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Procedural sedation for cardioversion

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doi: 10.1136/emj.2006.043067

Abstract
A short-cut review was conducted to establish whether any of the available drugs used for procedural sedation in patients with tachydysrhythmias are safer or more effective than the alternatives. In all, 135 papers were found using the reported searches, of which 7 presented the best evidence to answer the clinical question. The author, date and country of publication, patient group studied, study type, relevant outcomes, results and study weaknesses of these best papers are tabulated. It is concluded that propofol, methohexital, thiopentone and etomidate all seem to be good choices.

Clinical scenario
A 38-year-old man presents to the emergency department with palpitations and slightly light headed feeling. He has never had these symptoms before and is certain that they started 1 h before arrival. He is awake and alert with a blood pressure of 134/82 mm Hg and a pulse of 128 beats/min. His physical examination is unremarkable, with the exception of tachycardia and an irregular rhythm. You are aware that each attending staff used different drugs for procedural sedation in this situation—and that each of them has ''good reasons'' why their choice is the best. You wonder whether there is any evidence to support one choice over another.

Three-part question
In [patients with atrial fibrillation, atrial flutter or paroxysmal supraventricular tachycardia requiring sedation for electrical cardioversion] which [medications] are best at [achieving safe and effective procedural sedation]?

Search strategy
Medline 1966 to September Week 4 2006 using the Ovid interface. [(*atrial fibrillation/th OR exp electric countershock OR cardioversion.mp) *and* (exp etomidate/or etomidate.mp OR exp propofol/or propofol.mp OR exp midazolam/or midazolam.mp OR exp thiopental/or thiopental.mp OR exp ''Hypnotics and Sedatives''/)]. Limit to human *and* English.

Embase 1980 to 2006 Week 39 using the Ovid interface and multifile searching. [(*atrial fibrillation/th OR exp electric countershock OR cardioversion.mp) *and* (exp etomidate/or etomidate.mp OR exp propofol/or propofol.mp OR exp midazolam/or midazolam.mp OR exp thiopental/or thiopental.mp OR exp ''Hypnotics and Sedatives''/)] *and* (emergency department.mp OR emergency medicine). Limit to human *and* English

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[electric countershock (MeSH)] *and* ['hypnotics and sedatives'(MeSH)]

Outcome
A total of 135 papers were found, of which 7 were randomised trials comparing agents for sedation for cardioversion and were felt to be of sufficient quality to be included.

Comment
All of the agents used in these studies had relatively short time of onset and short duration of action with the exception of the benzodiazepines, which had considerably longer times for both. All anaesthetic agents have the potential to cause hypotension, although this did not cause any serious adverse events in any of the patients who participated in these studies. Etomidate may cause less hypotension than other agents, but causes myoclonus in some patients.

► CLINICAL BOTTOM LINE
Propofol, methohexital, thiopentone and etomidate all appear to be good choices for procedural sedation in patients requiring electrical cardioversion for atrial fibrillation, atrial flutter and paroxysmal supraventricular tachycardia. Midazolam and diazepam have a significantly longer recovery time, and can produce confusion in the recovery period as well. They should be considered a second-line agents for sedation for cardioversion.

