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EMA

ORIGINAL RESEARCH

Profiling adverse respiratory events and vomiting when using propofol for emergency department procedural sedation

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Abstract

Objectives: To evaluate the rate of adverse respiratory events and vomiting among ED patients undergoing procedural sedation with propofol.

Methods: This was a prospective, observational series of patients undergoing procedural sedation. Titrated i.v. propofol was administered via protocol. Fasting status was recorded.

Results: Four hundred patients undergoing sedation were enrolled. Of these 282 (70%, 95% confidence interval [CI] 66–75%) had eaten or drunken within 6 and 2 h, respectively. Median fasting times from a full meal, snack or drink were 7 h (interquartile range [IQR] 5–9 h), 6 h (IQR 4–8 h) and 4 h (IQR 2–6 h), respectively. Overall a respiratory event occurred in 86 patients (22%, 95% CI 18–26%). An airway intervention occurred in 123 patients (31%, 95% CI 26–35%). In 111 cases (90%, 95% CI 60–98%) basic airway manoeuvres were all that was required. No patients were intubated. Two patients vomited (0.5%, 95% CI 0.0–1.6%), one during sedation, one after patient became conversational. One patient developed transient laryngospasm (0.25%, 95% CI 0–1.2%) unrelated to vomiting. There were nil aspiration events (0%, 95% CI 0–0.74%).

Conclusions: Seventy per cent of patients undergoing ED procedural sedation are not fasted. No patient had a clinically evident adverse outcome. Transient respiratory events occur but can be managed with basic airway interventions making propofol a safe alternative for emergency physicians to provide emergent procedural sedation.

Key words: *conscious sedation, emergency medicine, fasting, propofol, respiratory therapy.*

Introduction

Procedural sedation is a core competency for the emergency physician. Providing sedation and analgesia for the performance of brief, but painful procedures has become standard emergency medicine practice. By definition procedural sedation (PSA) refers to the technique of administering sedatives or dissociative agents, with

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or without analgesics, to induce a state that allows the patient to tolerate unpleasant or anxiety provoking procedures while maintaining cardiorespiratory function.[1] ED patients undergoing urgent PSA are commonly not fasted on presentation or at the time of the procedure. Furthermore holding a patient for 6 h, in an overcrowded ED, to achieve a goal of fasting time is impractical if an urgent procedure needs to be performed.

There are 16 prospective studies[2–17] that report the use of propofol in ED procedural sedation. In some the goal was to compare and contrast different agents[4–7,10,12,16] and in others it was to document objectively the depth of sedation[5,8] or amnesia.[15] Small patient numbers,[5,8–13] special paediatric populations[2,3] or specific procedure types[4,16,17] make generalizations about propofol difficult. In the USA the combined American Society of Anaesthesiology–Joint Commission on Accreditation of Healthcare Organizations (ASA-JCAHO) guidelines state all hospital sedations require an appropriately fasted patient.[1] As such this was assumed to be the rule rather than the exception unless specifically stated. A recent multicentre trial of 792 patients studied three mixed ED populations, a proportion of whom were not fasted, but drew no conclusions about the role of fasting.[14] Fasting guidelines are consensus, not evidence, based. ASA recommends at least 2 h and 6 h from last intake of fluid and food, respectively,[18] but admit to a lack of evidence regarding these conclusions. Propofol is an agent with favourable pharmacological profile for such procedures and, anecdotally, is becoming more widely used.

Our study aimed to describe the adverse event profiles of patients administered propofol in a mixed ED setting, with an expected high proportion of unfasted patients.

Methods

This was a prospective series of patients who underwent procedural sedation with propofol between September 2004 and March 2006 (20 months). Patients presenting to Redcliffe ED, Queensland with an indication for procedural sedation were prospectively enrolled into the trial. The study was approved by the Redcliffe – Caboolture Health District Ethics Committee.

