N5UV
PEGASUS

Pre-Hospital Sedation Strategies

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We will discuss…

- What is sedation?
- Commonly used agents
- Some clinical scenarios
- Monitoring level of sedation
- Wrap-up

*No financial disclosures

What is Sedation?

- Sedation vs analgesia…
- “Conscious” sedation? (Procedural sedation)
- Sedation = ↓ awareness to the environment and ↓ responsiveness to external stimulation

Goals of Intervening?

- Reduce injury / illness pain and suffering
- Facilitate procedures / examination
- Scene safety

Why does your patient need sedation?

Analgesia

- 20% of all EMS patients have mod-severe pain (Mclean, 2002)

- “NAEMSP believes that the relief of pain and suffering of our patients must be a priority for every EMS system.” (Position statement 2003)

Room for improvement

- Largely ignored in prehospital care education
- Pain management protocols are lacking
- Oligoanalgesia
  - Fear of “masking”
  - Prevent side-effects
  - Unable to obtain IV access
  - Defer pain management to ED
  - Negative feedback from receiving staff
- Pain reduction is closely tied to satisfaction

A1 sedation

- "Analgesia first"

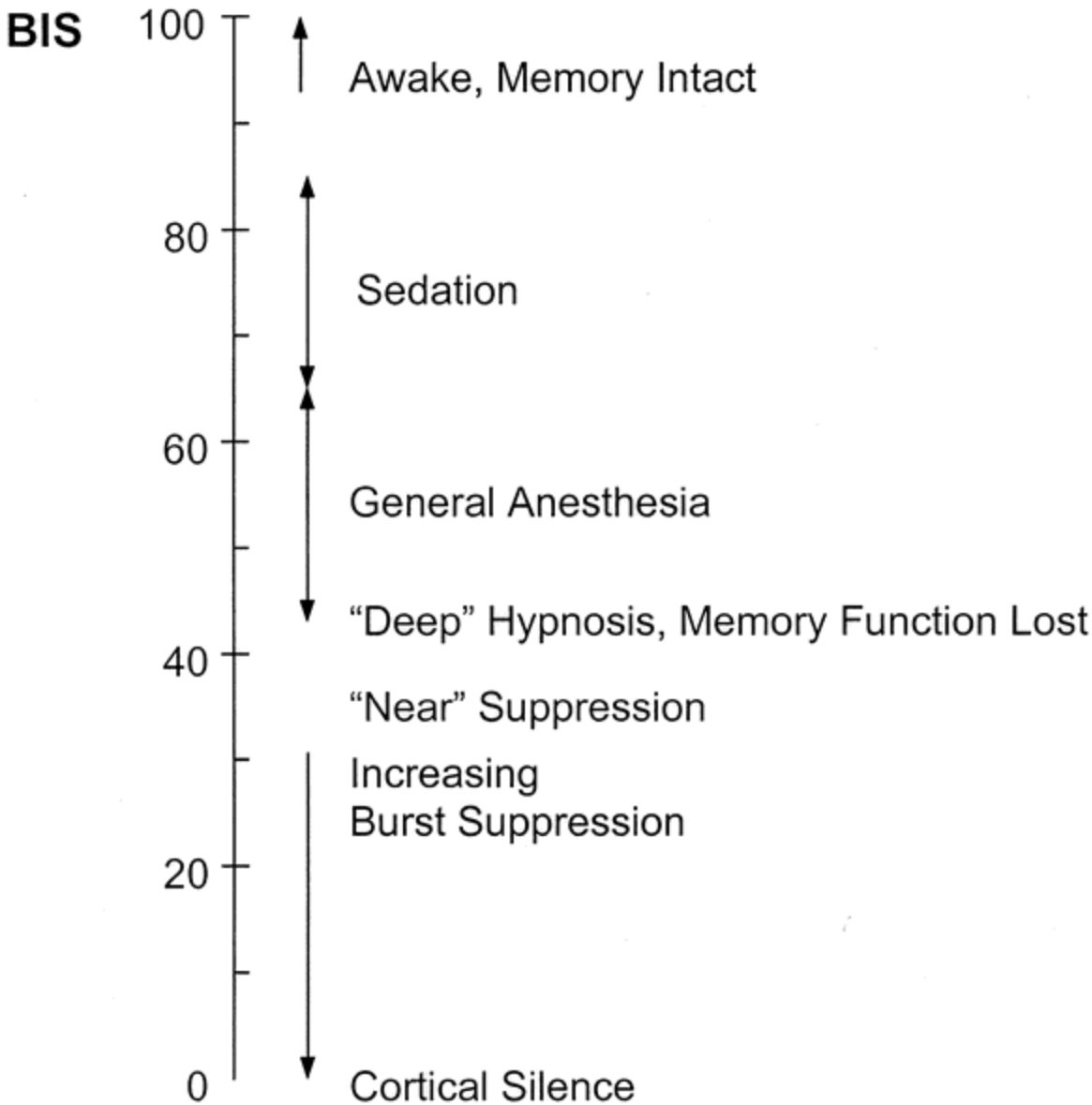
A protocol of no sedation for critically ill patients receiving mechanical ventilation: a randomised trial

