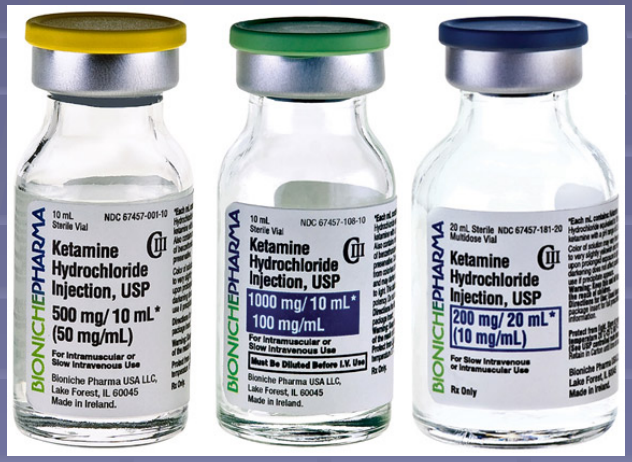
2013 EMS STATE OF THE SCIENCE:
Gathering of Eagles XVI

Vitamin K or KO ? – Part 1

Outcomes of EMS Ketamine Use



Dr. David P. Keseg M.D. FACEP

Associate Professor Ohio State University Wexner Medical Center

Medical Director Columbus Division of Fire

DISCLOSURE

- Dr. Keseg has no financial interest in any companies that are involved in the manufacture of products related to this presentation.

CFD EMS OVERVIEW

- All ALS Fire based EMS System
- Two EMT-Ps on each Medic Vehicle (32)
- At least one EMT-P on each engine (34)
- At least one Engine and One Medic per 32 stations
- Seven EMS Supervisors –one per battalion
  - (1 Captain and 6 Lieutenants per unit)

FIRST LINE APPARATUS SUMMARY

Emergency Units in Service

34	Engines	7	EMS Supervisors
15	Ladders	1	Incident Support Unit
5	Rescues	2	Bomb Squads
7	Battalion Chiefs	1	Safety Officer
32	Medics	14	Boats
1	Hazmat	1	Command Unit

ENGINE

MEDIC

LADDER

FOUR-YEAR COMPARISONS

	2008	2009	2010	2011
Total Incidents	146,144	142,981	148,918	161,693
Fire Incidents	24,868	21,470	21,861	23,715
EMS Incidents	110,739	110,398	115,311	137,442

GEOGRAPHICAL

Metro Columbus

399.1 square miles

population: 1,742,798

City of Columbus

9.9 square miles

population: 791,868

EMS MANAGEMENT OF THE AGITATED PATIENT

EMS Innovations 2010

By Christopher B. Colwell, MD, FACEP

Managing the Acutely Agitated Patient

Why Denver brought back the forgotten agent droperidol

Management of acutely agitated patients can present a challenge both in the field and in the emergency department. There are a variety of techniques that can be used to manage agitated behavior in the prehospital setting, including verbal management techniques and physical restraints. This discussion will focus on chemical restraint of the acutely agitated patient.

