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EMERGENCY MEDICINE Journal Reading-

Procedural Sedation and Analgesia

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Propofol versus Midazolam/Fentanyl for Reduction of Anterior Shoulder Dislocation

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Introduction

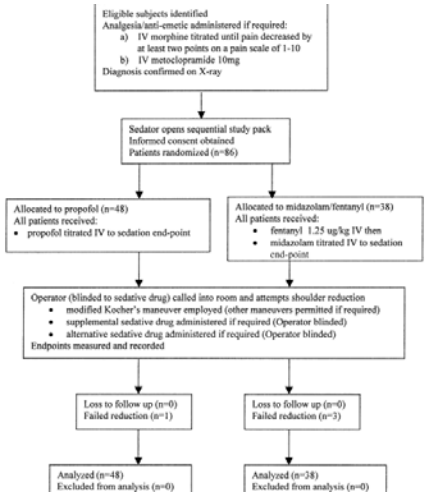
- For therapeutic procedures and investigations
- Sedative and opioid drugs (midazolam/fentanyl)
- Inadequate relaxation and analgesia, procedural failure, postprocedure apnea, and delayed recovery time
- Green and Krauss: (Propofol)
  very short and effective sedation and analgesia, antiemesis, and high patient acceptance

Introduction- Propofol

- EDs: painful procedures$_1$, anxiolysis or immobilization
- Reduction of an anterior shoulder dislocation (attendant pain and muscle spasm)
- Propofol V.S midazolam/fentanyl:
  wakening times, Muscle tone, ease of reduction, reduction failure rates, the number and type of reduction maneuvers required, and adverse events

Methods- design

- Prospective, randomized, clinical trial of patients with anterior shoulder dislocation
- October 2001~ August 2003, 2 tertiary referral hospitals, 1 large regional hospital
- Anterior dislocation of the shoulder ≥18 y/o
- Excluded: other injury, known allergy or contraindication to sedation



Methods- measurements

- The sedationist for all decisions relating to sedative drug administration
- The operator ED resident blinded to the drug

- Times from shoulder reduction to first wakening, full consciousness,
  muscle tone at first and successful reduction 1~5
  ease of shoulder reduction 1~5
- Reduction failure rate, the number of reduction attempts, the number of different reduction maneuvers required, adverse event rates

Results- mean dosage

- Initial dose of propofol: 118.1 mg or 1.5 mg/kg
- 24 (25.0%) a supplementary dose(s) within 4.0 minutes
- Total dose: 142.3 mg or 1.8 mg/kg

- The midazolam/fentanyl group mean fentanyl dose of 97.2 mg
- Initial dose of midazolam: 4.1 mg or 0.06 mg/kg
  22 patients (57.9%) a supplementary dose(s) within 3.5 minutes
- Total dose of midazolam: 7.3 mg or 0.1 mg/kg

Results

TABLE 1. Characteristics of the Two Patient Groups

Characteristic	Propofol group, *n* = 48 (95% CI)	Midazolam/Fentanyl Group, *n* = 38 (95% CI)	p-value
Men, %	83.3 (69.2, 92.0)	63.2 (46.0, 77.7)	0.060
Age (yr), mean	40.9 (34.7, 47.1)	45.2 (37.3, 53.1)	0.390
Weight (kg), mean	78.8 (74.7, 82.9)	73.8 (70.2, 77.4)	0.089
Body build,* mean	3.4 (3.2, 3.6)	3.0 (2.7, 3.2)	0.020
Prior dislocation, %	37.5 (24.3, 52.7)	31.6 (18.0, 48.8)	0.731
Morphine (mg), mean	10.9 (9.1, 12.7)	8.6 (6.0, 11.1)	0.126

*Ordinal scale (1, puny; 2, slight; 3, medium; 4, muscular; 5, very muscular).

