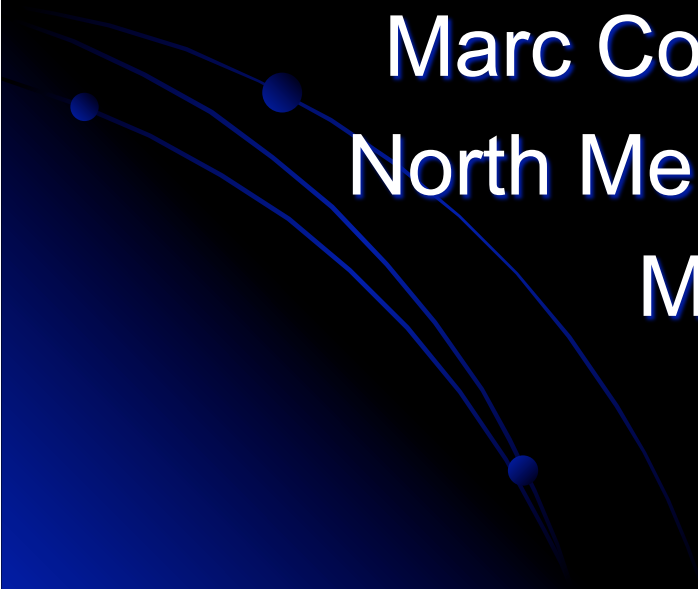
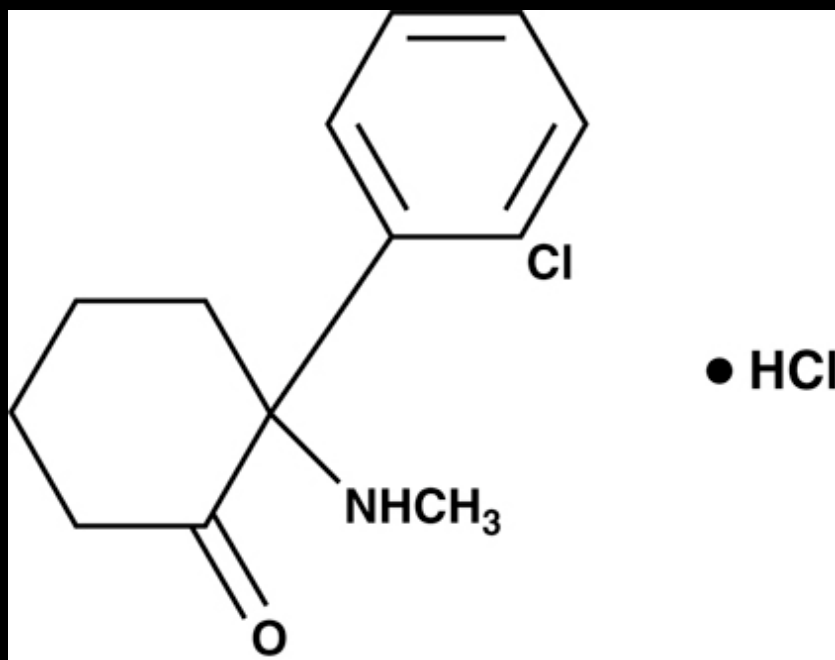