Thomas Strøm, Torben Martinussen, Palle Toft

Lancet 2010; 375: 475–80

- 140 critically ill patients expected to remain intubated > 24 hours

	No sedation (n=55)	Sedation (n=58)	p value
Days without mechanical ventilation (from intubation to day 28)	13·8 (11·0); 18·0 (0–24·1)	9·6 (10·0); 6·9 (0–20·5)	0·0191*†
Length of stay (days)			
Intensive care unit	13·1 (5·7–··)‡	22·8 (11·7–··)‡	0·0316*§
Hospital	34 (17–65)	58 (33–85)	0·0039*§¶
Mortality			
Intensive care unit	12 (22%)	22 (38%)	0·06
Hospital	20 (36%)	27 (47%)	0·27
Drug doses (mg/kg)‖			
Propofol (per h of infusion)**	0 (0–0·515)	0·773 (0·154–1·648)	0·0001
Midazolam (per h of infusion)	0 (0–0)	0·0034 (0–0·0240)	<0·0001
Morphine (per h of mechanical ventilation)	0·0048 (0·0014–0·0111)	0·0045 (0·0020–0·0064)	0·39
Haloperidol (per day of mechanical ventilation)	0 (0–0·0145)	0 (0–0)	0·0140
Tracheostomy	16 (29%)	17 (29%)	0·98
Ventilator-associated pneumonia	6 (11%)	7 (12%)	0·85



Anxiolysis

Moderate

Deep

Unconscious

*Bispectral Index Scale

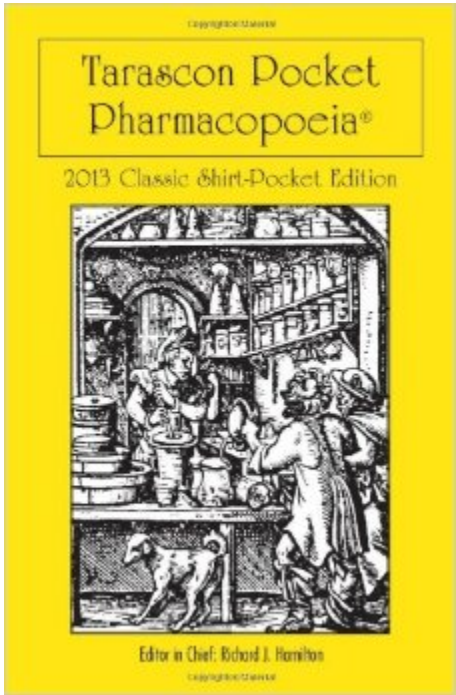
CITY PARKING
LIMITED TO
EVEN # SIDE ON EVEN # MONTHS
ODD # SIDE ON ODD # MONTHS
APR. THRU SEPT.
EVEN # SIDE ON EVEN # DAYS
ODD # SIDE ON ODD # DAYS
OCT. THRU MAR.
ALTERNATE 10AM
WARNING