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Table 2

Author, date and country	Patient group	Study type	Outcomes	Key results	Study weaknesses
Valtonen M *et al*, 1988, Finland	35 patients undergoing elective cardioversion due to atrial fibrillation. 30 patients received one cardioversion. 5 patients were cardioverted twice in the study period and received the other form of sedation the on the second occasion. Patients were randomised to receive either 2.5 mg/kg propofol or 5 mg/kg thiopentone and then observed until unresponsive to speech. The patient was then given up to 3 DC shocks	RCT	Induction time Time to orientation—from end of procedure Successful cardioversion	72.0 (20.0) s for propofol *v* 60.3 (13.0) s for thiopentone 7.7 (2.9) min for propofol *v* 6.5 (4.4) min for thiopentone 11/15 for propofol, 13/15 for thiopentone	Small group. Much of the data provided in form of graphs so unable to extract it to put in table
Ford S *et al*, 1991, USA	16 male patients undergoing elective cardioversion for atrial fibrillation or flutter. Patients were randomised to receive 0.2% etomidate or 2.5% thiopental. The drugs were administered at 2 ml every 15 s until the patient no longer responded to verbal commands. Observer blinded to drug received	RCT	Change in mean heart rate Change in mean arterial pressure Failure of cardioversion Pt recall of cardioversion Time of onset of adequate sedation (min) Orientation time (min) Myoclonus	Etomidate decreased the mean heart rate by 5%, thiopental increased it by 7% Etomidate decreased MAP by 4%, thiopental decreased it by 3% 1 in each group 1 in each group Etomidate 1.8 (0.2); thiopental 2.3 (0.2) Etomidate 7.4 (1.2); thiopental 10.1 (3.5) Etomidated 3/8 pts; thiopental 0/8 pts	Small study
Canessa R *et al*, 1991, Chile	44 patients with atrial flutter or fibrillation attending for elective cardioversion. All patients received 1.5 μg/kg fentanyl in addition to the sedative. Patients randomised by last digit of case-note number to one of 4 agents for sedation. 12 pts received 3 mg/kg thiopental (T), 10 patients received 0.15 mg/kg etomidate (E), 12 patients received 1.5 mg/kg propofol (P) and 10 patients received 0.15 mg/kg midazolam (M)	RCT	Change in mean systolic blood pressure Successful cardioversion Mean induction time in seconds (range) Myoclonus Apnoea (loss of ventilatory effort >30 s)	T decreased by 19%, E no significant difference, P decreased by 29%, M decreased by 19% T 12/12; E 7/10; P ? 11/12 (given as 90%); M 9/10 T 31(10–50); E 34 (12–49); P 17 (1040); M 68 (30–220) T 0; E 3; P 0; M 0 T 2/12; E 1/10; P 7/12; M 1/10	Small groups. Poor method of randomisation (treating doctor knows which drug patient will receive before decides whether or not to recruit them). Not clear how randomised between four outcomes using ten digits
Gale DM *et al*, 1993, USA	Thirty adult patients with atrial fibrillation, atrial flutter, or paroxysmal supraventricular tachycardia requiring electrical cardioversion Patients were randomised to receive one of three study drugs: propofol, midazolam or methohexital	RCT	Haemodynamics Dose requirements Time to awakening Adverse effects	No significant difference Propofol: 1.69 (0.46) mg/kg. Methohexital: 1.07 (0.34) mg/kg. Midazolam: 0.16 (0.06) mg/kg. Propofol: 11.2 (4.4) min. Methohexital: 9.4 (2.8) min. Midazolam: 33.1 (15.1) min Propofol: 2/10 patients recalled shock 1 h after event. Pain on injection noted. Methohexital: One patient recalled shock. Midazolam: 5/10 patients with post-recovery confusion lasting >10 min	Groups slightly dissimilar at baseline. Small study, power study not done
Herregods L *et al*, 2003, Belgium	34 patients with atrial arrhythmias who were scheduled to receive repetitive electrical cardioversion. 9 patients were not successfully cardioverted at the first or second session and so only 25 patients were analysed. Patients randomised in prospective double-blinded study to receive either 0.2 mg/kg etomidate or 1 mg/kg propofol. The patients were then cardioverted again at least one week later using the alternative agent. Patients who were not successfully cardioverted by four attempts at either session were excluded	RCT	Required manually assisted ventilation Time to opening eyes (s) Myoclonus Signficant decrease in BP	7/25 etomidate *v* 5/25 propofol 6.1 (2.0) etomidate *v* 4.7 (1.2) propofol 6/25 etomidate *v* 0/25 propofol No patients in either group	No information about induction times. Small group

Table 2 Continued

Author, date and country	Patient group	Study type	Outcomes	Key results	Study weaknesses
Mitchell A *et al*, 2003, UK	141 patients attending one unit for elective cardioversion of an atrial tachyarrhythmia who had not been cardioverted under sedation previously. Patients were randomised to receive diazepam (5–10 mg bolus followed additional 5–10 mg doses every minute up to a maximum of 70 mg) or midazolam (5 mg bolus plus 1–2 mg every minute up to a maximum of 30 mg)	RCT	Successful cardioversion	87% of pts receiving diazepam *v* 89% of patients receiving midazolam	Only patients blinded to drug received
			Episode of hypotension (decrease in systolic BP >20 mmHg or systolic BP <100 mmHg.	7% of pts receiving diazepam *v* 20% of patients receiving midazolam	
			Episode of oxygen desaturation (<99% despite supplementary oxygen)	No patients receiving diazepam *v* 3% of patients receiving midazolam	
			Time for adequate sedation (min)	Diazepam 6.5 (3.4) *v* midazolam 5.0 (3.4)	
			Time till awake and orientated (min)	Diazepam 39 (24) *v* midazolam 77 (46)	
			Pt able to recall events	1 in diazepam group, none in midazolam group	
Coll-Vincent B *et al*, 2003, USA	Thirty two hemodynamically stable adult patients undergoing cardioversion in the ED	RCT	Induction time	Propofol: 50 (30–100) s Etomidate: 90 (25–120) s. Midazolam: 120 (30–180) sec. Midazolam + Flumazenil: 112 (30–350) s	
			Haemodynamics	No significant differences	
	These patients were randomised receive etomidate, propofol, midazolam, or midazolam followed by flumazenil		Time to awakening	Propofol: 8 (3–15) min. Etomidate: 9.5 (5–11). Midazolam: 21 (1–42). Midazolam + Flumazenil: 3 (2–5)	
			Adverse effects	Propofol: 1/9 broncho-spasm. Etomidate: 4/9 myoclonus, 1 bronchospasm, 4 pain at injection site, 2 cough Midazolam: 3 dizziness Midazolam + Flumazenil: 5 resedation	