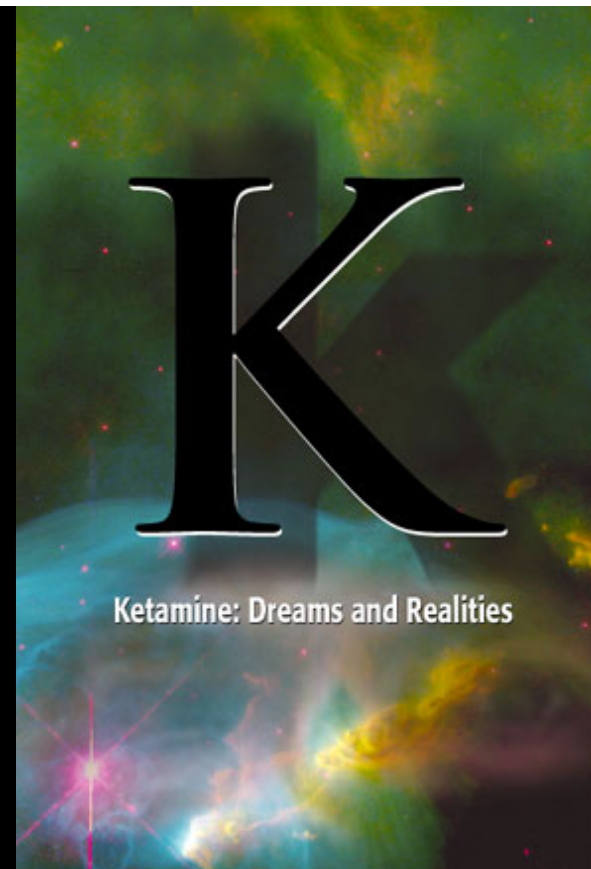
# Dissociative Practices: The Rationale for Ketamine in 9-1-1 Services

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# Ketamine



Perhaps a better title?

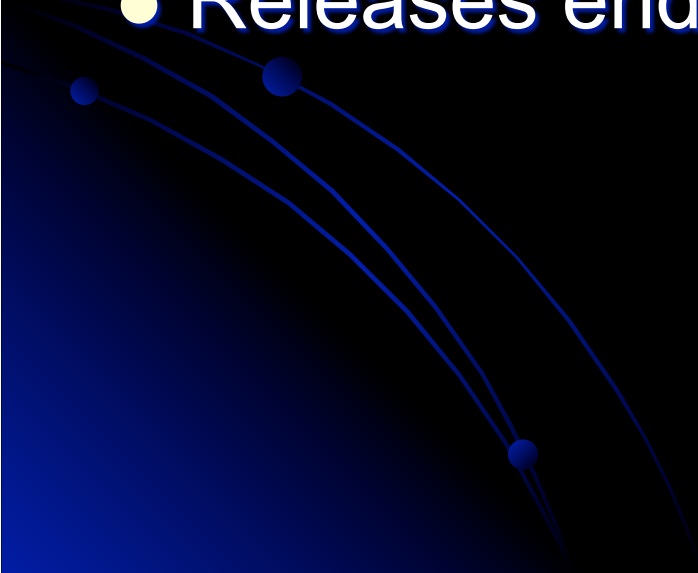
# Ketamine

- Generic Name: Ketamine Hydrochloride
- Trade Name: Ketalar
- Classification Sedative, Analgesic, Dissociative agent

# HISTORY

- First synthesized in 1962 by Parke-Davis
- Patented for human/animals in 1966
- First dissociative anesthetic
- Widely used as a field anesthetic by the U.S. during the Vietnam War
- Rapidly recognized for its psychedelic properties and abuse soon followed
- Extensive third-world use

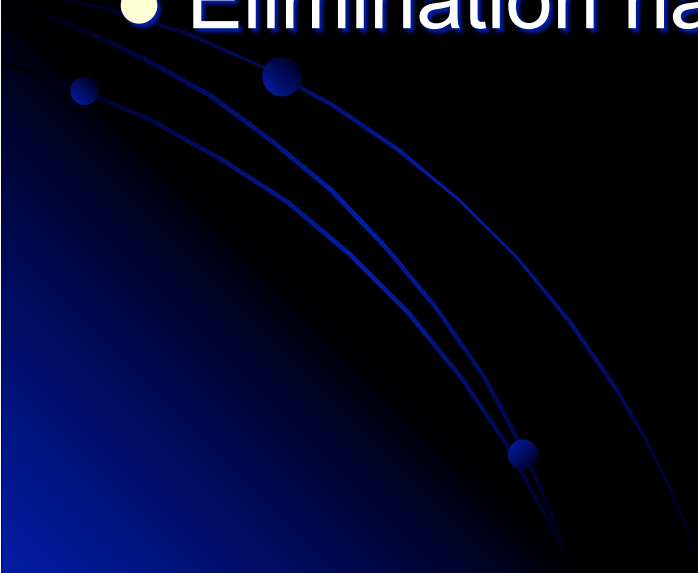
# Actions

- Phencyclidine derivative that causes dissociative anesthesia
  - Profound sedation and uncouples cortical pain perception.
  - Releases endogenous catecholamines
- 