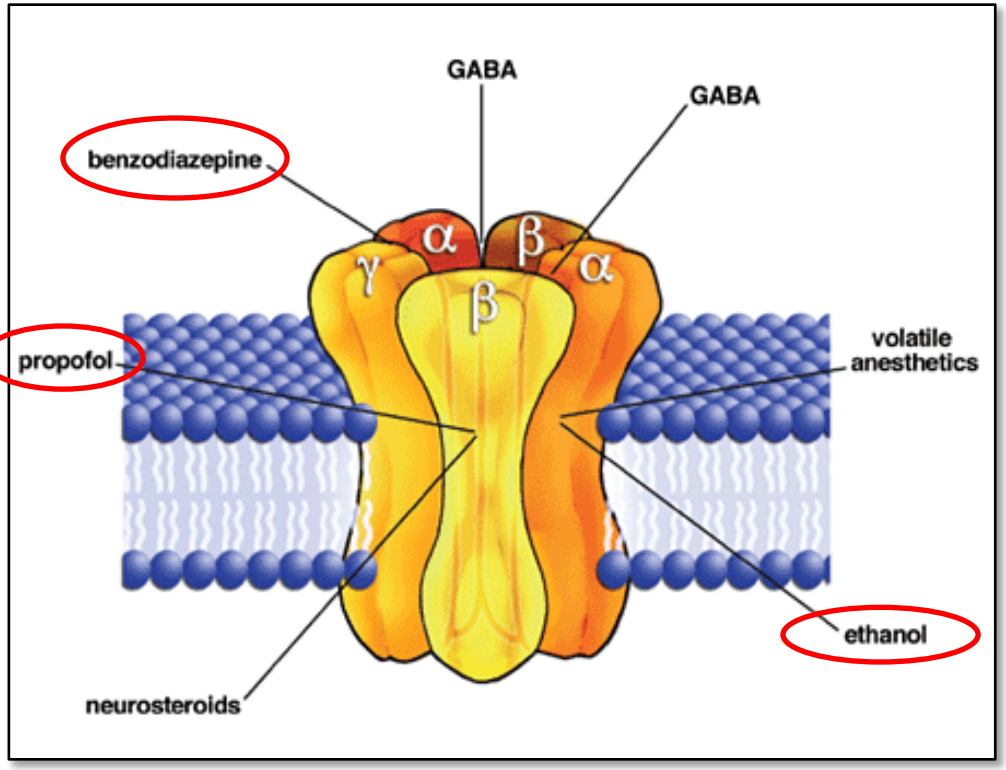
Sedation Agents

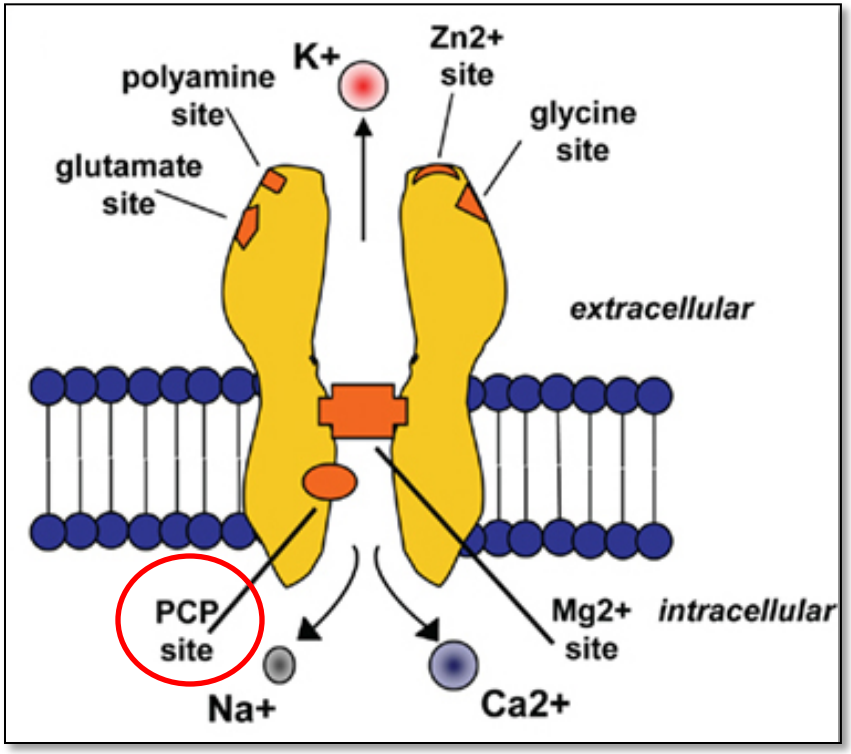
- **Benzodiazepines**
  - Midazolam
  - Lorazepam
- **Nonbarbiturate**
  - Propofol
  - Etomidate
- **Opioid**
  - Fentanyl
  - Morphine
  - Hydromorphone
- **Non-Opioid**
  - Ketamine

The best sedative???

- "Lets review the dosing, pharmacokinetics, Vd, metabolism, and clearance…"