TABLE 2. Comparison of Primary Outcomes of the Two Patient Groups (Mean)

Primary End Points	Propofol Group, *n* = 48 (95% CI)	Midazolam/Fentanyl Group, *n* = 38 (95% CI)	Mean Difference (95% CI)	p-value
Awakening times (mins)				
First awakening	3.4 (2.5, 4.3)	8.0 (3.8, 12.3)	4.6 (0.7, 8.6)	0.097
Full wakefulness	6.8 (5.5, 8.1)	28.5 (20.9, 36.1)	21.7 (14.7, 28.7)	<0.001
Muscle tone*				
First attempt	2.5 (2.2, 2.8)	3.0 (2.6, 3.4)	0.5 (0.0, 1.0)	0.081
Successful attempt	2.3 (2.1, 2.6)	2.5 (2.2, 2.9)	0.2 (−0.2, 0.6)	0.496
Ease of reduction†	2.0 (1.7, 2.3)	2.4 (2.1, 2.8)	0.5 (0.0, 0.9)	0.047

*Ordinal scale (1, totally flaccid; 2, tone just noticeable; 3, slight resistance; 4, obvious resistance; 5, impeding relocation).
†Ordinal scale (1, very easy; 2, easy; 3, average; 4, difficult; 5, very difficult).

Results

TABLE 3. Comparison of Secondary Outcomes of the Two Patient Groups

Secondary End Points	Propofol Group, *n* = 48 (95% CI)	Midazolam/Fentanyl Group, *n* = 38 (95% CI)	Mean Difference (95% CI)	p-value
Failed reduction	1/2.1% (0.1, 12.5)	3/7.9% (2.1, 22.5)	5.8% (−6.0, 17.7)	0.317
Reduction attempts, mean	1.3 (1.1, 1.5)	1.8 (1.4, 2.2)	0.5 (0.1, 1.0)	0.020
Maneuvers required, mean	1.2 (1.1, 1.3)	1.4 (1.1, 1.7)	0.2 (−0.1, 0.5)	0.403
Adverse events				
Moaning	18/37.5% (24.3, 52.7)	21/55.3% (38.5, 71.0)	17.8% (−5.5, 41.0)	0.154
Respiratory depression*	11/22.9% (12.5, 37.7)	6/15.8% (6.6, 31.9)	7.1% (−11.8, 26.1)	0.581
Decreased rate	6/12.5% (5.2, 25.9)	1/2.6% (0.1, 15.4)	9.9% (−3.1, 22.9)	0.127
Decreased SaO_2	4/8.3% (2.7, 20.9)	2/5.3% (0.9, 19.1)	3.1% (−9.9, 16.0)	0.690
Partial obstruction	6/12.5% (5.2, 25.9)	5/13.2% (5.0, 28.9)	0.7% (−16.0, 17.3)	0.815
Memory of procedure†	1/2.1% (1.1, 12.5)	3/8.3% (2.2, 23.6)	6.3% (−6.1, 18.6)	0.309
Pain at IV site	3/6.3% (1.7, 18.6)	1/2.6% (0.1, 15.8)	3.7% (−7.7, 14.6)	0.627
Hypotension	0/0% (0.2, 9.2)	1/2.6% (0.1, 15.4)	2.6% (−4.8, 10.1)	0.442
Vomiting	1/2.1% (1.1, 12.5)	0/0% (0.2, 11.4)	2.1% (−4.3, 8.5)	1.000
Aspiration	0/0% (0.2, 9.2)	0/0% (0.2, 11.4)	0% (−2.4, 2.4)	—

*Defined as decreased rate and/or decreased Pao_2 and/or partial obstruction.
†*n* = 84.