# Ketamine Systemic Effects

- CVS- increased HR, BP, CVP and CO
- Respiratory-increased bronchodilation and RR; preservation of airway reflexes; question of laryngospasm
- CNS-increased CBF/metabolic rate; question of increased ICP
- GI-nausea and vomiting; increased salivation
- **Emergence effects**

# Ketamine Facts

- Well absorbed IV, IM, rectally, orally (20% bioavailability) and nasally (40% bioavailability)
  - Distribution half-life is 11 minutes
  - Elimination half-life is 2.5 hours
- 

# Ketamine Onset

- IV 1-2 minutes
- IM 3-8 minutes
- Compared to Versed IV onset 1-5 minutes, IM 10-20 minutes
- Compared to Ativan IV onset 1-5 minutes, IM 20-30 minutes
- Compared to Haldol IV 10 minutes, IM 20 minutes

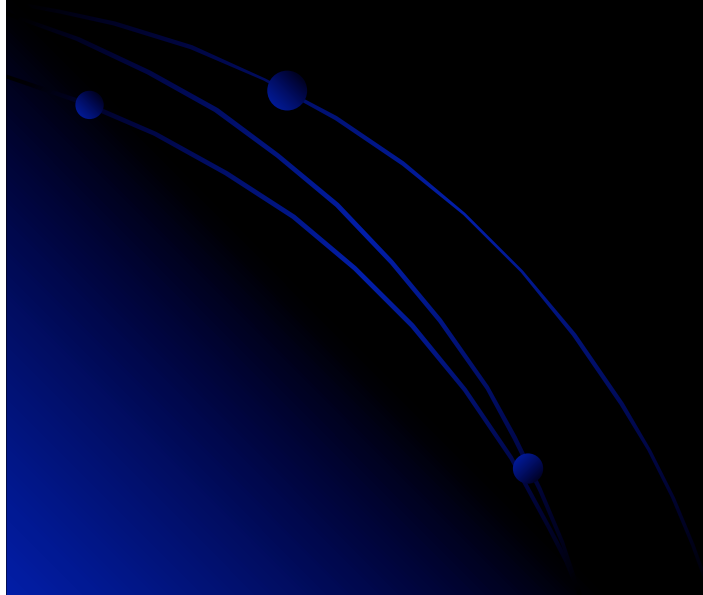


# Indications

- Used for sedation of patients with behavioral emergencies.
- Used for sedation of intubated or soon to be intubated patients (RSI).
  - Hypotensive, extreme agitation, status asthmaticus
- May be used for analgesia and sedation for painful procedures or painful conditions.

# Adjuvant to Narcotic Analgesia

- 0.2 mg/kg IV every 15 minutes as needed for adjuvant pain control
- Reduces narcotic requirement by 25-50%
- No sedation, no emergence reaction