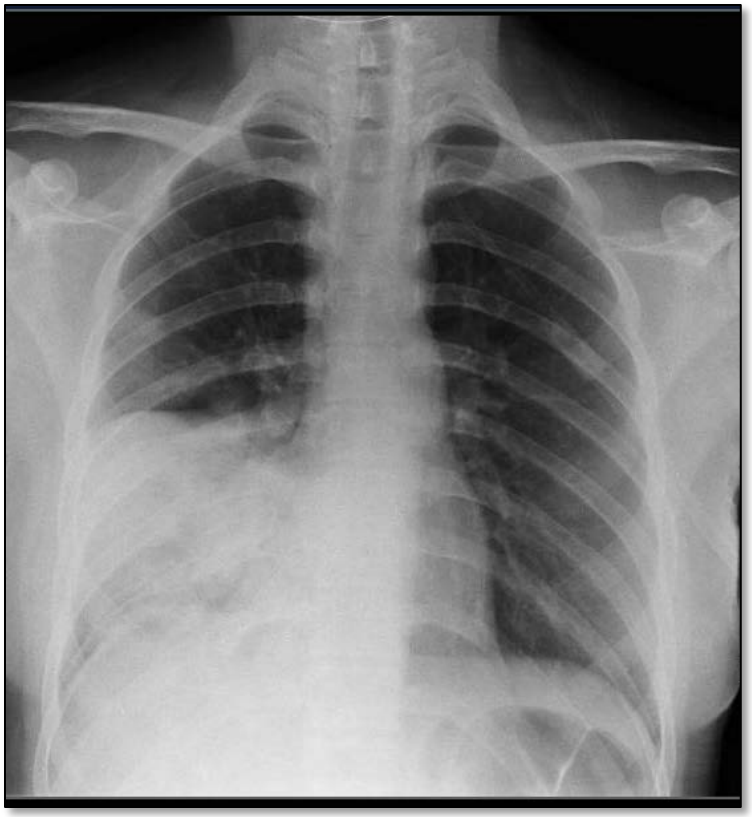

GABA
GABA
benzodiazepine
α
β
γ
α
β
propofol
volatile
anesthetics
ethanol
neurosteroids


K+
Zn2+
site
polyamine
site
glycine
site
glutamate
site
extracellular
PCP
site
Mg2+
site
intracellular
Na+
Ca2+

AMBULANCE
Western Albemarle
Rescue Squad
502
Western Albemarle
Rescue Squad
ADVANCED LIFE SUPPORT
EMERGENCY
DIAL 9-1-1
502
CROZET
VOL.
FIRE DEPT.

65 y.o. female nursing home pt. with respiratory distress…

- Fever since yesterday
- Productive cough
- T 103F, HR 134 ST
- RR 32, SaO2 93%
- BP 68/40



Challenges of sedation in shock

- Reduced perfusion & circulating volume
- Delayed drug delivery
- Reliant on hyper-catecholaminergic state

Options for induction sedative

- Midazolam
- Propofol
- Etomidate
- Ketamine

Midazolam

- GABA-A site
- Good amnesia & anxiolysis
- Induction dose varies (0.1-0.35 mg/kg)
- EEG changes after 3-5 min
- Duration 30 min

Midazolam

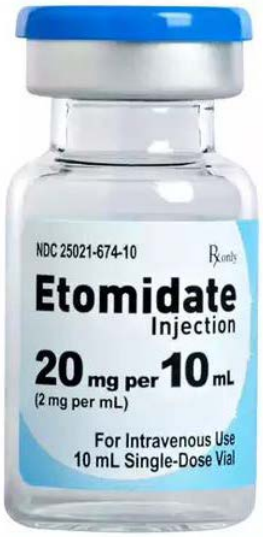
- Cardiovascular depression - hypotension seen at 2mg IV
- No analgesia
- Depress respiratory drive
- Long time to onset

Propofol

- GABA-A? Global CNS depression
- Onset 30-60 sec
- Duration 10 min minimum (dose dependent)
- Direct CV suppression
- No analgesia

Etomidate

- GABA-A, RAS
- Onset < 1 min
- Duration 5-8 min, little residual effects
- “CV neutral”
- Adrenocortical suppression 4-6 hrs
- 0.3 mg/kg
- No analgesia
- Shortages…



Ketamine

- NMDA antagonist (thalamocortical & limbic)
- Interaction with opioid receptors
- 1-2 mg/kg dissociative anesthesia
- 0.1-0.3 mg/kg subdissociative
- 4-13mg/kg IM

Ketamine

- Respiratory drive is maintained, pharyngeal reflexes preserved
- Increased SBP and HR (indirectly CNS outflow)
- Augments opioids
- Onset 30 seconds
- Duration 15-30 min

Ketamine

- Emergence reactions 10-20%
- Hypersalivation
- Laryngospasm

Don't let
FEAR
come
between
YOU
AND
your horse.