No endotracheal intubation, no serious adverse events
One episode of hypotension
(minimum systolic pressure, 94 mm Hg)

Discussions

- Etomidate also short procedural sedation and analgesia, but myoclonus
- Propofol has a shorter sedation time than midazolam
- Protective reflexes (airway, short or long)

- Evidenced: easier reduction and less muscle tone initially and fewer reduction attempts Sub
- Trends: fewer failures and fewer alternative reduction maneuvers

Discussions

- Most adverse events uncommon
- Moaning, 4 remember
- Pain at the propofol injection site, few

- Respiratory depression
- Other: assisted ventilation <10%; repositioning correct partial airway obstruction <5%

Discussions

- Mean total doses of propofol= 1.8 mg/kg and midazolam 0.1 mg/kg
- Induction of general anesthesia (2.0–2.5 mg/kg and 0.15–0.20 mg/kg, respectively)
- Deep sedation and relaxation; numerous factors

Limitations

- Not ideally matched at baseline, attenuated (muscle tone, ease of reduction……)
- Variables (body build, muscle tone, ease of reduction)- subjective and nonvalidated scales
- The sedation end point (spontaneous eye closure) = similar depths of sedation?[1]
- Numerous physicians as sedationists and operators, varied[1]

Conclusions

- Propofol as effective as midazolam/fentanyl for the reduction of anterior shoulder dislocation using the modified Kocher's maneuver, with significantly shorter wakening times
- Even rapid weakening; respiratory depression, vomiting- risk of aspiration

Conclusions

- After consideration of potential adverse events and adequate monitoring, resuscitation facilities
- Propofol acceptable alternative to midazolam/fentanyl, not conclude better drug regimen

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Propofol for Emergency Department Procedural Sedation and Analgesia: A Tale of Three Centers

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Introduction- Propofol

- Procedural sedation and analgesia (PSA) for painful procedures in the emergency department (ED)
- Midazolam, etomidate, methohexital, and propofol
- Rapid onset and brief duration; acute respiratory and cardiovascular complications (no reports)

Introduction

- Characterize propofol PSA a large population at multiple ED sites
- The frequency of respiratory and cardiovascular events
- The relationship between these events and patient descriptors

Methods- design

- Prospective, descriptive series of a consecutive sample of ED receiving propofol for PSA at three study sites
  (Overlake Hospital Medical Center (OMC) in Overlake, WA; Hennepin County Medical Center (HCMC) in Minneapolis, MN; and Maine Medical Center (MMC) in Portland, ME)
- No standardize PSA treatment or monitoring practices
- Vital signs and depth of sedation, patient weight, propofol dose, number of propofol doses, and PSA-related events, including respiratory events, hemodynamic events, or emesis

Methods

- Propofol initial dosing guideline of 1 mg/kg bolus, supplemented by 0.5-mg/kg (+/-)
- Pain with injection and occurrence of PSA amnesia collected at HCMC and OMC
- HCMC and MMC, nasal cannula with 2–4 L/min immediately before and during PSA
- OMC, high-flow oxygen nonrebreather mask before propofol for > 3 mins → nasal
- Hypotension, bradycardia

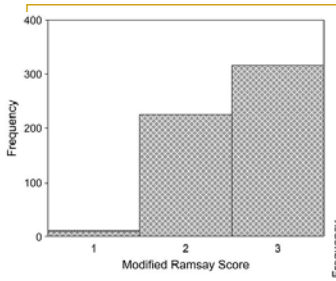

Figure 1. Histogram of maximum depth of sedation for patients undergoing PSA at HCMC or MMC as measured by modified Ramsay score.

2.6 (±0.5) / 2.5 (±0.6)

3.9 (±1.0)

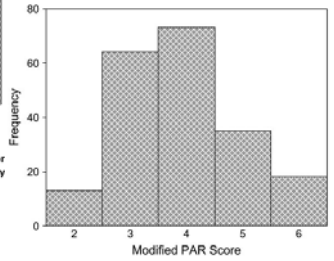

Figure 2. Histogram of maximum depth of sedation for patients undergoing PSA at OMC as measured by postanesthesia recovery (PAR) score.