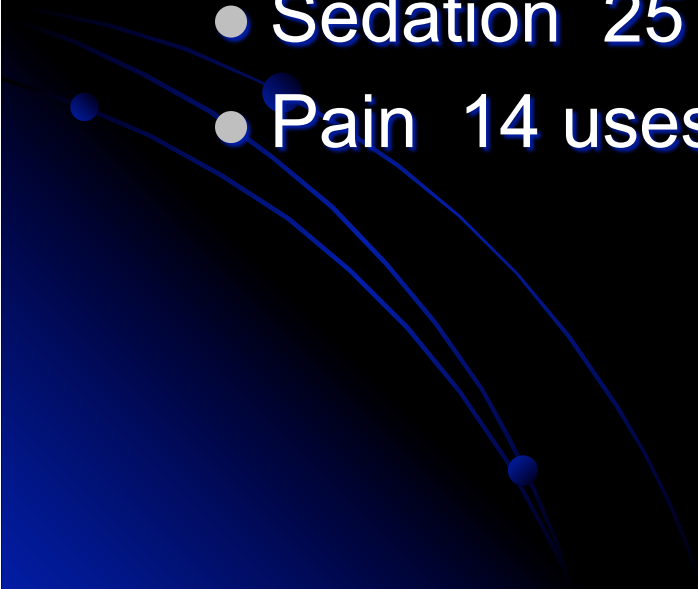
# Duration

- Analgesia: 10-15 minutes IV, 15-30 minutes IM.
- Sedation: Variable- at least as long as analgesia and IV may be up to 30 minutes and IM may be up to 60-90 minutes
- Longer with addition of narcotics/benzos

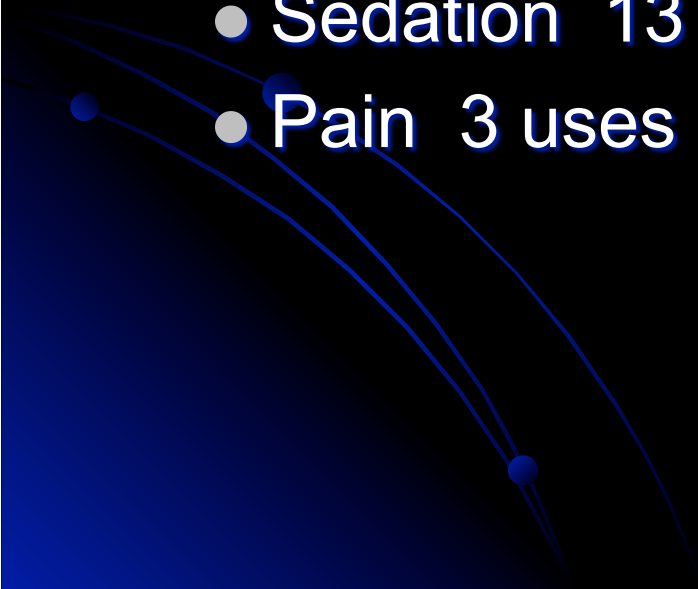
# SYSTEM IMPLEMENTATION

- Introduced in AirCare in April, 2009
- Introduced into ALS in June, 2009
- 2 hour training of all practitioners encompassing pharmacology, protocol use and case management
- All ketamine use tracked as to indication, dosing and outcome with QA feedback

# Ketamine Use: By The Numbers

- AirCare (54 Cases)
  - Ages 6-95
    - RSI 12 uses
    - Agitation/Anxiety 2 uses
    - Sedation 25 uses
    - Pain 14 uses
- 

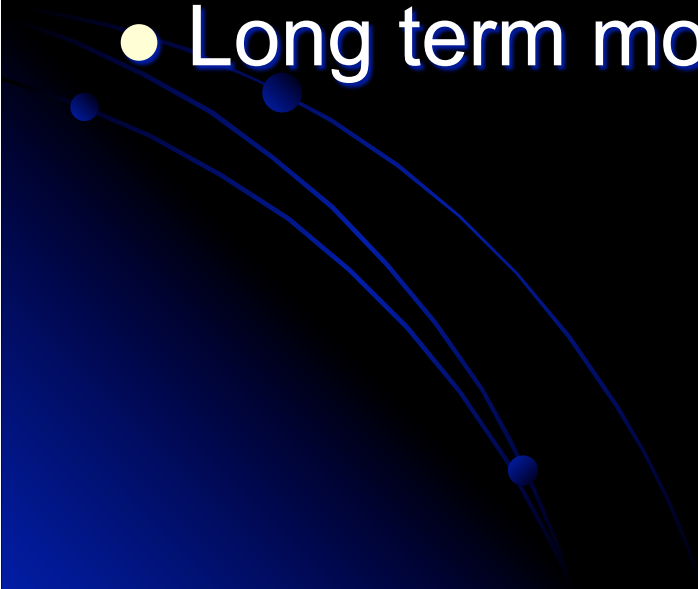
# Ketamine Use: By The Numbers

- 9-1-1 ALS (36 cases)
  - Ages 1-80
    - RSI 5 uses
    - Agitation 15 uses
    - Sedation 13 uses
    - Pain 3 uses
- 