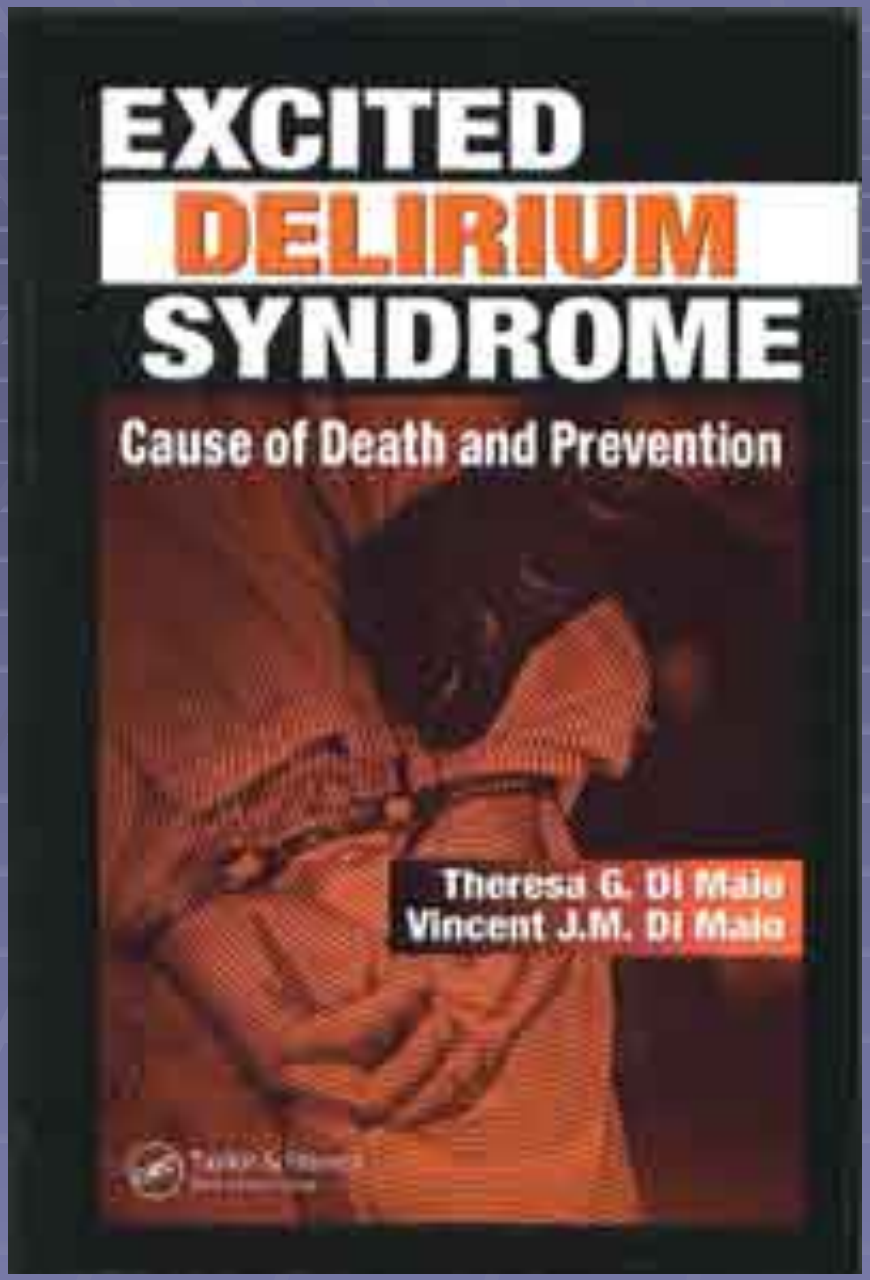
In September 2009, the American College of Emergency Physicians' Task Force on Excited Delirium published a white paper that concluded that some episodes of excited delirium "may be amenable to early therapeutic intervention in some cases in the pre-mortem state," and that "physical restraints should be rapidly supplemented with chemical restraints" in agitated patients who require restraint.[1] Options for chemical sedation in the prehospital setting include benzodiazepines, antipsychotics (also called neuroleptics), antihistamines and, rarely, dissociative agents such as ketamine. A survey of 34 larger metropolitan city EMS agencies at the annual Gathering of Eagles conference revealed that 33 of these agencies use some method of chemical restraint. Of those, 26 use midazolam (Versed), nine use diazepam (Valium), four use lorazepam (Ativan), eight use haloperidol (Haldol), two use droperidol (Inapsine), and one uses ketamine. (Some agencies have more than one agent available for chemical sedation.)

> The care of agitated patients in the field is challenging on many levels and chemical restraint is sometimes necessary.

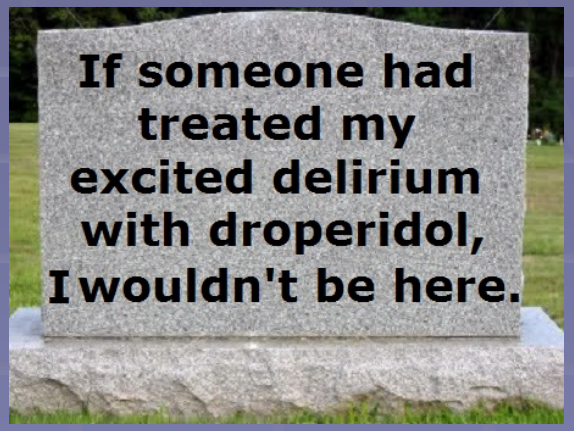
While benzodiazepines are excellent agents in many settings, particularly to treat patients with acute agitation related to cocaine or methamphetamine ingestion, they may not be ideal in all situations. Antipsychotics are also effective in managing agitated behavior and may result in fewer episodes of oversedation.[2] In particular, antipsychotics may be a better choice when dealing with agitated behavior related to alcohol use or psychiatric conditions. There are both typical antipsychotics such as haloperidol and droperidol and newer, atypical antipsychotics such as ziprasidone (Geodon) and olanzapine (Zyprexa).

First introduced in the United States in 1970, droperidol is a butyrophenone and a potent antagonist of dopamine subtype 2 receptors in the limbic system. It is a potent antipsychotic used both for chemical restraint and as an antiemetic. Droperidol has been shown to be an effective sedative agent with few treatment failures and no respiratory depression.[3,4] It has also been shown to be safe in a variety of clinical settings, including emergency management of acute agitation.[5–7] In a randomized controlled trial, droperidol was found to result in more rapid control of agitated patients than haloperidol, with no increase in undesirable effects.[8] In another trial comparing droperidol to midazolam, no difference was found in the onset of adequate sedation, but patients receiving midazolam showed an increased need for active airway management.[9]

Miami Police Shoot, Kill Man Eating Another Man's Face



Very difficult to manage
Agitation
Hyperthermia
Acidosis
FATAL



ExDS Indicators

"Excited Delirium Syndrome," is a medical crisis that may be due to a number of underlying conditions. Subjects can demonstrate some or all of the indicators below in law enforcement settings. More indicators will increase the need and urgency for medical attention.