65 y.o. female nursing home pt. with respiratory distress…

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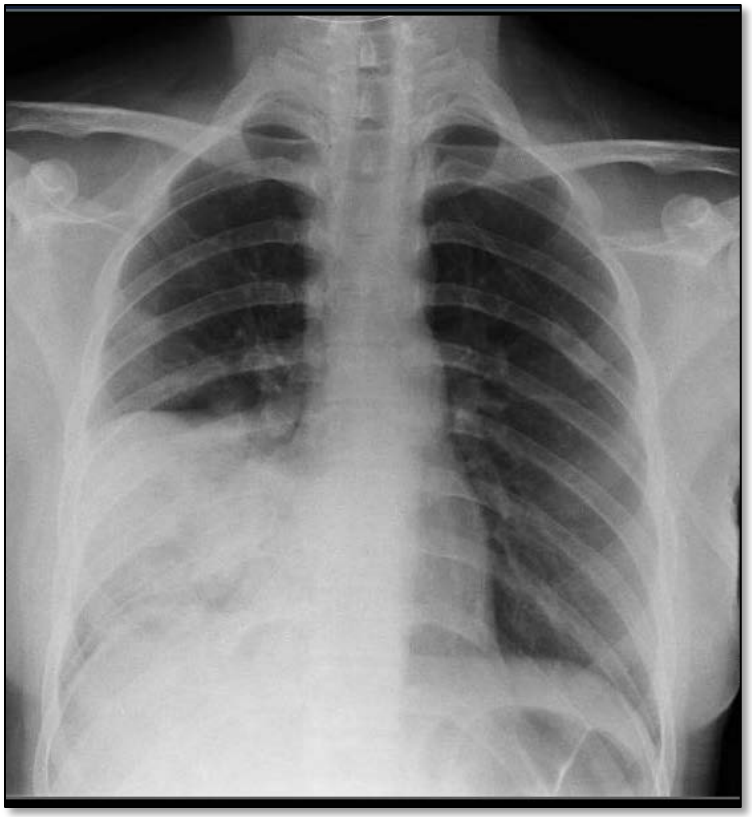


Death and Other Complications of Emergency Airway Management in Critically Ill Adults: A Prospective Investigation of 297 Tracheal Intubations

Schwartz, David E. MD; Matthay, Michael A. MD; Cohen, Neal H. MD

- Systolic hypotension (+/- vasopressors) is the biggest factor associated with death at time of intubation
- Anesthesiology 1995

The frequency and significance of postintubation hypotension during emergency airway management

- Post-intubation hypotension in **23%**
- Significantly associated with higher mortality & increased LOS
- Heffner et al. J Crit Care 2012 Aug;27(4):417

Anaesthesia in haemodynamically compromised emergency patients: does ketamine represent the best choice of induction agent?

C. Morris et al. Anaesthesia, 2009, 64, pages 532–539

Intravenous induction agent	Effector site equilibration and $t_{1/2}K_{eo}$	Haemodynamic effects in vivo	Comments and idiosyncratic reactions (see text)
Ketamine	Undetermined (see text), but probably ~2 min	↑CO, ↑HR, ↑ABP Sympathomimetic	→ or ↑CPP and →ICP with standard anaesthetic management
Thiopentone	1.5 min	↑HR, →CO, ↓ABP →laryngeal reflexes, ↓inotrope, vasodilates	Haemodynamically compromised patients unlikely to tolerate induction dose > 3 $mg.kg^{-1}$
Propofol	≤20 min	→HR, ↓CO, ↓ABP Vagotonic, ↓laryngeal reflexes	Haemodynamic compromise marked in elderly, ASA 3 or more or hypovolaemic patients with 'standard' induction dose
Etomidate	~2.5 min	→CO, →ABP Minimal dose adjustment in shock	Prolonged inhibition of steroid synthesis in the critically ill; withdrawn from number of countries
Benzodiazepenes	~9 min (e.g. lorazepam)	→CO, →HR	Induction time of anaesthesia incompatible with RSI
Phenylpiperidenes	~6 min (e.g. fentanyl)	Vagotonic, ↓CO, ↓HR, ↓ABP Vagotonic, ↓laryngeal reflexes	Potent vagally mediated bradycardia can compound effects of hypovolaemia

CO, cardiac output; ABP, arterial blood pressure; HR, heart rate; CPP, cerebral perfusion pressure; ICP, intracranial pressure.
ASA, American Society of Anesthesiologists preoperative grade.
↑, Increased; ↓, decreased; →, unaffected.

What's it gonna be?

