as satisfactory, difficult, or impossible. The procedure was abandoned if the SpO2 fell by <90 %, and immediate airway support was provided by the attending

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anesthesiologist. Any other adverse effect, such as agitation, increased salivation, and vomiting, shivering, and/or laryngospasm, if present, was noted. The Pediatric Anesthesia Emergence Delirium (PAED) Scale [6] was used to assess any agitation at the time of recovery. A score of 4 or 5 was considered as agitation, and midazolam 0.2 mg/kg was then administered intravenously. The time to recovery based on the Steward Recovery scoring system [7] was noted, and a score of 7 was considered to be full recovery.

The data was analyzed using SPSS software (ver. 14.0; SPSS, Chicago, IL). HR, MAP, and SpO_2 were noted as the mean ± standard deviation and analyzed using two-way repeated measures analysis of variance. Comparisons were made to the baseline values, and a $p < 0.05$ was considered to indicate significance. The assessment data of the endoscopist, the recovery score, and adverse effects were recorded as percentages.

The demographic data are shown in Table 1. The mean duration of UGIE was 15 min. The endoscopist assessed the ease of procedure as satisfactory in 41 cases (89 %) and as difficult in five cases where there was slight patient movement during the procedure. Additional ketamine (0.5 mg/kg) was required in these latter five cases. Two of these five patients, aged 3 and 4 years, respectively, had a PAED score of 4. One child had hiccups which subsided with additional ketamine. There was increased salivation in 11 patients (24 %) which was suctioned out easily with the patient in the lateral position and no intervention was required. Four children had one episode of vomiting each. The SpO_2 was maintained in all children, and no major airway intervention was required in any patient. There was no laryngospasm or shivering in any case. All of the children except two had a PAED score of <4.

The HR, MAP, and SpO_2 values did not change significantly from the baseline values ($p > 0.05$), as shown in Table 2. The recovery score of 7 was achieved in a mean duration of 18 (range 12–20) min.

Table 1 Patient and procedure characteristics ($n = 46$)

Patient characteristics	Values
Age (years)	7 (2–11)
Gender (male/female)	22/24
Weight (kg)	21 (5–35)
Duration of endoscopy (min)	15 (10–20)
Ease of endoscopy (satisfactory/difficult/impossible)	41/5/0
Pediatric Anesthesia Emergence Delirium (PAED) score 4/5	2
Recovery time (min)	18 (12–20)

Data are presented as the mean with the range in parenthesis for age, weight, duration of procedure; and recovery time, and as the number for the remaining parameters

Table 2 Hemodynamic parameters

Hemodynamic parameters	Baseline	Time from beginning of procedure			
		5 min	10 min	15 min	20 min
Heart rate (bpm)	88 ± 4.8	90 ± 1.6	92 ± 3.2	90 ± 1.8	92 ± 2.8
Mean arterial pressure (mmHg)	88 ± 2.4	88 ± 4.8	88 ± 1.8	90 ± 2.8	90 ± 4.2
Oxygen saturation (SpO_2)	98 ± 1.2	96 ± 1.8	98 ± 3.8	98 ± 1.4	98 ± 1.0

Data are the mean ± standard deviation

Discussion

Upper gastrointestinal endoscopies are common but unique in children: on the one hand they require a deeper level of sedation, while on the other hand airway interventions are difficult during the procedure. In addition, most cases involve outpatients, and the procedures are performed outside the operation theater, in the gastroenterology department, many times by non-anesthesiologists. This creates a scenario where safety of the sedation protocol is of paramount importance, and early recovery with minimal side effects is most desired [8, 9].

Ketodex, a combination of dexmedetomidine and ketamine, balances the sympathoinhibitory effects of the former with the cardiostimulatory effects of the latter. In addition, it provides adequate sedation and analgesia and maintains spontaneous ventilation while concomitantly attenuating the undesirable central nervous system effects of ketamine [10].

In this case series, the level of sedation was adequate, and endoscopy could be performed in all cases without any airway intervention. There was a slight initial difficulty in 11 % of the cases where additional ketamine was required. The PAED scale, a reliable and validated method to assess the emergence delirium or agitation, was used, and there was no significant adverse effect observed. There was increased salivation in 24 % of the patients, which lead the authors to recommend that the prophylactic use of anticholinergics be considered with the use of ketodex. Other adverse effects, such as hiccups and vomiting, were also minimal in this series.

This was a preliminary series of cases, and further large randomized controlled studies are required to evaluate the safety of ketodex in comparison to the standard balanced sedation with propofol and/or benzodiazepine, opioid, among others.

Conflict of interest There is no conflict of interest identified.

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