# Medical Conditions

- Respiratory distress
- Multi-trauma
- RSI
- Head injury
- CVA
- Aortic dissection
- Sepsis
- Resuscitated arrest
- Burns
- OD/ingestions
- Behavioral emergencies
- Agitated delirium
- GI bleed
- Fracture/dislocations

# COMPLICATIONS

- Respiratory suppression requiring intervention, excluding RSI (2 cases)
  - Inappropriate use of medication (1 case)
  - Inappropriate dosage use (1 case)
  - Long term morbidity/mortality (NONE)
- 



# PROTOCOLS

- **\*Sedation of Intubated Patients:**
- 1. If the patient has had an invasive airway (ET, CombiTube, King) placed and becomes agitated from increase consciousness, it is likely that the agitation may be because the patient is experiencing pain. You should consider the following to manage this agitation.
- • Dilaudid 1-2 mg. (0.015mg/kg for pediatric patients) IV/IM/IO, if IV/IO route used titrate to patient response.
- • May also consider the following providing patient has been given an adequate dose of Dilaudid (at least 2 mg)
- • Versed 2-5 mg IV/IO ( 0.1mg/kg for pediatric patients) titrated to patient response while maintaining a systolic BP of 90 or greater (max. dose 5 mg). If no IV available 2-5 mg IM,
- or Ativan 0.05 mg/kg up to 2mg IV/IO titrated to patient response while maintaining a systolic BP of 90 or greater (max. dose 2 mg). If no IV available, may give 2 mg IM.
- **2. If systolic BP is less than 90 or less than appropriate for patient, consider Ketamine 1-2 mg/kg IV/IO or 4 -5 mg/kg if IM route.**
- **3. If additional sedation is necessary to achieve or maintain desired effect, consider,**
- • Additional Dilaudid 0.5-2 mg IV/IM/IO, every 15 minutes providing SBP remains 90 or greater.
- • Additional Versed up to 2 mg IV/IO every 10-15 minutes titrated at 0.5 mg increments.
- If no IV available, may give 2 mg IM.
- **Or additional Ativan 0.05 mg/kg up to 2 mg IV/IO every 10-15 minutes titrated at 0.5 mg increments). If no IV available, may give 1-2 mg IM.**
- • **If patient continues to have SBP of less than 90, consider additional doses of Ketamine 0.5mg/kg IV/IO every 3-5 minutes. If no IV available, may repeat 4-5mg/kg IM.**
- **4. If you have used Ketamine initially and have obtained the desired effect, consider use of analgesics or benzodiazapines, if necessary, to maintain sedation (providing SBP is adequate).**
-

# PROTOCOLS

- **PAIN MANAGEMENT:**

- To provide relief of pain when indicated. This protocol is **NOT** to be used in cases where the patient:

- • Has systolic blood pressure less than 90,
- • Is in active labor.

- **\*ALS Pain Management**

- 1. Assess pain on 0-10 scale or other acceptable method for patients with difficulty communicating.
- 2. Inform patient that pain is an important diagnostic parameter and that the goal of this protocol is to relieve suffering, not totally eliminate pain.

- 3. \*Dilaudid 1-2 mg IV//IO/IM/IN. If using IV//IO route titrate in increments to patient's response.  
(Maximum initial dose 2 mg)

- • If IN route used, a maximum of 0.5ml (1mg) should be administered per each nares.