Results- Patient Demographics

Site	*n*	Mean age, yr (SD)	Age range, yr	Male (%)	Mean total propofol dose, mg/kg (SD)*
At each study site					
HCMC	371	40 (16)	16–88	50	1.9 (0.9)
MMC	201	36 (26)	0.5–90	60	2.2 (2.5)
OMC	220	50 (23)	3–89	57	1.5 (0.8)
Total	792	41 (22)	0.5–90	56	1.8 (1.4)
Patients 12 years or older at each study site					
HCMC	371	40 (16)	16–88	50	1.9 (0.9)
MMC	146	47 (22)	12–90	56	1.3 (0.9)
OMC	176	52 (21)	12–89	51	1.4 (0.7)
Total†	693	45 (19)	12–90	51	1.7 (0.9)
Patients younger than 12 years at each study site					
HCMC	0				
MMC	52	5.7 (3)	0.5–11	69	3.8 (3.4)
OMC	11	7.0 (3)	3–10	75	2.5 (0.6)
Total†	63	6.0 (3)	0.5–11	70	3.6 (3.2)

Results- Patient Demographics

Table 2
Number (%) of Procedures Performed with Propofol Procedural Sedation and Analgesia at Each Study Site

Site	*n*	Dislocation Reduction	Fracture Reduction	Cardioversion	Abscess Incision and Drainage	Other*
HCMC	371	141 (38)	156 (42)	0	57 (15)	17 (5)
MMC	201	90 (45)	57 (28)	26 (13)	5 (3)	23 (11)
OMC	220	71 (32)	64 (29)	51 (23)	5 (3)	29 (13)
Total	792	302 (38)	277 (35)	77 (10)	67 (8)	69 (9)

HCMC = Hennepin County Medical Center; MMC = Maine Medical Center; OMC = Overlake Hospital Medical Center.
* Other (number of procedures) = computed tomography imaging (16), lumbar puncture (2), Foley catheter placement (2), chest tube placement (8), laceration repair (4), foreign body removal (6), endoscopy (6), unclassified (23), hernia reduction (1), and dilatation and curettage (1).

The most common sites of joint dislocation reduction:
hip 102 (34%), and shoulder 120 (40%)
The most common anatomic sites for fracture reduction:
wrist 119 (43%), and ankle 37 (13%)

Results

- Intravenous analgesia similarly distributed three
- 526; 66%- Morphine sulfate in 299 (57%), fentanyl in 133 (25%), hydromorphone in 93 (18%), and meperidine in 1 (<1%)

- Intravenous antiemetics before PSA in 107 (14%) primarily at OMC(86)
- Ondansetron in 69 (64%), promethazine in 22 (21%), and droperidol in 16 (15%).

Results

Table 3
Number (%) of Cases with Respiratory Events, Hypotension, or Emesis Associated with Propofol Procedural Sedation and Analgesia at Each Study Site

Site	*n*	SpO_2 <90%	Bag-valve Mask Ventilation	Oral Airway	Hypotension	Emesis
HCMC	371	31 (8.4)	14 (3.8)	1 (0.3)	10 (2.7)	0 (0)
95% CI		5.9, 11.0	1.9, 5.9	0.1, 0.5	1.1, 4.3	0, 0.8
MMC	201	19 (9.4)	6 (3.0)	0 (0)	13 (6.5)	0 (0)
95% CI		5.0, 13.9	1.0, 5.0	0, 1.5	2.5, 10.4	0, 1.5
OMC	220	11 (5.0)	11 (5.0)	1 (0.5)	5 (2.2)	1 (0.5)
95% CI		1.8, 8.2	1.8, 7.7	0.1, 0.9	0.9, 3.6	0.1, 0.9
Total*	792	61 (7.7)	31 (3.9)	2 (0.3)	28 (3.5)	1 (0.1)

HCMC = Hennepin County Medical Center; MMC = Maine Medical Center; OMC = Overlake Hospital Medical Center.
* Some patients had more than one event.

