Randomized Clinical Trial of Etomidate Versus Propofol for Procedural Sedation in the Emergency Department

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Study objective: We compare the efficacy, adverse events, and recovery duration of etomidate and propofol for use in procedural sedation in the emergency department (ED).

Methods: This was a randomized nonblinded prospective trial of adult patients undergoing procedural sedation for painful procedures in the ED. Patients received either propofol or etomidate. Doses, vital signs, nasal end-tidal CO_2 ($ETCO_2$), pulse oximetry, and bispectral electroencephalogram analysis scores were recorded. Subclinical respiratory depression was defined as a change in $ETCO_2$ greater than 10 mm Hg, an oxygen saturation of less than 92% at any time, or an absent $ETCO_2$ waveform at any time. Clinical events related to respiratory depression, including an increase in supplemental oxygen, the use of a bag-valve-mask apparatus, airway repositioning, or stimulation to induce breathing, were noted during the procedure. After the procedure, patients completed visual analog scales about perceived pain during the procedure and recall of the procedure.

Results: Two hundred twenty patients were enrolled; 214 underwent sedation and were analyzed. One hundred five patients received etomidate and 109 received propofol. No clinically significant complications were noted. Subclinical respiratory depression was observed in 36 of 105 (34.3%) patients in the etomidate group and 46 of 109 (42.2%) in the propofol group (difference –7.9%; 95% confidence interval [CI] –20.9% to 5.1%). Myoclonus was noted in 21 of 105 (20.0%) patients in the etomidate group and 2 of 109 (1.8%) in the propofol group (difference 18.2%; 95% CI 10.1% to 26.2%). The mean difference between baseline systolic blood pressure and the nadir was 3.8% (95% CI 2.3% to 5.3%) for etomidate and 7.9% (95% CI 6.1% to 9.7%) for propofol. Clinical events related to respiratory depression included an increase in supplemental oxygen in 6.7% of etomidate patients and 5.5% of propofol patients (difference 1.2%; 95% CI –5.2% to 7.6%), the use of bag-valve-mask apparatus in 3.8% of patients in the etomidate groups and 4.6% in the propofol group (difference –0.8%; 95% CI –6.1% to 4.6%), airway repositioning in 13.3% of etomidate patients and 11.0% of propofol patients (effect size 2.3%; 95% CI –6.4% to 11.1%), and stimulation to induce breathing in 11.4% of etomidate patients and 11.9% of propofol patients (difference –0.5%; 95% CI –9.1% to 8.1%). The procedures were successful in 93 of 105 (88.6%) for etomidate and 106 of 109 (97.2%) for propofol (difference –7.4%; 95% CI –14.3% to –1.1%).

Conclusion: Etomidate and propofol appear equally safe for ED procedural sedation; however, etomidate had a lower rate of procedural success and induced myoclonus in 20% of patients. [Ann Emerg Med. 2007;49:15-22.]

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INTRODUCTION

Background

Patients undergoing painful procedures in the emergency department (ED), such as orthopedic manipulations or abscess drainage, often require moderate or deep procedural sedation for successful performance of the procedure. This sedation is achieved with the use of a sedative agent administered at a dose that allows patients to maintain airway reflexes and have some response to verbal stimuli (moderate sedation) or to pain (deep sedation). The ideal sedative agent for this purpose would

Editor's Capsule Summary

What is already known on this topic

Etomidate and propofol are the most popular ultrashort-acting sedatives for emergency department (ED) deep sedation.

What question this study addressed

Are the 2 sedatives similar in terms of efficacy, adverse events, and recovery duration?

What this study adds to our knowledge

The 2 sedatives were similar with respect to airway adverse events and recovery duration; however, etomidate produced myoclonus in 20% of patients. Success rate with propofol (97%) was higher than with etomidate (90%), which could be due to the drug's performance but also could be due to differences in case mix between the groups.