- a. Decrease dose (0.25 -1 mg) in the elderly or patients who may be impaired by drugs or alcohol.

- In the event that Dilaudid is unavailable, Morphine Sulfate at 0.1 – 0.2 mg/kg, up to 10 mg IV//IO/IM- if using IV//IO route titrate in increments to patient's response.

- 4. Reassess pain scale. If necessary, consider additional Dilaudid 0.25-2 mg IV//IO/IM/IN every 15 minutes as needed for continued pain. Use lower dose for elderly or impaired. If using IV//IO route titrate in increments to patient response. Morphine 0.1-0.2 mg/kg up to 10mg may be used every 15 minutes if Dilaudid unavailable.

- 5. If pain relief is inadequate after 4 mg Dilaudid), consider using one of the following, in order as outlined,

- • Versed 2 mg IV//IO/IM. If using IV//IO route titrate, to patient response, up to 2 mg or Ativan 1 mg IV//IO/IM or Ketamine 0.2mg/kg (low dose) IV//IO every 15 minutes as needed for adjuvant pain control.

- Use caution (lowest effective dose) in the elderly or patients who may be impaired by drugs or alcohol.

- 6. Monitor vital signs. If respiratory depression or hypotension occurs after administration of Dilaudid or Morphine, ventilate patient as necessary and administer Narcan 0.4 – 2 mg IV//IO/IN and contact a medical control physician.

- **Contact medical control physician for orders if:**

- a. Patient has SBP less than 90

- 7. Physician may consider initial or additional pain medication, benzodiazepines or Ketamine as appropriate.

# PROTOCOLS

- 1. **For General Behavioral Emergencies** - patient has moderate to severe agitation that may require
- restraints and medications to modify behavior, but does not pose an immediate threat to self or others.
- a. Consider restraining patient if not already restrained. If restraints have already been applied, they should be left in place unless removal is necessary to facilitate interventions.
- b. Consider administration of one of the following combinations of medications
  - • Versed 5 mg., Haldol 5-10 mg. and Benadryl 25 mg, IV/IO/IM
  - Or
  - • Ativan 2 mg., Haldol 5-10 mg., and Benadryl 25 mg., IV/IO/IM
  - Or
  - • If patient has SBP less than 90, consider Ketamine 4-5 mg/kg IM, if IV already established – 1-2 mg/kg IV/IO over 2 minute, as a last resort.
  - • Be prepared to administer additional Versed 2-5 mg for emergence reaction from Ketamine.
  - • If Ketamine used, on arrival at destination ED administer 2 mg of Versed IV/IO/IM.
  - • Alert ED staff that Ketamine has been used so patient may be placed in the appropriate area of the ED.
  - • Be prepared for vomiting to occur.


# PROTOCOLS

- **For Severe to Profound Agitation or suspected Excited Delirium.**
- Severe to Profound Agitation should be considered when the patient is an immediate threat to their own safety or the safety of others
- Excited Delirium is a continuum of symptoms that may lead to death. It is most commonly associated with Cocaine use. The patient may have sudden onset of shouting, paranoia, panic, violent towards others, Hyperthermia, "superhuman" strength, followed by respiratory arrest, followed by death. Excited delirium is associated with metabolic acidosis and rhabdomyolysis.
- a. Patient should be restrained as soon as possible
- b. Oxygen per general guidelines
- c. **Consider administration of Ketamine 4-5 mg/kg IM**
- **Or Ketamine 1-2 mg/kg IV/IO at 0.5 mg/kg/min. If IV has already been established. DO NOT attempt to start IV in severely agitated patients.**
- **d. Expedite Transport (transport Code 3 to closest appropriate facility).**
- e. Once sedation occurs, establish IV access per general guidelines and run wide open up to 1 liter.
- f. Administer Sodium Bicarbonate 50 mEq (1amp).
- g. Be prepared to administer Versed 2-5 mg for emergence reaction.
- h. Be prepared to support Respiratory Depression and/or Intubate if necessary.
- i. **If Versed not already administered during transport, administer 2mg IV/IO/IM just prior to arrival at destination ED.**
- j. If hypersecretion is present, consider Atropine 0.1-0.3 mg IV/IO or 0.5 mg IM.
- **k. Alert ED staff that Ketamine has been used so patient may be placed in the appropriate area of the ED.**
- l. Be prepared for vomiting to occur.

