ORIGINAL ARTICLE

Propofol for procedural sedation in the emergency department

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Objectives: To observe procedural sedation practice within a district general hospital emergency department (ED) that uses propofol for procedural sedation.

Methods: Prospective observation of procedural sedation over an 11 month period. Patients over 16 years of age requiring procedural sedation and able to give informed consent were recruited. The choice of sedation agent was at the discretion of the physician. The following details were recorded on a standard proforma for each patient: indication for procedural sedation; agent used; depth and duration of sedation; ease of reduction; use of a reversal agent; complications and reasons for delayed discharge from the ED.

Results: 48 patients were recruited; propofol was used in 32 cases and midazolam in 16 cases. The median period of sedation was considerably shorter in the propofol group (3 vs 45 min) but this did not confer a shorter median time in the ED (200 vs 175 min). There were no documented cases of over-sedation in the propofol group; however, four patients in the midazolam group were over-sedated, three requiring reversal with flumazenil. There were no other significant complications in either group. There was no difference in the median depth of sedation achieved or ease of reduction between the two groups.

Conclusions: Propofol is effective and safe for procedural sedation in the ED. Propofol has a considerably shorter duration of action than midazolam, thereby shortening the period of sedation.

The aim of procedural sedation is to enable painful procedures to be performed safely and effectively with minimal discomfort to the patient. It is important that the depth of sedation is controlled to achieve these aims without compromising the patient's airway or causing haemodynamic instability.

In the UK many clinicians use an opiate with a benzodiazepine, usually midazolam, for the purpose of procedural sedation. This technique has several potential problems, including prolonged sedation due to the long half-life of midazolam. Propofol is used as a procedural sedation agent in Australasia and the USA,^{1,2} and there is increasing interest in the UK with the recent publication of a meta-analysis of current evidence.³ Propofol can be used as an anaesthetic or sedation agent; its use as a sedation agent can be for prolonged sedation within intensive care units or for procedural sedation in the emergency department (ED). There have been several studies of propofol for procedural sedation in children which have shown it to be safe and effective^{4,5}; however, there are considerably fewer published studies of its use in adults. The only UK study of propofol in adults reported no adverse events.⁶ The aim of this study was to observe practice within an ED in the UK that uses propofol for procedural sedation in adults.

METHODS

This prospective study, conducted at the ED of Wexham Park Hospital, observed procedural sedation over an 11 month

period. Wexham Park is a district general hospital and the ED sees 75 000 new patients per year.

Inclusion criteria were all patients aged over 16 years of age who required procedural sedation and were able to give informed consent for the procedure. Children, haemodynamically unstable patients, and those with previous severe reactions to anaesthesia or sedation were excluded. All patients received supplemental oxygen and were continuously monitored with pulse oximetry, respiratory rate, three lead ECG and non-invasive blood pressure.

All procedural sedations were performed by ED physicians according to departmental guidelines, the choice of sedation agent being at the discretion of the physician performing the sedation. Propofol was administered intravenously as an initial bolus of 0.5 mg/kg (up to a maximum of 50 mg) followed by further boluses, if required, up to a maximum total dose of 1 mg/kg; midazolam was titrated by bolus intravenous doses of 1 mg to achieve the desired level of sedation. The following details were recorded on a standard proforma for each patient: indication for procedural sedation; agent used; depth and duration of sedation; ease of reduction; use of a reversal agent; complications and reasons for delayed discharge from the ED. The depth of sedation was recorded using a four point scale

Table 1 Depth of sedation

Level of sedation	Expected response
3	Awake and responding
2	Drowsy but responds to voice
1	Sleeping but responds to loud voice
0	Deeply sedated

Table 2 Number of patients sedated by grade of emergency department staff

Grade of sedationist	Number of patients sedated with midazolam n = 16	Number of patients sedated with propofol n = 32
Consultant	1	1
Specialist registrar	4	22
Staff grade	10	9
Senior house officer	1	0

Table 3 Baseline characteristics

	All patients	Propofol group	Midazolam group
Number in group (n)	48	32	16
Median age in years (IQR)	39.5 (27–58)	48 (29–65)	31.5 (26–50.5)
Proportion of males	65%	57%	81%
Median weight in kg (IQR)	80 (70–88)	78 (68–91)	77.5 (70–82.5)
Median dose of morphine in mg (IQR)	7 (5–10)	7.5 (5–10)	6 (5–10)
Median total dose of sedation agent in mg (IQR)		100 (70–125)	7 (7–10)
Median time starved before sedation in minutes (IQR)	240 (180–360)	300 (240–540)	180 (90–300)

IQR, interquartile range.

(table 1).⁷ Duration of sedation was defined as the time from first drug administration until return to point 3 on the sedation scale. The specific complications recorded were hypotension (defined as systolic blood pressure <90 mm Hg), desaturation (SpO₂ <90%), apnoea (requiring bag valve mask ventilation), and airway compromise (requiring the use of an airway adjunct).

The patients were analysed in two groups according to the sedation agent used. Descriptive statistics are used to analyse the data, and presented as medians with interquartile ranges.

As this study was an observational study of usual practice ethical approval for the study was not required.

RESULTS

Forty-eight patients were recruited during the study period. Propofol was used in 32 cases (67%) and midazolam in 16 cases (33%). The majority of procedural sedation was given by staff grades and specialist registrars, with two episodes of sedation given by a consultant and one by a senior house officer under senior supervision (table 2). Patient baseline characteristics are shown in table 3 and the indications for procedural sedation are shown in table 4.