How this might change clinical practice

This study supports both sedatives as highly satisfactory for ED deep sedation. This study provides tentative evidence that propofol is superior.

provide adequate sedation to perform the procedure successfully, with a minimum of cardiorespiratory adverse effects, and have a short duration of action. Etomidate and propofol are 2 ultrashort-acting sedative agents thought to provide these characteristics.[1-17] Despite their common use in procedural sedation, the performance and safety of these 2 agents have not been compared in a randomized controlled fashion.[18]

Propofol has an onset of action of approximately 45 seconds and begins to redistribute from the blood to fat and muscle in 3 to 5 minutes, with a rapidly resolving clinical effect. Propofol provides reliable amnesia and rapid recovery when used for procedural sedation.[11] Etomidate has an onset of action of approximately 1 minute and duration of action of 5 to 15 minutes. It is considered to have the least homodynamic effect of any of the agents available for procedural sedation. A number of studies have found that etomidate provides effective, reliable sedation with minimal adverse effects.[2,5,10,15,17]

Importance

Both of these agents are frequently used for procedural sedation in the ED, but it is not yet known whether one of these agents is more effective or safe than the other. Determining differences in the effectiveness and safety of these agents will allow the development of more specific guidelines about their use.

Goals of This Investigation

This study prospectively compared procedural sedation with etomidate or propofol in terms of the level of sedation achieved, the rate of subclinical respiratory depression, the rate of clinical signs of respiratory depression, the time required for patients to return to baseline mental status, the success of the procedure, and patient-derived outcome factors of perceived pain, recall of the procedure, and satisfaction with the care they received.

MATERIALS AND METHODS

Study Design

This was a prospective, randomized, nonblinded, clinical trial of propofol versus etomidate for ED procedural sedation of patients undergoing painful procedures between June 1, 2004, and September 1, 2005. The institutional review board of Hennepin County Medical Center approved the study. Patients provided prospective informed consent before enrollment.

Setting

This study was performed at an urban county medical center with approximately 97,000 ED patient visits per year. In our ED, procedural sedation is performed at the discretion of the treating emergency physician. It is standard practice in our ED to treat patients with fractures or dislocations with intravenous morphine (0.1 mg/kg intravenously followed by 0.05 mg/kg intravenously every 10 minutes as needed/tolerated) for pain control as soon as possible in their treatment.

Selection of Participants

All adult (age >18 years) ED patients who were to receive procedural sedation using either propofol or etomidate were eligible for study enrollment. Patients were excluded if they were unable to give consent, had an American Society of Anesthesiologists Physical Assessment Score[19] greater than 2, had a known hypersensitivity to either medication, were pregnant, or had clinical evidence of intoxication before the start of the procedure.

Interventions

Patients began receiving cardiac, blood pressure, pulse oximeter, and nasal sample end-tidal CO_2 ($ETCO_2$) monitors according to standard guidelines for procedural sedation in our ED. The $ETCO_2$ monitor (Capnocheck Plus, Smiths BCI, London, England) displays a continuous numerical $ETCO_2$ value and waveform. Additionally, patients were also monitored with a bispectral EEG for level of awareness. Baseline values were recorded. Patients were then randomized to receive either propofol, 1 mg/kg bolus followed by 0.5 mg/kg every 3 minutes as needed for sedation, or etomidate, 0.1 mg/kg followed by 0.05 mg/kg every 3 to 5 minutes, as needed. Randomization was achieved by selecting a sequentially numbered sealed envelope containing the group assignment, which had been determined using computer-generated random numbers by the investigators. Neither patients nor physicians were blinded to the agent being administered. The use of supplemental oxygen during procedural sedation was at the discretion of the treating physician.

Outcome Measures

Subclinical respiratory depression was defined as a change from baseline $ETCO_2$ of greater than 10 mm Hg, an oxygen saturation of less than 92% at any time during the procedure, or airway obstruction with cessation of gas exchange at any time (noted by an absent $ETCO_2$ waveform).[12,13,20] These are criteria we have used to detect subclinical respiratory depression in previous studies of procedural sedation. It is presumed that increases in $ETCO_2$ are indicative of hypercapnia and decreases are due to increased mixing of the breath sample with room air because of airway obstruction or decreasing tidal volume.