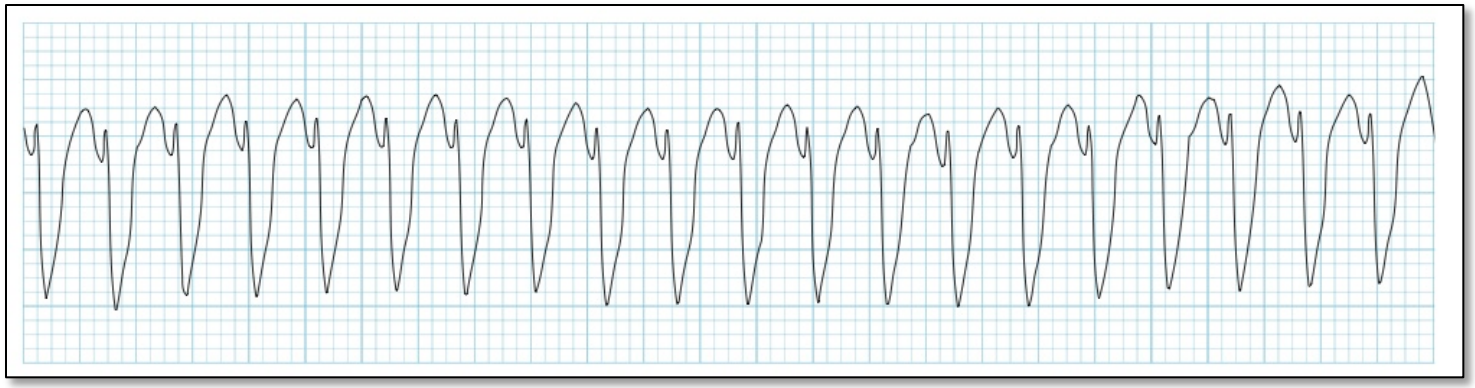
- Optimize pre-RSI condition
- Ketamine + PRN fentanyl
- Etomidate as a distant second choice
- Propofol
- Midazolam

+ ACLS

EMS 11
FIRE RESCUE
ALBEMARLE COUNTY

Dispatched to 88 y.o. male C.A.

- CPR in progress, BVM



- ACLS, defibrillate x 3 then ROSC

- Sats 72% with snoring RR 4-5/min
- BP 95/60
- AFRVR at 140-155 bpm
- You decide to control the airway…

What's it gonna be?

- Optimize pre-RSI condition

- Ketamine
  - Indirect sympathomimetic via CNS outflow
  - Reduces catecholamine reuptake

- Etomidate
- Propofol at reduced dose (1/10th)
  - Anesth 2004 101:567

- No Midazolam / Fentanyl for this patient

'NO' MEANS
NOTHING TO A DUCK

33 y.o. male in custody agitated

- Flailing in handcuffs, disoriented
- Large pupils, BP 200/140, HR 135
- “bath salts” in pocket

White Paper Report on Excited Delirium Syndrome

- ACEP 2009
- Agitated or violent patients posing immediate danger to themselves or those around them
- Associated with SCD

FEATURE	FREQUENCY % (95% CI)
Pain Tolerance	100 (83-100)
Tachypnea	100 (83-100)
Sweating	95 (75-100)
Agitation	95 (75-100)
Tactile Hyperthermia	95 (75-100)
Police Noncompliance	90 (68-99)
Lack of Tiring	90 (68-90)
Unusual Strength	90 (68-90
Inappropriately Clothed	70 (45-88)
Mirror/Glass Attraction	10

Excited Delirium

- Traditional:
  - Antipsychotic + bzd
- Ideal:
  - IM or IV
  - Rapid onset
  - Sustained effects
  - Minimal SE

Table 5. Sedation Agents for ExDS–type symptoms

Class	Agent (Trade Name)	Available Routes	Dosing (mg)*	Onset (min)	Duration (min)
	Midazolam (Versed)	IN	5	3-5	30-60
		IM	5	10-15	120-360
		IV	2 - 5	3-5	30-60
	Lorazepam (Ativan)	IM	4	15-30	60-120
		IV	2 - 4	2-5	60-120
	Diazepam (Valium)	IM	10	15-30	15-60
		IV	5 - 10	2-5	15-60
	†Haloperidol (Haldol)	IM	10– 20	15	180-360
		††IV	5 – 10	10	180-360
	†Droperidol (Inapsine)	IM	5	20	120-240
		IV	2.5	10	120-240
	Ziprasidone (Geodon)	IM	10– 20	10	240
	Olanzapine (Zyprexa)	IM	10	15-30	24 hrs
	Ketamine (Ketaset, Ketalar)	IM	4-5 mg/kg	3-5	60-90
		IV	2 mg/kg)	1	20-30

Droperidol versus haloperidol for chemical restraint of agitated and combative patients. Ann Emerg Med. 1992 Apr;21(4):407-13

- 21 haldol 5mg IM
- 26 droperidol 5mg IM
- droperidol decreased combativeness significantly more than IM haloperidol at ten (P = .006), 15 (P = .01), and 30 (P = .04) minutes

The association between ketamine given for prehospital chemical restraint with intubation and hospital admission☆,☆☆

Burnett, et al. Am J Emerg Med. 2015 Jan;33(1):76-9

- 49 pts with IM dose 2.2 – 9.4 mg/kg
- 14 required intubation in ED
  - 6.16 vs 4.9 mg/kg
- Trend towards higher dose associated with medical admission

Ketamine for excited delirium

- Limited comparison data in prehospital setting

- Rapid onset
- Large therapeutic window
- Seems to work well

- Potential for airway compromise (laryngospasm or hypoxia)
- Emergence in 10-20% (rarely alters clinical course)

What's it gonna be?