- ☐ Extremely aggressive or violent behavior
- ☐ Constant or near constant physical activity
- ☐ Does not respond to police presence
- ☐ Attracted to/destructive of glass/reflective
- ☐ Attracted to bright lights/loud sounds
- ☐ Naked/inadequately clothed
- ☐ Attempted "self-cooling" or hot to touch
- ☐ Rapid breathing
- ☐ Profuse sweating
- ☐ Keening (unintelligible animal-like noises)
- ☐ Insensitive to/extremely tolerant of pain
- ☐ Excessive strength (out of proportion)
- ☐ Does not tire despite heavy exertion

Excited Delirium (ExD) Panel Workshop (April 2011),
The NIJ Technology Working Group (TWG) on Less-Lethal Devices
The Weapons and Protective Systems Technologies Center

ExDS Response Measures

IDENTIFY

Observe, record, and communicate the indicators related to this syndrome – handle primarily as a medical emergency.

(SEE REVERSE SIDE)

CONTROL

Control and/or restrain subject as soon as possible to reduce risks related to a prolonged struggle

SEDATE

Administer sedation as soon as possible. Consider calming measures. Remove unnecessary stimuli where possible, including lights/sirens.

TRANSPORT

Take to hospital as soon as possible for full medical assessment and/or treatment.

This material is based upon work supported by the National Institute of Justice (NIJ) under a Cooperative Agreement Award No. 2010-IJ-CX-K005. Any opinions, findings, and conclusions or recommendations are those of the author(s), is the best knowledge currently available and does not necessarily reflect the views of the NIJ and should not be construed as an official Department of Justice position, policy, or decision.

EMS Drugs for Sedation

- Benzodiazepines
  - Valium, Versed, Ativan
- Antipsychotics
  - Haldol, Droperidol
- Atypical Antipsychotics
  - Geodon, Zyprexa
- Dissociative agents
  - Ketamine

Ideal Drug for Sedation

- Rapid Onset
- Single Dose
- Easy to administer
- Minimal adverse effects on:
  - Cardiac
  - Blood Pressure
  - Respiratory
  - Temperature
  - Neurologic

So how about Ketamine???

- Rapid onset of action: < 5 minutes
- Highly Effective in single dose
- Can give IM (through jeans)
- Favorable Safety Profile
  - Supports heart rate and BP
  - Preserves respiratory drive
  - No hyperthermia

- Limited data for Ketamine in Excited Delirium

REVIEW

[West J Emerg Med. 2011;12(1):77-83.]

Excited Delirium

Asia Takeuchi, MD*
Terence L. Ahern, BA†
Sean O. Henderson, MD‡

* University of California, San Diego School of Medicine
† Keck School of Medicine of the University of Southern California
‡ Keck School of Medicine of the University of Southern California, Department of Emergency Medicine and Preventive Medicine

"Despite the promise of Ketamine, more structured research is needed to establish its safety and efficacy for emergent sedation of the agitated patient. "

EAGLES query on use of Ketamine for Excited Delirium

City	Ketamine	Dosage	Other drug
KCMO	No		Versed
OKC/Tulsa	No		Versed/Haldol
New York City	No		
New Orleans	No		Versed
Houston	No		
Memphis	No		Versed
Atlanta	No		
San Antonio	Will start	2mg IV 4mg IM	Now use Versed and Zyprexa
London	No		
Denver	Will start	2mg IV 4mg IM	Now use Versed and Droperidol
Cincinnati	No		
Wichita	No		
Las Vegas	Will start	1-2 mg/kg IV; or 4 mg/kg IM.	
San Francisco	No		
Honolulu	No		Versed
Vancouver	No		
Portland	No		Versed, Droperidol, Ziprazadone
Chicago	No		
Greenville SC	No		
Albuquerque	Will start		
Salt Lake City	No		
Louisville	No		
St. Paul	Yes		
Hennepin County	Yes		

Case Conference

Successful Management of Excited Delirium Syndrome with Prehospital Ketamine: Two Case Examples

Jeffrey D. Ho, MD, Stephen W. Smith, MD, Paul C. Nystrom, MD, Donald M. Dawes, MD, Benjamin S. Orozco, MD, Jon B. Cole, MD, William G. Heegaard, MD, MPH

Advantages of Ketamine for ExD:

- *Safety of IM administration to EMS personnel*
- *Onset of action IM 5 minutes*
- *Duration of action 20-30 minutes*
- *Keeps protective airway reflexes intact*
- *Rarely affects respiratory drive*
- *High minute ventilation buffers acidosis*

The Emergency Department Experience with Prehospital Ketamine
A Case Series of 13 Patients

Aaron M. Burnett, MD, Joshua G. Salzman, MA, EMT-B, Kent R. Griffith, RN, EMT-P,
Brian Kroeger, PhD, Ralph J. Frascone, MD