In addition to these objective measures, clinical events related to respiratory depression were detected by specific query to the physician performing the procedure after its completion, including any increase or addition of supplemental oxygen, the use of a bag-valve-mask apparatus to increase ventilation, repositioning of the patient's airway to improve ventilation, or stimulation of the patient to induce breathing.[21] The presence of myoclonus at any time during the procedure was noted as well. Myoclonus has been observed with both etomidate[3,17] and propofol.[22] After the procedure, the physician was asked to note any complications experienced by the patients, including, but not limited to, vomiting or aspiration, intubation, transfers to a higher level of care after the procedure, hypotension, or arrhythmias.

The depth of sedation was measured in 2 ways. The first was with the bispectral index monitor, an analog EEG that provides a score of 1 to 100, describing the patient's level of alertness.[11,13,14] Patients with bispectral index scores less than 90 have been found to be amnestic,[11] and those with scores less than 70 have been shown to have an increased incidence of respiratory depression.[13] A subjective scale, the modified Observer's Assessment of Alertness score,[23,24] was the second measure of the level of sedation. This is a 5-point scale describing the patient's clinical appearance of sedation.

After the patients returned to their baseline mental status, they were asked to complete 3 100-mm visual analog scales assessing their perceived pain, recall of the procedure, and satisfaction with the procedure. The pain visual analog scale consists of the question, How much pain did you experience? followed by the words "no pain" and "most pain imaginable" on either end of a 100-mm line. The recall visual analog scale consists of the question, How much of the procedure do you remember? with the words "none of it" and "all of it" on either side of a 100-mm line. The satisfaction visual analog scale consists of the question, How satisfied are you with the treatment you received during this procedure? with the words "completely satisfied" and "not satisfied at all" on either side of the 100-mm line.

Data Collection and Processing

During the procedure, pulse oximetry, pulse rate, blood pressure, respiratory rate, $ETCO_2$, and bispectral index scores were monitored continuously. The lowest value during every 1-minute period was recorded by trained research assistants. The Observer's Assessment of Alertness score was also recorded every minute. Any loss of $ETCO_2$ waveform or use of airway adjuncts, such as bag-valve-mask-assisted respirations or oral airway placement, was noted. Any clinical events relating to respiratory depression were recorded as well. Data were collected by a designated research assistant during the procedure and then entered into an Excel (Microsoft, Redmond, WA) database for further analysis.

Primary Data Analysis

Data were analyzed using Stata 9.0 (Stata Corporation, College Station, TX). The proportion of patients with subclinical respiratory depression and clinical signs of respiratory depression, the mean bispectral index nadir, and the mean Observer's Assessment of Alertness scores were compared using 95% confidence intervals (CIs). The differences in the means and the CI around this difference are described as well. The visual analog scale outcomes of pain, recall, and satisfaction were described with descriptive statistics. The time to return of baseline mental status was described using median and interquartile ranges and was tested for equality between the 2 groups with Wilcoxon rank sum.

Assuming a baseline proportion of 30%, to detect a 20% difference in the proportion of patients with respiratory depression between the 2 groups, with an α of 0.05 and a β of 0.1 (90% power), power analysis indicated that 108 patients per group were required.

RESULTS

Characteristics of Study Subjects

Two hundred ninety-six patients met the inclusion and exclusion criteria for the study during the enrollment dates. Patient enrollment is shown in the Figure. The characteristics of the study subjects and the procedures for which patients were sedated are described are presented in Table 1.

Main Results

The main results are described in Table 2. Clinical events related to respiratory depression are described in Table 3. There was no difference in the need for increased supplemental oxygen or airway repositioning between patients who met criteria for subclinical respiratory depression and those who did not. There was an increased rate of bag-valve-mask use and stimulation to induce breathing in patients who met the criteria for subclinical respiratory depression. Postprocedural outcomes are described in Table 4.