- Physical restraints
- Ketamine 4-5 mg/kg IM
  - Midazolam 2mg IV

- Droperidol 5mg IM + Midazolam 5mg IM
- Haldol 5-10mg IM + Midazolam 5mg IM

- Monitor closely (ETCO2 especially if pt is on O2)

VIA FUNNYMEME.COM

83 y.o. female GLF, private apartment

- Fell from commode 3 hrs ago
- Wedged between toilet and bath tub
- Exquisite left hip pain, LLE appears shortened
- HR 87, BP 185/79

Painful Extrication

- Provide analgesia and facilitate movement

- Bredmose et al. Prehospital use of ketamine for analgesia and procedural sedation. Emerg Med J. 2009;26:62-4
  - Review 1030 trauma patients
  - 26% entrapped
  - No complications (0.5-1 mg/kg IV dose)

Etomidate in Procedural Sedation

Thomas Levins, BSN, RN, CCRN, CFRN

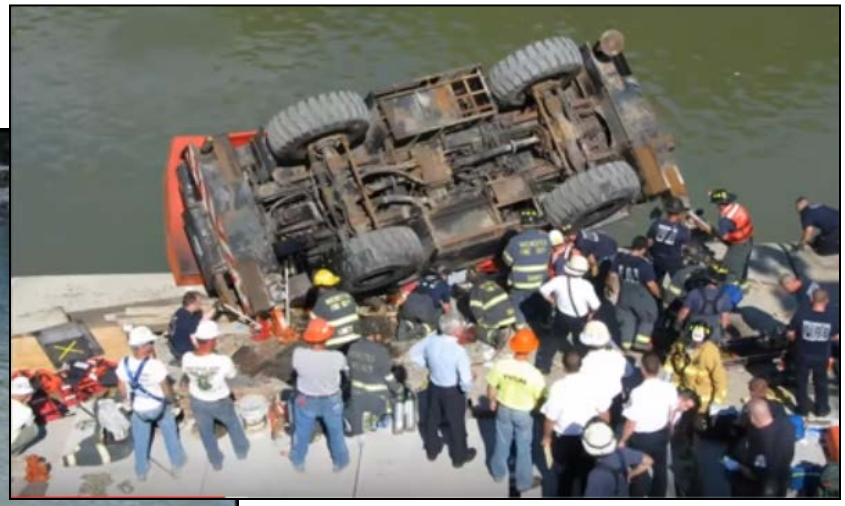
- Air Medical Journal, 2010
- 0.1 mg/kg
- 17 patients
  - Facilitated extrication
  - Isolated extremity splinting
- No hemodynamic complications
- 4 ETI's, 1 unplanned

What's it gonna be?

- Analgesia first

- Etomidate 0.1 mg/kg IV
- Ketamine 0.5-1 mg/kg IV

In-field amputation while entrapped



One step further…

- Post-intubation sedation
  - Keep oriented
  - Preserve sleep architecture

- Prevent Delirium

Early Intensive Care Sedation Predicts Long-Term Mortality in Ventilated Critically Ill Patients

Shehabi et al. Am J Respir Crit Care Med Vol 2012;186(8):724–731

- Large multicenter prospective study
- 251 intubated patients
- Deep sedation at 4 hours is a negative predictor of the time to extubation, hospital death, and 180-day mortality
- Conclusions: Early sedation depth independently predicts delayed extubation and increased mortality, making it a potential target for interventional studies.

Monitoring Sedation

TABLE 1. RICHMOND AGITATION–SEDATION SCALE

Score	Term	Description
+4	Combative	Overtly combative or violent; immediate danger to staff
+3	Very agitation	Pulls on or removes tube(s) or catheter(s) or has aggressive behavior toward staff
+2	Agitated	Frequent nonpurposeful movement or patient–ventilator dyssynchrony
+1	Restless	Anxious or apprehensive but movements not aggressive or vigorous
0	Alert and calm	
−1	Drowsy	Not fully alert, but has sustained (more than 10 seconds) awakening, with eye contact, to voice
−2	Light sedation	Briefly (less than 10 seconds) awakens with eye contact to voice
−3	Moderate sedation	Any movement (but no eye contact) to voice
−4	Deep sedation	No response to voice, but any movement to physical stimulation
−5	Unarousable	No response to voice or physical stimulation