Patient selection was based on the need for sedation for a brief, painful procedure. Written consent was obtained after explanation of specific risks of PSA. American Society of Anaesthesiologists Classification (ASA) system[18] was used and patients classified as ASA I (Healthy) and ASA II (Mild systemic disease) were targeted. If an ASA III patient (Severe disease but not incapacitating) was sedated out of necessity they were also enrolled. Past medical history and previous anaesthetic complications were documented. A focused airway assessment was performed with attention to mouth opening, pharyngeal visualization, neck movement, thyromental distance and dentition. Fasting status post intake of meal, snack or fluid was noted, but patients were not specifically excluded on this basis. Patients with adverse anaesthetic history or with unstable, acute medical conditions were excluded at the discretion of the treating physician. The sedation took place in a resuscitation area, with one physician for the procedure plus an emergency physician/senior medical officer to administer the sedation and monitor the patient with the assistance of an ED nurse. All patients received supplemental oxygen. Physiologic parameters recorded were end tidal carbon dioxide ($etCO_2$) monitoring, pulse oximetry, non-invasive blood pressure, heart rate, ECG rhythm and respiratory rate.[1,19]

The recommended starting dose was 0.5–1 mg propofol/kg bolus. Propofol was then titrated with boluses of 10–40 mg until enough sedation to perform the procedure was achieved. No specific guidelines regarding the use of analgesics before or during the procedure were given. No objective measurement of sedation depth was documented.

Data collection forms were completed by the nursing staff and emergency physician/senior medical officer performing the sedation and delivered to one of the investigators. Baseline physiologic observations (pulse, blood pressure, respiratory rate, oxygen saturations and $etCO_2$) were recorded at commencement and repeated three minutely during the procedure. Any adverse events, including vomiting, aspiration or respiratory depression were recorded. In addition, any interventions by the sedating physician were recorded. These included basic airway manoeuvres (chin lift or jaw thrust), assisted ventilation or intubation. Time taken for the patient to become conversational, any resedation that occurred and time until ready for discharge was documented.

The primary aims of the present study were perform a safety evaluation for using propofol in unfasted ED patients and to report any adverse respiratory events. At commencement of the study, there were no reported cases of aspiration in the literature when using propofol for procedural sedation. So it was assumed this event was rare. There are many examples in the literature of diagnostic or therapeutic applications with low adverse

Table 1. Contingency table of age and sex for 404 sedation events in 400 patients

	Male	Female	Missing data	Total
Age (years)				
≤15	55	57	0	112
16–64	117	86	0	203
≥65	38	45	0	83
Unknown	0	0	6	6
Total	210	188	6	404

There were six incomplete records where demographic information was unclear from the sedation form and could not be identified for chart review.

event rates, in the setting of a safety determination, but no reported confidence intervals (CI).[20] As such reporting a worst case scenario was our focus of interest. Using this rationale linear interpolation from a table of CI for a binomial distribution was used. A 2% upper limit for vomiting was considered acceptable and is consistent with the reported literature.[4] In order to achieve this greater than 250 unfasted patients (if one vomit occurred) was needed.

Respiratory events included respiratory rate less than 12/min, oxygen saturation less than 95%, any loss of $etCO_2$ trace or rise of $etCO_2$ greater than 10 mm Hg. Apnoea and airway intervention rates were also recorded. Apnoea was defined as any transient cessation in respiration even if this was less than the established definition of 30 s.

All information from the data collection forms was entered into Microsoft Excel. Data summaries were performed using Pivot Tables in Excel. Fasting data were grouped according to ASA guidelines so that for a patient to be adequately fasted they must not have eaten or drunken for 6 and 2 h, respectively.

Results

Data on 404 sedation episodes were collected. Two patients had failed prosthetic hip relocations and two represented after dislocating their shoulders at another time. Sex and age distribution is shown in Table 1. Predominantly ASA Classes one and two patients were suitable for PSA in the ED. A small number of Class three patients were sedated through necessity. Two hundred and eighty-nine (72.3%) were ASA Category one, 89 (22.3%) were ASA Category two and 22 (5.4%) of sedation episodes occurred in ASA Class three patients. (Four records had incomplete ASA information).The majority of sedation episodes performed in this group were for upper limb fracture reduction or shoulder relocations (see Table 2).

Table 2. Indication for procedural sedation

Indication	No. cases (%)
Fracture reduction	
Upper limb	180 (45)
Lower limb	23 (5.75)
Joint relocation	
Shoulder	94 (23.5)
Elbow	8 (2)
Hip	20 (5)
Ankle	6 (1.5)
Patella	4 (1)
Miscellaneous	
Cardioversion	6 (1.5)
I&D/wound repair	39 (9.75)
Other	20 (5)

Indication not stated in four records. I&D, incision and drainage.