No cardiac rhythm abnormalities, episodes of vomiting or aspiration, intubation, transfers to a higher level of care after the procedure, or arrhythmias were noted during any of the procedures. Systolic blood pressure changes are noted in Table 2. Five patients had a systolic blood pressure less than 100 mm Hg at some time; 4 had received propofol, and 1 received etomidate. The lowest systolic pressure recorded in the study was 80 mm Hg. No patients with decreased blood pressure were

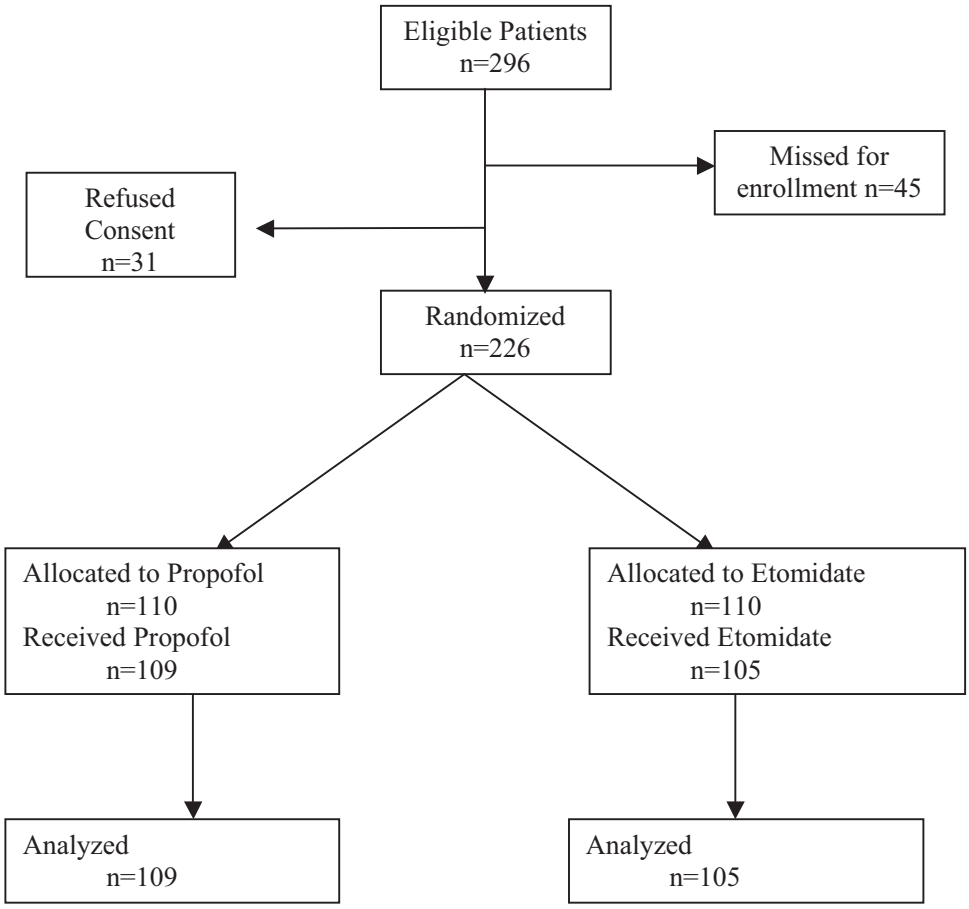

Figure. Patient flow through the study.

noted to have negative sequelae from this. One patient who was given etomidate received naloxone during the procedure because of poor ventilation, which was noted on the $ETCO_2$ monitor. This patient had an $ETCO_2$ waveform on the monitor, but the $ETCO_2$ value decreased from a baseline of 47 mm Hg to 14 mm Hg 3 minutes after the etomidate was given. The patient continued to have very low $ETCO_2$ values for 2 additional minutes before returning to within 10 mm Hg of baseline. The patient had no further complications.