- ***Two*** **patients required intubation in the ED due to**
  - **recurrent laryngospasm (Ketamine dose 5.3mg/kg)**
  - **intracranial hemorrhage (Ketamine dose 5.2mg /kg)**
- ***One*** **hypoxic patient required jaw thrust/NRB (Ketamine dose 4.5mg/kg)**
- ***One*** **patient had hypersalivation treated with suction (Ketamine dose 5.7mg/kg)**
- ***Five*** **patients required additional sedation**
- ***Five*** **patients discharged home**
- ***Seven*** **admitted to hospital**

PREHOSPITAL EMERGENCY CARE 2012;16:412–414

LARYNGOSPASM AND HYPOXIA AFTER INTRAMUSCULAR ADMINISTRATION OF KETAMINE TO A PATIENT IN EXCITED DELIRIUM

Aaron M. Burnett, MD, Benjamin J. Watters, MD, Kelly W. Barringer, MD,
Kent R. Griffith, RN, EMT-P, Ralph J. Frascone, MD

"The constant attendance to the patient by EMS providers allows for immediate and, if necessary, repeated assisted ventilation. Restricting ketamine to EMS units capable of rapid-sequence intubation therefore seems unnecessary.
Providers should be educated to vigilantly monitor for hypoventilation. The use of end-tidal carbon dioxide measurement and pulse oximetry should be routine."

CONCLUSION

We report what we believe is the first case of laryngospasam associated with prehospital administration of IM ketamine to a patient in excited delirium. This case demonstrates that laryngospasm may be encountered with IM ketamine but that it can be successfully managed with positive-pressure ventilation.

So why did Columbus add Ketamine??