# PROTOCOLS

- **Contact a Medical Control Physician for patients with continued Moderate-to-Severe Respiratory**
- **distress.**
- **Physician may consider:**
- i. additional albuterol with/without atrovent.
- j. \*If not already given, Terbutaline 0.25 mg SC.
- k. Consider one adult Epi-Pen 0.3 mg SC.
- l. If patient anxious, agitated, and/or difficult to control as a result of underlying problem, consider sedation of patient,
- **Ketamine 1.0 mg/kg up to 100mg – should be first choice, as long as patient does not have an elevated SBP**
- or Versed 0.1mg/kg up to 3mg IV/IO/IM
- or Ativan 0.05mg/kg up to 2mg IV/IO/IM

# USE IN AUSTERE ENVIRONMENTS

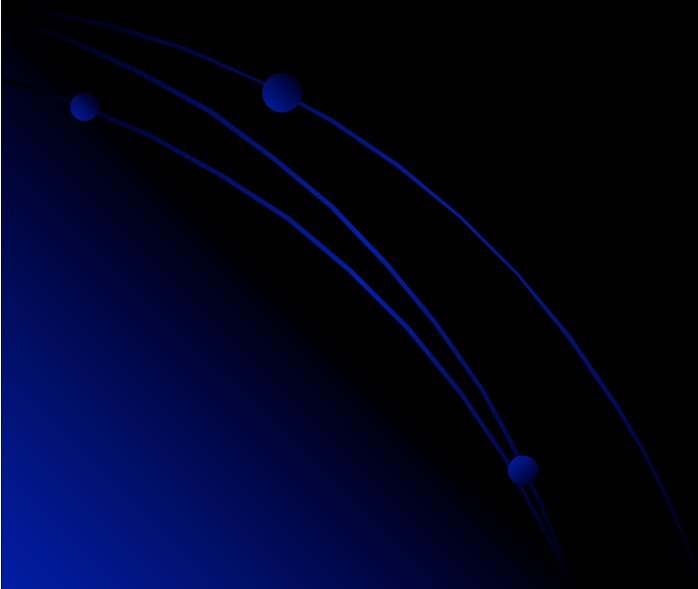
- Deployed with Israeli Defense Forces since 2000; used by medics and MDs.
  - Deployed with U.S. SOF medics for over 5 years, and used in FAST stations.
    - Used for painful procedures, RSI and acute pain management.
- 

# FUTURE DIRECTIONS

- \$8M study with private industry/DoD for development of intra-nasal ketamine delivery system and guidelines for acute pain management.
- Now entering Phase III trials.
- Excellent results with IN doses of 10 mg, 30 mg, and 50 mg; time duration 15-60 minutes.
- Reports significant pain reduction in @50% of patients; rescue meds required in <10% of subjects.