The median initial propofol bolus was 0.82 mg/kg (interquartile range [IQR] 0.47–1.0 mg/kg) and total propofol dose was 1.78 mg/kg (IQR 1.0–2.3 mg/kg), comprising a median of three doses of 15 mg (IQR 9–22 mg). Opiates were given, before or during sedation episodes, in 62.5% of cases ($n = 252$) at the discretion of the treating emergency physician.

Median fasting times from a full meal, snack or drink were 7 h (IQR 5–9 h), 6 h (IQR 4–8 h) and 4 h (IQR 2–6 h), respectively. In contrast to ASA guidelines 282 (70%, 95% CI 66–75%) had something to eat within 6 h and/or drink within 2 h.

Respiratory events and basic airway interventions were common and are shown by category in Table 3. Vomiting was very uncommon. The first of two patients that did vomit was fasted; the vomit occurred during the procedure. The second patient vomited after completion of the procedure and was awake. A third patient developed transient laryngospasm unrelated to vomiting. Although the study was not powered to compare statistically the fasted and unfasted patient subgroups, there did not appear to be any excess of adverse events in either group. There were no observed aspiration events, no endotracheal intubations or laryngeal mask insertions. No unplanned inpatient admissions occurred related to sedation or recovery.

Discussion

The safety of procedural sedation with propofol, in appropriately selected patients, in the ED by trained

Table 3. Respiratory events and interventions in ASA fasted and unfasted groups

	Fasted $n = 118$ (%)	Not fasted $n = 282$ (%)	Overall $n = 400$ (%, 95% CI)
Transient apnoea	6 (5)	13 (4.6)	19 (4.7, 3–7)
Desaturation <95% SaO_2	2 (1.7)	9 (3.2)	11 (1.7, 1.5–5)
Respiratory rate <12/min	14 (11.9)	36 (12.8)	50 (12.5, 9.6–16)
Elevated $etCO_2$ >10 mm Hg	0 (0)	4 (1.4)	4 (1, 0.4–2.5)
Vomiting	1 (0.8)	1 (0.4)	2 (0.5, 0.0–1.6)
Aspiration	0 (0)	0 (0)	0 (0, 0–0.74)
Total respiratory adverse events	**23** **(19.5)**	**63** **(22.4)**	**86** **(22, 18–26)**
Basic airway manoeuvres	28 (23.7)	83 (29.4)	111 (27.8, 24–32)
Guedel/BVM	1 (0.8)	8 (2.8)	9 (2.3, 1.2–4.2)
Suctioning	0 (0)	3 (1)	3 (0.8, 0.3–2)
Total respiratory interventions	**29** **(24.6)**	**94** **(33.3)**	**123** **(31, 26–35)**

Fasting status not recorded in four records. ASA, American Society of Anaesthesiology; BVM, bag value mask ventilation.

emergency physicians is supported by a growing body of evidence.[1] There are no clinical data to support the consensus view regarding prolonged fasting before sedation as opposed to General Anaesthesia.[18,21] The acute nature of ED presentations make adherence to fixed fasting regimens of elective general anaesthesia difficult to adhere to. We strive to reduce the time our patient's are in pain and perform procedures using an individualized approach to choice of agent and sedation depth.[22]

Although clinically apparent aspiration during any form of sedation is dangerous, the incidence using propofol in the ED setting has yielded only one reported case.[23] In a recent review by Green and Krauss, vomiting (with no clinical evidence of aspiration) was reported in 0–2% of ED PSA patients. There are varying reports of the perceived risk of aspiration under anaesthesia in the anaesthetic literature – ranging from 1:978 to 1:14 139 overall, with a higher risk during emergency surgery (presumed non-fasted) – ranging from 1:373 to 1:895. Two-thirds of aspirations during general anaesthesia are said to occur during airway manipulation.[24] Such elective airway manipulation falls outside the scope of ED PSA. The endpoint of sedation in the ED should be tailored to the urgency of procedure and fasting status.[25] Some degree of responsiveness to painful stimuli, and thus protective airway mechanisms, should decrease the risk of aspiration if vomiting occurs. Furthermore these aspiration figures from the general anaesthesia literature include inhalational agents, which are known to be emetogenic. Propofol has been noted to have antiemetic properties and in theory should decrease the frequency of vomiting.[13,26] The role of adjunctive narcotics in peri-sedation emesis also needs consideration and is the focus of ongoing investigation at our institution.