- Two words! Mark Debard

Dr. Mark DeBard

White Paper Report on Excited Delirium Syndrome

ACEP Excited Delirium Task Force

TASK FORCE CHAIR

Mark L. DeBard, MD, FACEP, Chair

Professor of Emergency Medicine

Ohio State University College of Medicine

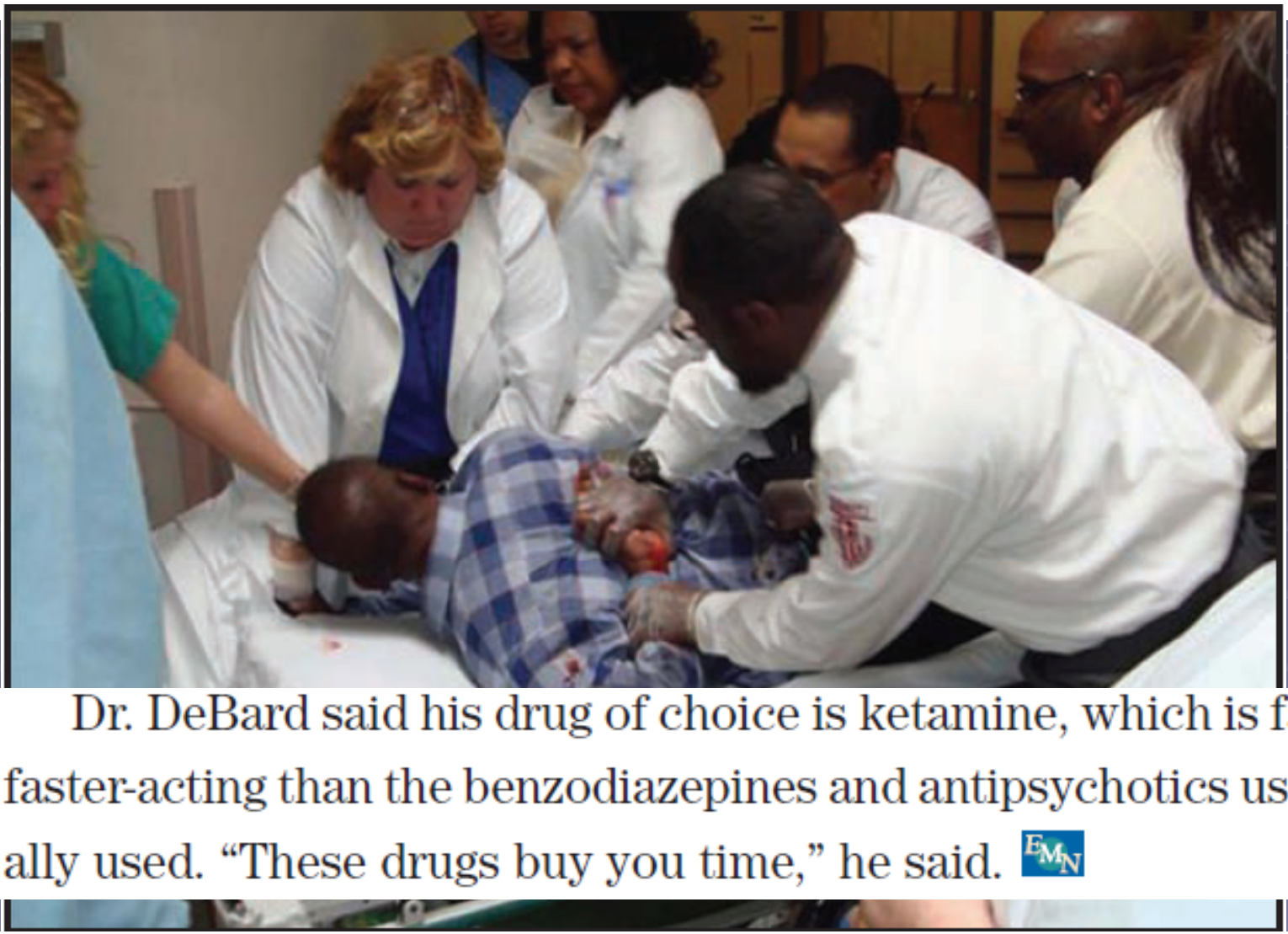
Columbus, Ohio

White Paper Report on Excited Delirium Syndrome and Ketamine Use

The dissociative agent ketamine can also be administered by the IV or IM route and appears advantageous due to very rapid onset (especially by the IM route when compared to other medications), and lack of significant respiratory and cardiovascular effects. Case reports have indicated excellent results and safety when used in ExDS patients. Potential disadvantages include rare side effects such as increased oral secretions, laryngospasm, hypertension, and distress from emergence phenomena.

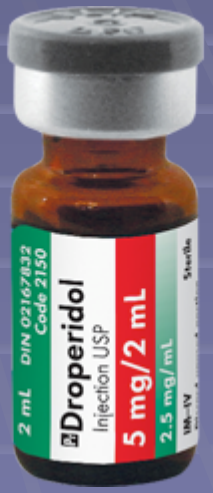
EMERGENCY MEDICINE NEWS Exclusively for **EMNow's** ACEP Scientific Assembly Edition: October 2009

ACEP Recognizes Excited Delirium Syndrome



Dr. DeBard said his drug of choice is ketamine, which is far faster-acting than the benzodiazepines and antipsychotics usually used. "These drugs buy you time," he said.

Sedation Ninjas



CFD EMS Protocol Committee

- **Presented to EMS Protocol Committee April 2010**
- **Voted to put it on our seven EMS Officer vehicles**

The Ketamine club:

EMS Officers Only

BATTALION 1
US 33
I-71
I 670
Broad St
25
8
1,9
2,3
I 70
SR 104

BATTALION 2
33
DUBLIN GRANVILLE RD
6
29
SR 161
24
28
I-71
US 62

BATTALION 3
HIGH ST
I 71
16
13
SR 315
18
7
I 670

BATTALION 4
I 70
MAIN ST
US 40
15
14
SR 104
4
22
32
I-71
US 33
US 23

BATTALION 5
US 33
HIGH ST
I 70
26
17
I 670
10
US 40
12
I 70
HARRISBURG PK
I-71
31

BATTALION 6
US 62
I 270
20
SR 16
BROAD ST
5
21
MAIN ST
US
23
I 70

BATTALION 7
SR 257
27
US 23
SR 161/SR 33
DUBLIN GRANVILLE RD
11
34
19
I-71
I 270
30
US 33
SR 315

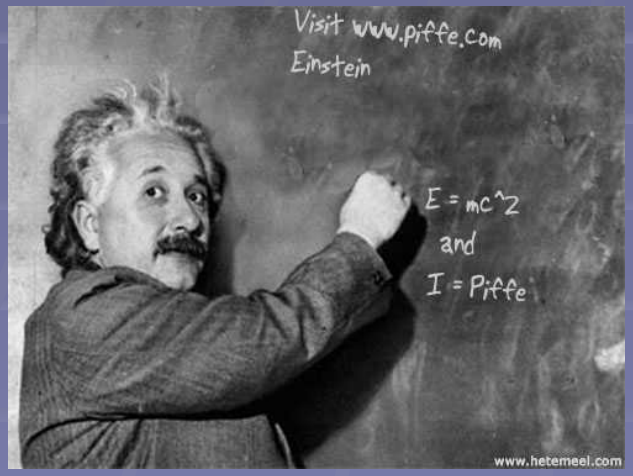
Ketamine Implementation

- Inquiry to DEA regarding storage:
  - could store in vehicle or on person

- Inquiry into concentration and pricing:
  - 50MG/ML 10MLVials $63.75 a Vial

Ketamine Implementation

- Did extensive CME on Excited Delirium and Ketamine to all EMS personnel
- Notified all of our receiving hospitals of intent to use Ketamine



Ketamine Implementation

- Put into EMS protocol changes effective July 2010

Standard Operating Procedures		
Subject: Agitated Patient - Excited Delirium		
S.O.P. Number 07-02-27 Vol-CH-Cat.Sub	Approved Fire Chief	Acknowledged Medical Director
Page: 1 of 2	Effective Date: 08/01/2007	
	Revised Date: 07/01/2010	

Adult Medical Emergencies **Agitated Patient – Excited Delirium**

A. Agitated Patient

1. An agitated patient has been described as an individual who displays excessive verbal or motor activity including; physical or verbal abuse, threatening gestures or language, physical destructiveness, and/or excessive verbalizations of distress.

2. Enough providers should be on the scene to adequately handle the situation. Secure the scene and use universal precautions. An EMS Field Officer should be summoned to the scene. Police should be involved as necessary. Providers should utilize the "least restrictive method of restraint", meaning the patient should be provided with alternatives to correct inappropriate behavior in order to obtain and maintain a positive relationship.