LIMITATIONS

There are 2 principal limitations to our trial. The first is that we were unable to blind patients, physicians, or data collectors to the agent used in each procedural sedation. Propofol is white and opaque, and etomidate is clear, and because of the specific nature of the dosing, we did not think blinding could be safely achieved. All of the physicians who enrolled patients in this study are familiar with both of these agents and likely had preconceived notions about the 2 agents, resulting in possible bias. Furthermore, a large number of patients in our study did not receive the exact dosing required in the study protocol, which is also likely due to the common usage of both agents in our ED and physicians' preferences and preconceived ideas about how to dose the agents.

The second principal limitation is in the outcome measures. A wide range of outcome measures has been suggested for sedation research, and all measures have significant limitations. In the case of subclinical respiratory depression, we have used these criteria in several studies from our institution and will continue to use them until we can find superior measures to maintain internal validity among our studies and clinical practice. Decreases in the $ETCO_2$ are associated with airway obstruction, and increases are representative of hypercarbia. It is possible for a patient with hypoventilation and increasing airway obstruction to maintain a stable $ETCO_2$ value; we therefore continue to use pulse oximetry and the absence of the $ETCO_2$ waveform as additional criteria for the detection of subclinical respiratory depression. Because we are assuming unmeasured combinations of airway obstruction and hypoventilation, we have used the presence or absence of $ETCO_2$ changes rather than comparing the values or the direction of changes. A decreased oxygen saturation or an absent $ETCO_2$ waveform is likely a more ominous sign of impending respiratory depression than an isolated change from baseline $ETCO_2$. Because it is not known

Table 1. Characteristics of the study subjects.

Procedures and Characteristics	Etomidate	Propofol	Difference (95% CI)
Procedures	N=105 (%)	N=109 (%)	
Incision and drainage of abscess	40 (38.1%)	40 (37.6%)	0.5% (–12.5 To 13.5)
Fracture reduction	44 (41.9%)	38 (35.8%)	6.1% (–6.9 To 19.2)
Dislocation reduction	17 (16.2%)	26 (24.8%)	–8.6% (–19.3 To 2.2)
Tibial traction pin placement	3 (2.9%)	0	2.9% (–0.3 To 6.0)
Cardioversion	0	1 (0.9%)	–0.9 (–2.7 To 0.9)
Chest tube placement	1 (0.9%)	3 (2.9%)	–1.8% (–5.4 To 1.8)
Foreign body removal	0	1 (0.9%)	–0.9 (–2.7 To 0.9)
Patient Characteristics			
Age, y (SD)	36.9 (3.1) (Range 18–74)	40.4 (14.5) (Range 18–78)	–3.9 (–7.2 To 0.2)
Weight, kg (SD)	82.2 (21.1)	81.8 (23.3)	0.5 (–5.9 To 6.0)
ASA physical status score=1 (%)	66/105 (62.9)	67/109 (62.4)	0.5 (–12.5 To 13.4)
Initial systolic blood pressure, mm Hg, mean (+95% CI)	135.0 (131–138, Range 96–196)	132.0 (128–135, Range 93–201)	3.1 (–2.2 To 8.3)
Initial $ETCO_2$ (mm Hg), mean (+95% CI)	40.9 (39.4–42.3) (Range 6–59)	38.5 (36.9–40.2) (Range 15–58)	2.6 (0.4–4.5)
Initial oxygen saturation, %, mean (SD)	99.3±1.3	98.7±3.3	0.6 (–0.1 To 1.3)
Preprocedural supplemental oxygen use	87/105 (82.8%)	87/109 (79.8%)	–3.0 (–11.8 To 9.5)
Initial BIS score, mean (SD, range)	96.9 (±3.1, 76–100)	96.2 (±3.8, 76–99)	0.6 (–0.3 To 1.6)
Initial OAAS score, mean (SD)	4.9 (±0.27)	5.0 (±0.16)	0.1 (–0.1 To 0.3)
Number of doses of sedative (95% CI, range)	2.4 (2.1–2.7, 1–7)	2.8 (2.5–3.1, 1–8)	–0.5 (–0.9 To –0.1)
Total time of procedure, mean, min (95% CI)	10.8 (9.6–12.1)	10.3 (2.5–3.1)	0.5 (–0.9 To 2.1)