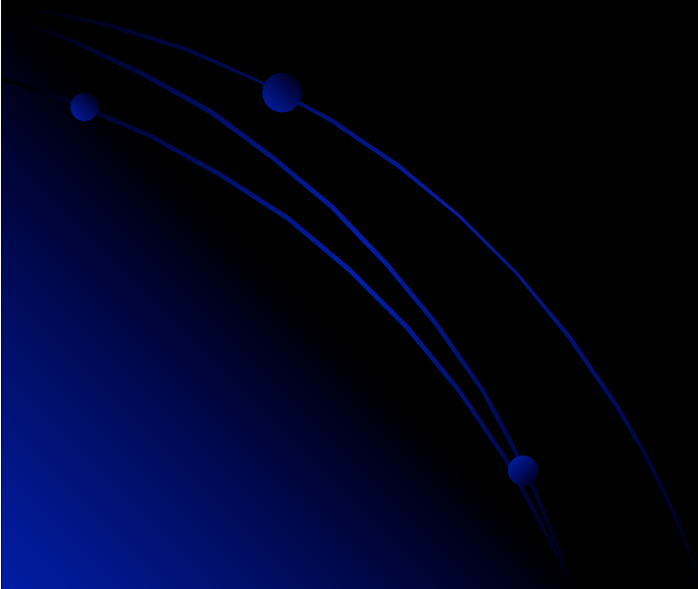
# KEY POINT

- In adults, doses of 50 mg IV/IN or less every 15 minutes produce anesthetic effects without ANY emergence or respiratory complications.





# CASES

- #1 Multi-trauma patient
  - #2 Critical elderly patient
  - #3 Critical pediatric patient
  - #4 Behavioral management patient
- 

# CASE #1

- 20 yo male in MVA with ejection, bilateral femur fractures, agitated and combative
- Fighting with police, first responders and EMS.
- Ketamine 400 mg IM, and sedated within 2 minutes.
- IV established and RSI completed; femur fractures splinted.
- Packaged for AirCare and transported.

## CASE #2

- 95 yo male hospital in-patient for GI bleed, now with dissecting TAA.
- Awake and alert, severe chest and back pain, with HR 105 and BP 85/40 mm Hg.
- Airway intact with high-flow oxygen in place and actively being transfused.
- AirCare transport with ketamine 25 mg IV X 3, and reduction of pain 2/10.

# CASE #3

- 6 yo male in status asthmatic, and intubated at referring hospital
- Paralyzed and sedated, but remains with markedly elevated airway pressures.
- Transported by AirCare and receives ketamine 40 mg IV, then 20 mg IV, and then Versed 2 mg IV enroute to receiving facility.
- Airway pressures markedly reduced.

# CASE #4

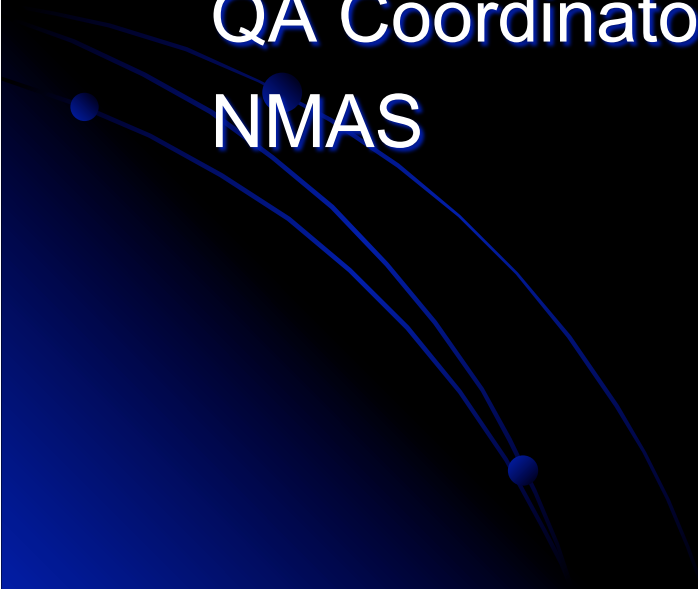
- 28 yo male with ETOH intoxication, possible cocaine ingestion and in police custody.
- “Tazed” twice, hand-cuffed, still fighting and spitting (semi-pro boxer).
- Ketamine 380 mg IM administered, and patient sedated in less than 2 minutes.
- IV established, oxygen placed, Versed 2 mg IV and patient transported without complications.

# Ketamine



So good,  
the horses want it back

# Special Thanks To:

- Steve Andrews, MD, EMT-P, FACEP  
ED Physician  
Oconomowoc, WI
  - Kim Tast, NREMT-P  
QA Coordinator  
NMAS
- 

# QUESTIONS?