3. Providers should always be considerate of their own safety. Never underestimate the potential for violence or turn your back on a potentially violent patient.

4. If necessary, sedate the patient as necessary by administering Versed via MAD 2-5 mg at a time up to 10 mg total or 0.1 mg/kg to a maximum of 10 mg.

   a) Versed may be administered via MAD, IV, or may be given rectally. The rectal dosage is doubled to 0.2 mg/kg.

   b) Total Versed administration should not exceed 10 mg.

5. After the EMS Field Officer arrives on the scene, sedation can be continued using Ketamine in the following dosages and routes of administration:

   a) Ketamine 4 mg/kg IM

   b) Ketamine 2 mg/kg IV

6. Establish IV access with 0.9% NS.

7. Use restraints if the patient is perceived to be a threat to themselves or others.

Ketamine Utilization by EMS Officers

1. How many times have you used Ketamine?

	Response Percent	Response Count
0-1	43.8%	7
2-5	31.3%	5
6-10	12.5%	2
>10	12.5%	2
answered question		16
skipped question		0

Ketamine Utilization by EMS Officers

2. What indications have you given Ketamine?

	Response Percent	Response Count
Excited Delirium	85.7%	12
Agitated patient not in Exceited Delirium	71.4%	10
Sedation for purpose of airway control	14.3%	2
Other	7.1%	1
answered question		14
skipped question		2

Ketamine Utilization by EMS Officers

3. What complications have you encountered in administering Ketamine?

	Response Percent	Response Count
Laryngospasm	0.0%	0
Respiratory depression requiring endotracheal intubation	7.1%	1
Hypotension	0.0%	0
Nausea and vomiting	0.0%	0
Hallucinations	0.0%	0
No complications	92.9%	13
answered question		14
skipped question		2

Ketamine Utilization by EMS Officers

4. Ketamine provided adequate patient control:

	Response Percent	Response Count
Never	7.7%	1
Always	61.5%	8
less than 10% of the time	0.0%	0
less than 50% of the time	0.0%	0
More than 50%	7.7%	1
More than 90%	23.1%	3
answered question		13
skipped question		3

ADEQUATE PATIENT CONTROL >83% OF TIME

Ketamine Utilization by EMS Officers

5. What route did you adminster Ketamine?

	Response Percent	Response Count
Intramuscular	84.6%	11
Intravenous	46.2%	6
Intranasal	0.0%	0
answered question		13
skipped question		3

Ketamine Utilization by EMS Officers

What difficulties have you had in giving Ketamine?

	Response Count
16 out of 16 answered “NONE” Some individual responses below:	16
answered question	**16**

- None. Typically, patients with certain street drugs on board require the maximum dose to achieve sedation. Have had zero difficulties. Maybe consider an optional second dose if first one isn't effective within 3-5 minutes
- I have needed to inject multiple time due to quantity of fluid. I have heard about issues at the receiving hospital but have not experienced these myself. This has been a very useful drug. I wish it were more concentrated. It has no doubt prevented injuries to the patient and the crews and allowed for a better pre-hospital evaluation of the patient
- Would like a predosed syringe

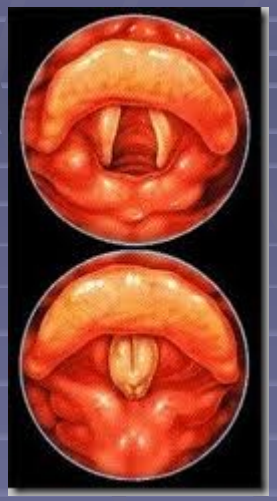
Ketamine Utilization by EMS Officers

7. Ketamine has been a helpful adjunct to my practice as a paramedic:

	Response Percent	Response Count
Yes	80.0%	12
No	13.3%	2
Unsure	13.3%	2
answered question		15
skipped question		1

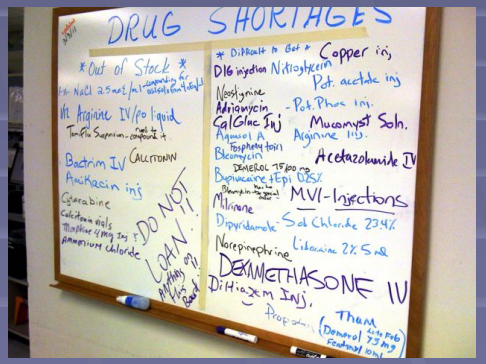
Ketamine Adverse Effects

- Laryngospasm
- Hypersalivation
- Nausea/Vomiting
- Possible drug interactions:
  - ETOH
  - Opiates
  - Benzos
  - Psych Meds



Ketamine disadvantages

- Cost of drug 
- Need to draw it up and give it “under duress”
- Prominent member on the Drug Shortage list



- Maybe better alternatives??
  - Droperidol 

  - Zyprexa
  - Geodon
  - Others??