All but three patients received morphine before the administration of the sedation agent. One patient received no analgesia, one received oral tramadol, and one a combination of oral ibuprofen and co-codamol. A total of seven patients were fasted for <4 h before administration of the sedation agent.

All patients in the midazolam group had successful completion of the procedure. In the propofol group, one patient with a dislocated total hip replacement had an unsuccessful reduction and went on to have a reduction under general anaesthetic.

The median period of sedation was considerably shorter in the propofol group: 3 min (IQR 2–10) vs 45 min (IQR 25–90). Median time spent in the department was 200 min (IQR 140–255) in the propofol group and 175 min (IQR 130–240) in the midazolam group. Reasons for delayed discharge from the ED were documented in 26 patients. Twelve patients (24%) were delayed waiting for x rays and nine patients (18%) for a bed before admission. Five patients (10%), all in the midazolam group, were delayed because of prolonged sedation. The median duration of sedation and total time spent in the ED is illustrated in fig 1.

There was no difference in the depth of sedation achieved between the two groups, with both groups having a median sedation depth of 1 and an IQR of 1–2 (fig 2). Ease of reduction was also similar between the two groups.

Four patients in the midazolam group were over-sedated, three requiring reversal with flumazenil. All four over-sedated patients remained sedated between 1–5 h. There was no documented over-sedation in the propofol group. There were

no documented episodes of apnoea, desaturation, airway compromise or hypotension in either group.

DISCUSSION

This prospective study demonstrates that propofol is a safe and effective agent for procedural sedation in the ED. The study also shows that propofol has a considerably shorter duration of action than midazolam, thereby shortening the period of sedation. Safe practice of procedural sedation requires two doctors, with one doctor acting as the sedationist and remaining with the patient until fully conscious.^{8,9} This has clear resource implications for the ED, which could be mitigated by reducing the duration of sedation. Although the shorter sedation time in our study did not produce a shorter overall length of time in the department, there were several potential reasons for this including prolonged time spent waiting for x ray or inpatient bed availability.

A shorter duration of sedation with propofol has been reported in previous studies. Taylor *et al*¹ compared propofol with midazolam/fentanyl in a randomised controlled trial of patients in an Australian ED for reduction of anterior shoulder dislocations. The authors titrated each drug to a clinical end point of spontaneous eye closure rather than use weight determined bolus doses. Patients in the propofol group had shorter mean times to first waking and full consciousness, and had easier reductions; however, there were more episodes of respiratory depression (11 vs 6 patients) and one episode of vomiting. The high incidence of respiratory depression in the propofol group may have resulted from larger doses being given due to titration to spontaneous eye closure rather than using a weight-determined bolus dose.

Low rates of adverse events have also been demonstrated in other studies. Swanson *et al*¹⁰ used a bolus of fentanyl with a propofol infusion to an end point of ptosis and slurred speech for a variety of procedures. They reported one transient episode of hypotension and two episodes of apnoea resolving within 30 s. The mean recovery time for patients was 6.1 min. Miner *et al*¹¹ compared propofol with methohexital for fracture/dislocation reduction. Propofol was administered as a 1 mg/kg bolus then 0.5 mg/kg. The two agents were similar for duration

Table 4 Indications for procedural sedation

Indication for procedural sedation	Number (%)
Dislocated shoulder	25 (52)
Dislocated prosthetic hip	8 (17)
Dislocated ± fracture ankle	7 (15)
Dislocated elbow	2 (4)
Dislocated knee	2 (4)
Other	3 (6)

Figure 1 Median duration of sedation and mean total time in the emergency department.

of sedation (9.9 vs 8.5 min), level of sedation, and rate of adverse events. Coll-Vincent *et al*¹² compared propofol, etomidate, midazolam and midazolam plus flumazenil in patients undergoing cardioversion for atrial fibrillation or flutter and demonstrated a significantly shorter recovery time occurred with propofol group and midazolam/flumazenil group.

None of the patients in our study who received propofol were over-sedated. However, four patients who all received large doses of midazolam (10–20 mg) were over-sedated. This rate of over-sedation is higher than that found in the recent study by Duncan *et al*,¹³ most probably due to the larger doses that were given, which were most likely the result of a failure to follow the departmental guidelines. The shorter duration of action of propofol makes titration of the dose easier than with midazolam. Symington and Thakore³ systematically reviewed the use of propofol for procedural sedation and concluded that propofol was safe and effective for procedural sedation.

The period of fasting was another area where the departmental guidelines may not have been followed, with seven patients receiving sedation after <4 h of fasting. The minimum period of fasting before emergency sedation is a contentious area. The recently published American College of Emergency Physicians Clinical Policy on sedation could find no evidence either way on a minimum period of fasting.¹⁴ Their level C recommendations stated that recent food intake was not a contraindication to procedural sedation in the ED.

There were several limitations to our study. We had lower than anticipated numbers enrolled into the study, possibly due to poor recruitment of patients, or poor identification of suitable patients for the study. Therefore the number recruited may not be large enough to detect all potential adverse events and reduces the ability for direct comparison between the two groups.

In conclusion, this study has shown propofol to be effective and safe for use in procedural sedation in the ED. Further work is required in the form of a randomised controlled trial comparing propofol and midazolam to study whether this shorter duration of action translates into a shorter length of stay in the ED.

Figure 2 Sedation levels achieved with propofol and midazolam.

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