- Injection pain in 11: two at HCMC; 9 at OMC
- Absence of procedure recall: 325 patients (88%) at HCMC and 178 (81%) at OMC
- No statistically significant between the incidence of the events and the study site, total propofol dose, or number of propofol doses

Results

Table 4
Number (%) of Cases with Respiratory Events and/or Emesis by Procedural Sedation and Analgesia Procedure

Event	Dislocation Reduction	Fracture Reduction	Cardioversion	Abscess Incision and Drainage	Other*	p-value
SpO_2 <90%	28 (9.3)	17 (6.1)	10 (13.0)	1 (1.5)	5 (7.2)	0.07
Bag-valve mask ventilation	16 (5.3)	6 (2.2)	4 (5.2)	1 (1.5)	4 (5.8)	0.21
All†	36 (11.9)	20 (7.2)	10 (13.0)	2 (3.0)	7 (10.1)	0.08

* *Other* includes computed tomography imaging, lumbar puncture, Foley catheter placement, chest tube placement, laceration repair, foreign body removal, endoscopy, unclassified, hernia reduction, and dilatation and curettage.
† Includes SpO_2 <90%, bag-valve mask-assisted ventilation, oral airway (two patients), and/or emesis (one patient). Some patients had more than one event.

- SpO2 <90% associated with increased age (mean age of 51 vs. 40; p < 0.001)
- Increased age also associated with BVM ventilation (mean age of 52 vs. 41; p = 0.003)
- Trend toward increased weight (81 kg vs. 74 kg; p= 0.085)

Discussions

- Propofol unique, commonly used in sedation
- Pediatric population, reduce recovery time compared with midazolam, no significant differences in the rate of adverse effects 1999, Havel et al.
- Largest adult population with characterization of intravenous propofol for ED PSA

- Adverse events not unique to propofol but also for other PSA agents
- Endotracheal intubation, prolonged observation, or admission to the hospital

Discussions

- Age and procedure most associated with any propofol-related respiratory event

- Electrical cardioversion, joint dislocation reduction Stimulus is minimal at the completion

- Risk factors:
  comorbidities, baseline airway assessment, age, weight-based propofol dosing, and the planned procedure with consequent planned depth of sedation

Discussions- Propofol

- Importance of ‘‘nothing by mouth’’ ?
  The emesis in the study all approximately 0.1%

- Reduction of venous return and venous dilatation→ hypotension→ patient selection
  (cessation of propofol with intravenous fluid)

- Absence of nausea, confusion, and agitation
- Routine utilization of an antiemetic medication?
- Analgesic agent if needed, unclear for events

Limitations

- Lack of standardized data collection, common study period
- No training program or rigid guideline for propofol dosing
- Impact of the number of providers present and the incidence of reported PSA events (variety of ED settings)

Future……

- Optimal dosing strategies for propofol PSA (1.0-mg/kg bolus followed by 0.5-mg/kg as needed)
- Selected for patient- or procedure-specific considerations
- The impact of additional monitoring modalities? end-tidal carbon dioxide monitoring

Conclusions

- Propofol typically confers a deep sedation experience for ED PSA.
- Most common PSA-related events: respiratory
- Consistent the frequency across these three practice settings with large PSA populations
- Resolved with brief supportive interventions with no adverse sequelae

- Thank you for listening~

Modified Ramsey score

1. Anxious, Agitated, Restless
2. Cooperative, Oriented, Tranquil; Accepts mechanical ventilation.
3. Responds to commands only
4. Brisk response to light glabellar tap or loud noise.
5. Sluggish response to light glabellar tap or loud noise.
6. No Response.

Modified PAR score

Chart 1. The 'modified' Aldrete Scale

RESPIRATION	2	1	0
	Able to take deep breath and cough	Dyspnea/Shallow Breathing	Apnea
O2 SATURATION	2	1	0
	Maintains > 92% on room air	Needs O2 inhalation to maintain O2 saturation > 90%	Saturation < 90% even with supplemental O2
CONSCIOUSNESS	2	1	0
	Fully awake	Arousable on calling	Not responding
CIRCULATION	2	1	0
	BP ± 20mmHg pre op	BP ± 20-50mmHg pre op	BP ± 50mmHg pre op
ACTIVITY	2	1	0
	Able to move 4 extremities voluntarily or on command	Able to move 2 extremities voluntarily or on command	Able to move 0 extremities voluntarily or on command