GEODON™
(ziprasidone HCl)

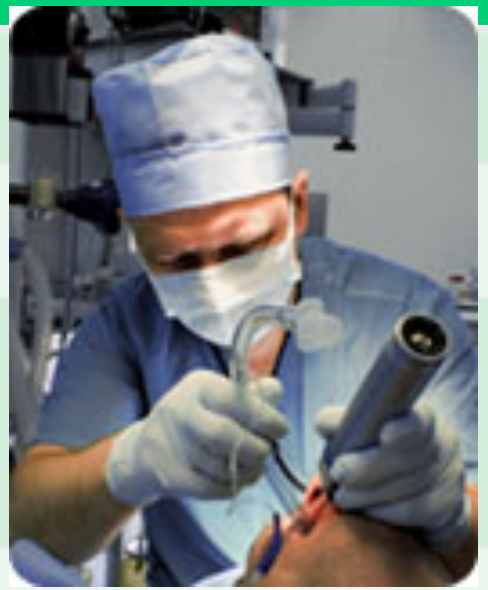
Hospital Reactions to EMS Utilization of Ketamine

- You're giving the patients WHAT???????
- Do you realize what Ketamine does to:
  - ICP
  - Blood pressure
  - Respiratory drive
  - Hair loss, acne, and the heartbreak of psoriasis
  - YOURE KILLING THEM WITH KETAMINE!

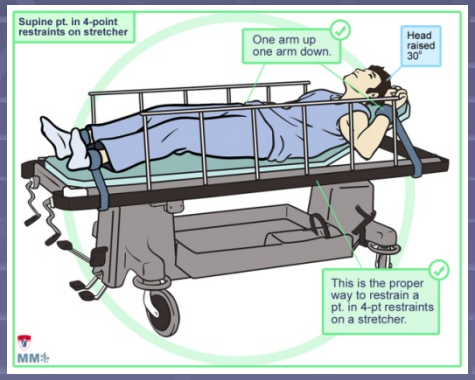
CFD Ketamine Hospital Data: 7/2010 to 7/2012

- 35 total patients given Ketamine for Agitation and transported
  - Seven “required” endotracheal intubation
  - Four of these at same hospital
  - All patients discharged to home either from the ED or after several days in hospital
  - None died
  - 9/35 had “adverse incidents”

Adverse Incidents	9/35
Cardiac arrest	0/35
Respiratory failure	7/35
Emergence reaction	5/35
Hypotension	0/35
ED interventions	