ASA, American Society of Anesthesiology; *BIS*, bispectral index score; *OAAS*, Observer's Assessment of Alerthess Score.

which of the changes we have defined as subclinical respiratory depression is more likely to be associated with an adverse event, we continue to study the presence or absence of these changes in a binary fashion but have also reported them individually in this study.

We added clinical signs of respiratory depression to this study[21] but are hesitant to make them the first approach to measuring outcomes in sedation research. Because the agents are not blinded and the clinical events we measured are all dependent on the actions of the physician, it seems that these measures will be biased by the physician performing the procedure and may measure their particular practice style as much as the effect of the drug. Unless we could use the same physician for every sedation or develop strict criteria for the application of the clinical signs of respiratory depression, we are reluctant to use them as our sole measure. The subclinical respiratory depression criteria, although more objective and less subject to bias, are only assumed to be indicative of respiratory depression and are not intended to detect patients experiencing an adverse event. Although we have established that they are associated with decreased breathing and likely indicate that patients whose respiratory effort is being negatively affected by the sedative agent are at an increased risk of developing clear respiratory complications, their clinical significance is unclear.

DISCUSSION

This comparison of etomidate and propofol found that both agents have similar rates of sedation, subclinical respiratory depression, hypoxia, apnea, and clinical events related to respiratory depression. Propofol had a higher rate of procedural success than etomidate, myoclonus was observed much more frequently with etomidate, and hypotension was observed more frequently with propofol. None of these differences resulted in clinically significant adverse events, and it appears that both of these medications are similarly safe for use in procedural sedation in the ED.

The time to return to baseline mental status was slightly shorter for patients receiving propofol than for those receiving etomidate, with a mean 2-minute difference. This is so short a time difference that it may not be clinically significant, but there may be certain situations in ED care in which a patient's more rapid return to baseline mental status would be desirable.

We found that subclinical respiratory depression occurred in patients who received bag-valve-mask-assisted ventilation or who needed stimulation to induce breathing but was not present in patients whose supplemental oxygen was increased or who received airway repositioning. Using clinical events as a marker for respiratory depression requires the recognition and interpretation of the event by the treating physician,

Table 2. Main results for the procedures.

Results	Etomidate (n=105)	Propofol (n=109)	Difference (95% CI)
First dose (SD)	0.15 mg/kg (±0.07)	0.99 mg/kg (±0.17)	
Total dose, mean (SD)	0.26 mg/kg (±0.13)	1.86 mg/kg (±0.82)	
Subclinical respiratory depression (%)	34.3% (36/105)	42.2% (46/109)	–7.9% (–20.9 To 5.1)
Absolute change in $ETCO_2$ from baseline, mean mm Hg (range, SD)	10.0 (1–29, ±6.1)	11.5 (5–34, ±8.1)	–1.5 (–3.4 To 0.5)
Change in $ETCO_2$ >10 mm Hg	26.7% (28/105)	37.6% (40/109)	–10.9% (–23.4 To 1.4)
Loss of $ETCO_2$ waveform	4.8% (5/105)	11.0% (12/109)	–6.2% (–13.4 To 0.9)
Oxygen saturation <92%, %	9.5 (10/105)	9.1 (10/109)	0.3 (–7.5 To 8.2)
Increased supplemental oxygen, %	6.7 (7/105)	5.5 (6/109)	1.2 (–5.2 To 7.6)
Bag-valve-mask, %	3.8 (4/105)	4.6 (5/109)	–0.8 (–6.1 To 4.6)
Airway repositioning, %	13.3 (14/105)	11.0 (12/109)	2.3 (–6.4 To 11.1)
Stimulation to induce breathing, %	11.4 (12/105)	11.9 (13/109)	–0.5 (–9.1 To 8.1)
Systolic blood pressure low, mm Hg	129.6 (Range 64–178)	120.9 (Range 60–158)	8.7 (3.7 To 13.6)
Decrease in systolic blood pressure from baseline, %	3.8	7.9	–4.1 (–6.4 To 1.7)
BIS nadir	63.6 (Range 25 to 97)	62.0 (Range 5 to 94)	1.6 (–4.1 To 6.2)
Observer's Assessment of Alertness score nadir	Median=1 (IQR=1–2)	Median=1 (IQR 1–2)	*P*=.77 (Wilcoxon rank sum)
Time to return of baseline mental status after completion of procedure, mean min	8.8 min (Range 1–42, median 7, IQR=4–10)	6.8 min (Range 1–20, median 5, IQR 3–10)	2.0 (0.4 To 3.6)
Myoclonus, %	20.0 (21/105)	1.8 (2/109)	18.2 (10.1 To 26.2)
Successful procedure	89.5 (94/105)	97.2 (106/109)	–7.4 (–14.3 To –1.1)