Respiratory depression using propofol has been variably defined in previous studies. Overall respiratory depression rates as high as 49% in ASA Classes one and two patients[5,6,8] and 61% in the critically ill have been given.[7] Hypoxia resulted in 6–44% of sedation episodes.[2,3,5–14,16] and apnoea (for greater than 30 s) was seen in up to 22%.[16] Supplemental oxygen was not routinely applied during PSA in all studies.[11] The respiratory event rate of 21.5% in the present study is comparable with other published data. Our rate of

apnoea at 4.7% was higher than if a definition of 30 s was applied[16] (in that transient apnoea <30 s were also included but seemed appropriate in the setting of safety profiling).

Basic airway interventions in 31% exceeded respiratory events and represent physician vigilance in recognizing imminent loss of airway patency or respiratory depression. Not all the patients with apnoea had (or needed) airway manipulation. We use $etCO_2$ monitoring as a routine and this might have led to the detection of previously unrecognized subclinical respiratory depression. Although not formally measured such interventions were always brief, which supported the available literature[4,14] No clinically significant differences in either rate of respiratory events or interventions was found when comparing the fasted and unfasted groups. Anecdotally, different emergency physicians practice differently in the PSA setting; some being interventionalists (i.e. always providing chin lift), and others only intervening if the patient lost a patent airway. This may skew the results to more airway interventions than were required.

No association between fasting status and adverse events, during procedural sedation in the ED, has been found for patients receiving sedation with other agents. Agrawal *et al.* reported 1014 children (receiving either ketamine, midazolam/fentanyl, chloral hydrate or pentobarbital),[27] Roback *et al.* studied 2085 children (receiving ketamine or midazolam/fentanyl).[28] Treston reported 272 children (receiving ketamine) and has directly challenged the relationship between fasting time and emesis in that setting[29] and Babl 227 children receiving nitrous oxide.[30] The proportion of unfasted patients in those studies was 53–71%. These data are the first to look specifically at patients undergoing PSA with propofol with respect to their fasting status. Although our results do not appear to reveal any apparent increase in adverse events between fasted and unfasted patients, we recommend additional research that is adequately powered to examine these uncommon events.

The study has important limitations. It is likely that not all eligible patients were enrolled as this was a convenience sample. Although no log book was used it was uncommon that agents other than propofol were used in teenagers and adults in this department. As such no record was kept or any attempt made at comparisons with other agents. The acceptable risk of vomiting, during procedural sedation, was taken to be 2% and sample size based on this. The degree of risk an individual practitioner is willing to accept in this regard is likely to be subjective so such a safety margin may be unacceptable to some practitioners. Telephone follow up has been undertaken to assess any late complications and is the subject of a further report. Silent aspiration has not been reported and is not an issue in this population. There was no objective measurement of sedation depth during the procedure, although physicians were asked to subjectively assess sedation 'adequacy' and whether they would use this method again. Bi-Spectral analysis technology was not available. A full discussion of the controversy surrounding this is beyond the scope of the present article.

Conclusion

Our study indicates the majority of patients, undergoing PSA in the ED when it is inappropriate to delay the procedure, are unfasted if ASA guidelines applied. Currently there is no evidence that prolonged preprocedural fasting decreases the incidence of peri-procedural vomiting or aspiration. The present study provides qualified support for the belief that vomiting is rare during ED procedural sedation with propofol, and that its incidence is not increased in non-fasted patients. Respiratory events are common but transient in nature and easily managed by appropriately trained staff. Further data collection is needed to define the exact relationship between fasting and periprocedural vomiting.

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Author contributions

AB, GT and RC conceived the study and submitted the ethics application. KM performed data entry and presented the interim analysis of 250 patients in poster form at ACEM Annual Scientific Meeting 2005. AB and CM drafted the manuscript. AB performed the statistical analysis and presented the data. All authors recruited patients, ensured completeness of data forms and were responsible for administering the database. AB takes responsibility for the paper as a whole.

Competing interests

None declared.

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