Monitoring Sedation

- Behavioral Pain Scale. Crit Care Med 2001;29(12):2258

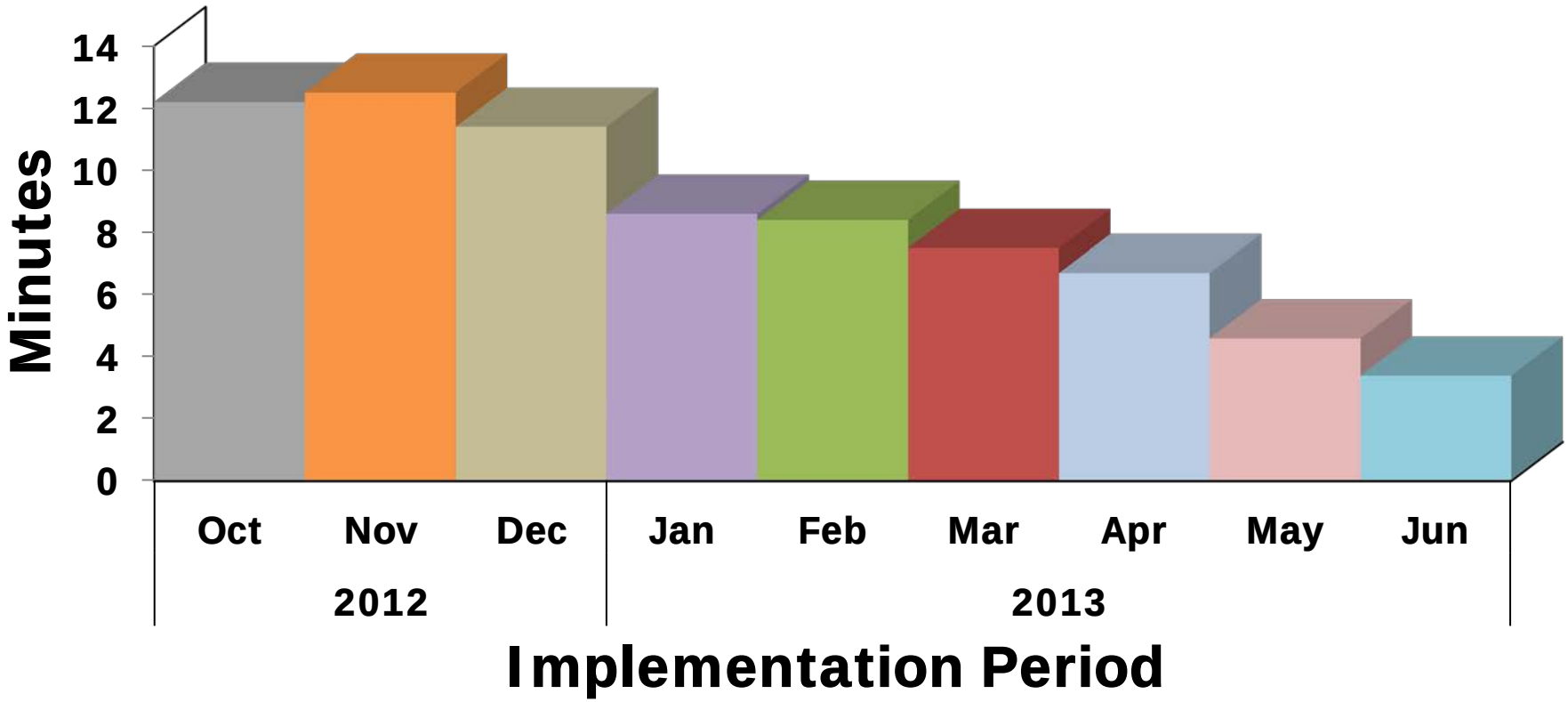
Item	Description	Score
Facial expression	Relaxed	1
	Partially tightened (e.g. brow lowering)	2
	Fully tightened (e.g. eyelid closing)	3
	Grimacing	4
Upper limbs	No movement	1
	Partially bent	2
	Fully bent with finger flexion	3
	Permanently retracted	4
Compliance with ventilation	Tolerating movement	1
	Coughing with movement	2
	Fighting ventilator	3
	Unable to control ventilation	4

Reproduced from Payen et al. (2001)

Effects of the use of the Richmond Agitation Sedation Scale (RASS) on time to post-intubation sedation in the pre-hospital setting

- 165 intubated patients transported 10/1/2012 through 7/1/2013
- Average time to sedation was 12 minutes and longest time 20 minutes
- January – April average time to initial sedation was 7 minutes with longest time of 10 minutes
- May – July average time to initial sedation was 4 minutes, with longest time of 8 minutes

Average Time to Sedation



THE END

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