Table 3. Clinical events related to respiratory depression versus subclinical respiratory depression.

Agent	Etomidate (n=105)		Propofol (n=109)	
Subclinical respiratory depression detected	Yes (n=36)	No (n=69)	Yes (n=46)	No (n=63)
Increased supplemental oxygen (%, 95% CI)	3/36 (8.3, 1.8–22.5)	4/69 (5.8, 1.6–14.2)	4/46 (8.7, 2.4–28.8)	2/63 (3.2, 0.3–11.0)
Bag-valve-mask (%, 95% CI)	5/36 (13.9, 3.9–25.6)	0/69 (0, 0–5.5)	4/46 (8.7, 2.8–23.7)	0/63 (0, 0–5.4)
Airway repositioning (%, 95% CI)	7/36 (19.4, 5.9–33.0)	7/69 (10.1, 2.8–17.4)	6/46 (13.0, 2.9–23.2)	6/63 (9.5, 2.1–17.0)
Stimulation to induce breathing (%, 95% CI)	8/36 (22.2, 10.1–39.2)	4/69 (5.8, 1.6–14.2)	7/46 (15.2, 6.3–28.9)	6/63 (9.5, 3.6–19.6)

rather than the detection of respiratory depression by specific criteria. It is therefore difficult to determine why our patients with no measured subclinical respiratory depression were given supplemental oxygen or were repositioned. There currently is no way to determine the optimal method to clinically detect early changes in a sedated patient's respiratory status.

The mean initial dose of etomidate was 0.15 mg/kg, which is higher than the dose recommended in our study protocol and higher than in previous studies.[2,15] The total dose was 0.26 mg/kg, which is more similar to previous reports.[2,15,17] The rate of complications we observed was similar to rates in previous reports, such as with 4.8% of sedated patients requiring bag-valve-mask in our study, which is only slightly higher than the 3.7% reported by Vinson and Bradbury.[17]

The mean initial dose of propofol was 0.99 mg/kg, which is similar to the dosing recommended in the study protocol. The total dose of 1.8 mg/kg is also similar to that of previous reports.[3] The rate of subclinical respiratory depression and hypoxia observed in our patients who had received propofol is also similar to that of other research,[3,12] as is the rate of bag-valve-mask in our patients (3.7%).[12]

There was a larger percentage of decrease in the systolic blood pressure in patients who received propofol than in those who received etomidate, which has been described previously. No patient in our study required treatment for hypotension or

Table 4. Postprocedural outcomes.

Postprocedural outcomes	Etomidate (n=105)	Propofol (n=109)	Difference (95% CI)
Patient report of pain during procedure (95% CI)	18.3 mm (12.8–23.8)	16.2 mm (11.1–21.3)	2.1 (–5.3 To 9.6)
Patient report of recall of any of the procedure (95% CI)	23.9 mm (17.0–30.8)	16.1 mm (10.5–21.6)	7.8 (–0.9 To 16.5)
Satisfaction with procedure (95% CI)	9.8 mm (6.1–13.6)	10.3 mm (7.0–13.6)	–0.4 (–5.4 To 4.5)

had any negative sequelae, but all patients in the study were already receiving intravenous fluids as a standard part of the department's clinical procedural sedation protocol, and we did not measure for changes in the rate of fluid administration for any patient in our the study. The hypotension previously described with propofol was also observed here but appeared to have no clinical consequence, probably because of the healthy status of the patients in this study. Larger decreases in blood pressure have been observed with propofol relative to etomidate in a study of critically ill patients.[18]

The rate of myoclonus we observed in patients who received etomidate (20.0%) was higher than the 15% observed by Ruth et al[15] and, oddly, was noted in 2 patients who received propofol. We had not previously detected myoclonus in other studies of propofol, and, except for a case report of possible seizure activity with propofol,[22] this phenomena is not well described. The difference between this study and our previous work is that we were specifically looking for myoclonus, which may have increased our sensitivity to detect it where it had not been.

Our rate of procedural success was significantly lower for patients who received etomidate than for those who received propofol. It is unclear whether this was due in part to the increased rate of myoclonus we observed. Five of the 14 patients who had unsuccessful procedures were reported to have myoclonus, 1 from propofol and 4 from etomidate. The rate of myoclonus is much higher among patients who had unsuccessful procedures, and it seems possible that this was a factor in unsuccessful procedures among our study patients.

The rate of myoclonus we observed and the higher incidence of unsuccessful procedures may be enough to factor into the decision to use etomidate as a sedative. The hypotension associated with propofol and the myoclonus associated with etomidate leave neither of these agents without relative faults, but they can be ameliorated by appropriately choosing between the 2 agents.

The postprocedural outcome questions showed a higher rate of reported recall among patients who received etomidate than among patients who received propofol. There was no association between recall and the occurrence of myoclonus, which might have been an unpleasant experience for patients who are inadequately sedated. It is difficult to determine which portion of the procedure is being remembered. In a previous study of recall after propofol administration, we found dense amnesia throughout the procedure and even some retrograde amnesia.[11] A similar study of etomidate will be needed to determine the amnestic profile of etomidate used for procedural sedation.

In conclusion, our comparison of etomidate and propofol found that both agents produce similar rates of sedation, subclinical respiratory depression, hypoxia, apnea, and clinical events related to respiratory depression and a slightly different rate of procedural success. Myoclonus was observed more frequently with etomidate, and hypotension was observed more frequently with propofol. With these observations in mind and with a careful selection of patients, both agents appear similarly safe for use in ED procedural sedation.

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DIAGNOSIS:

Molar pregnancy. The ultrasonography demonstrated the characteristic "snowstorm" appearance of molar pregnancy. Quantitative serum β-human chorionic gonadotropin (β-hCG) level was 1,300,000 mIU/mL. Chest radiograph showed no evidence of metastatic disease. Obstetric consultation was obtained, and the patient was taken to the operating room for suction dilation and curettage. Surgical pathology specimens revealed chorionic villi with histologic features consistent with partial molar pregnancy. The patient was discharged in good condition, and subsequent β-hCG measurements have demonstrated an appropriate decline in β-hCG levels.

Molar pregnancy is a rare complication of pregnancy, occurring in approximately 1 in 1,000 to 1,500 pregnancies.[1] The diagnosis is usually confirmed by a markedly elevated quantitative serum β-hCG level and a typical snowstorm appearance on ultrasonography.[2] Complete and partial molar pregnancies have the potential for malignant transformation, although the rate of subsequent malignancy is significantly higher in complete mole (20%) than in partial mole (2% to 6%).[1,3] Treatment is with dilation and curettage, followed by serial β-hCG measurements and close outpatient follow-up.

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