ED Interventions



Intubation

Geodon

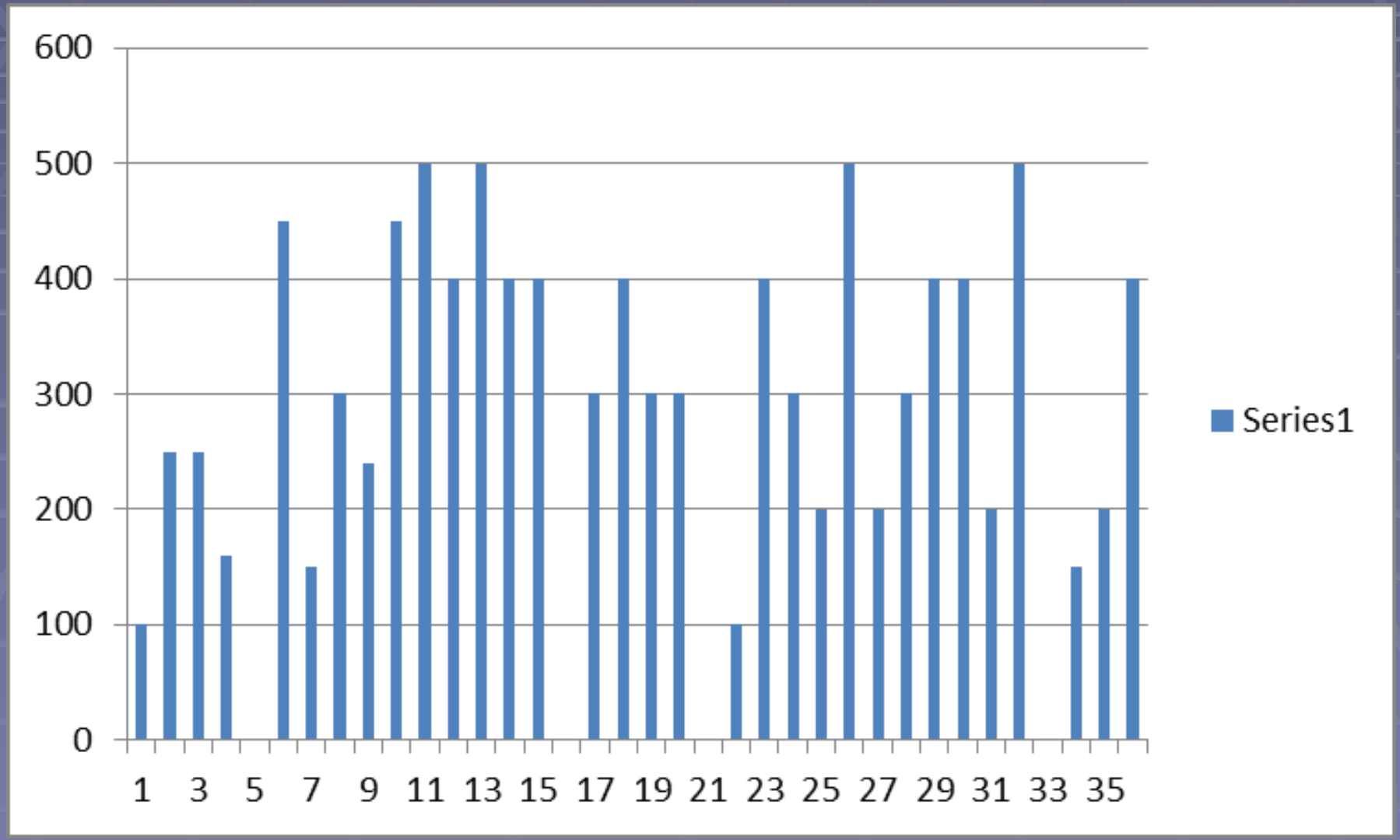
Ativan

Padded side rails

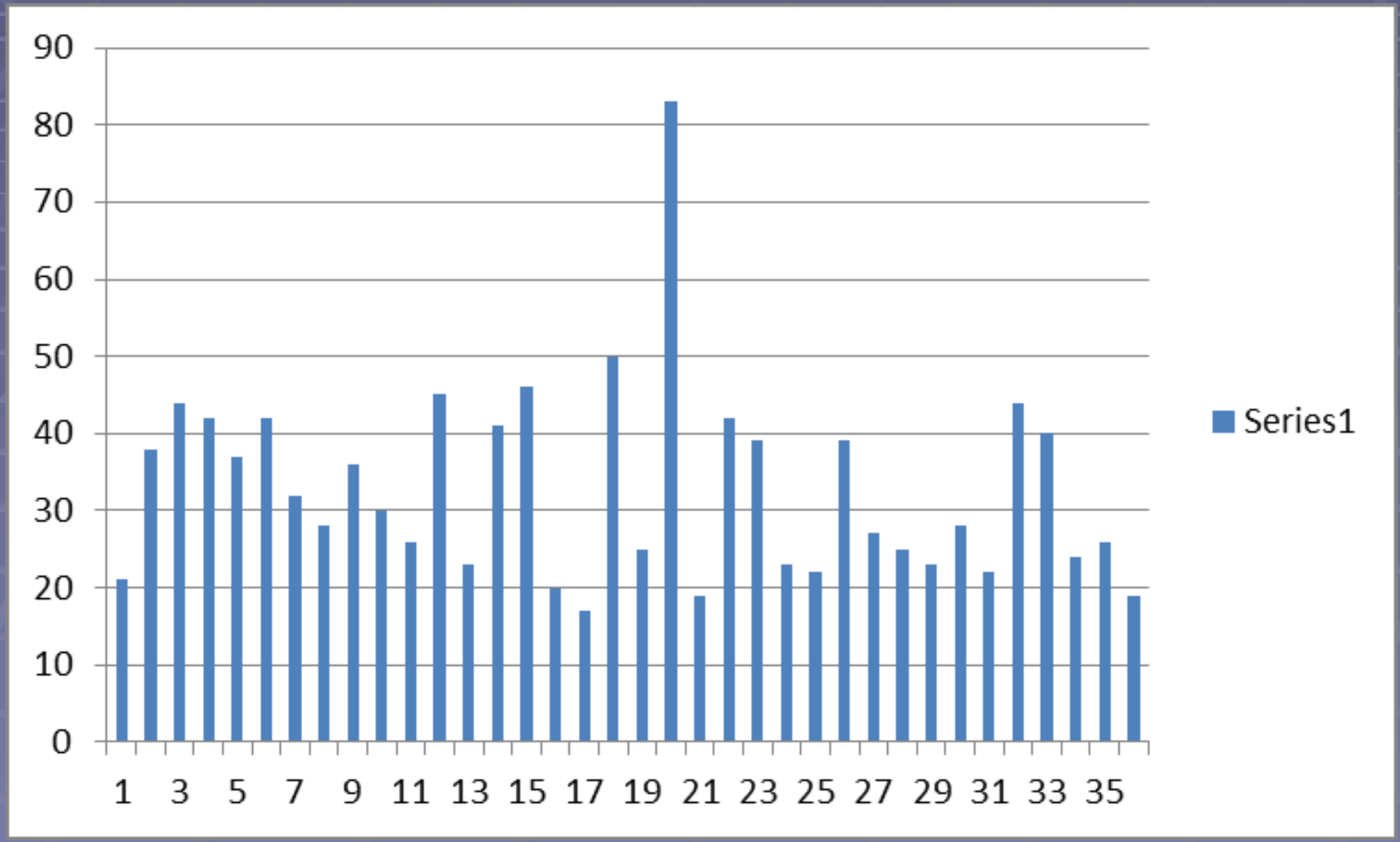
Sitter

Four point restraints

Dosages of Ketamine Given

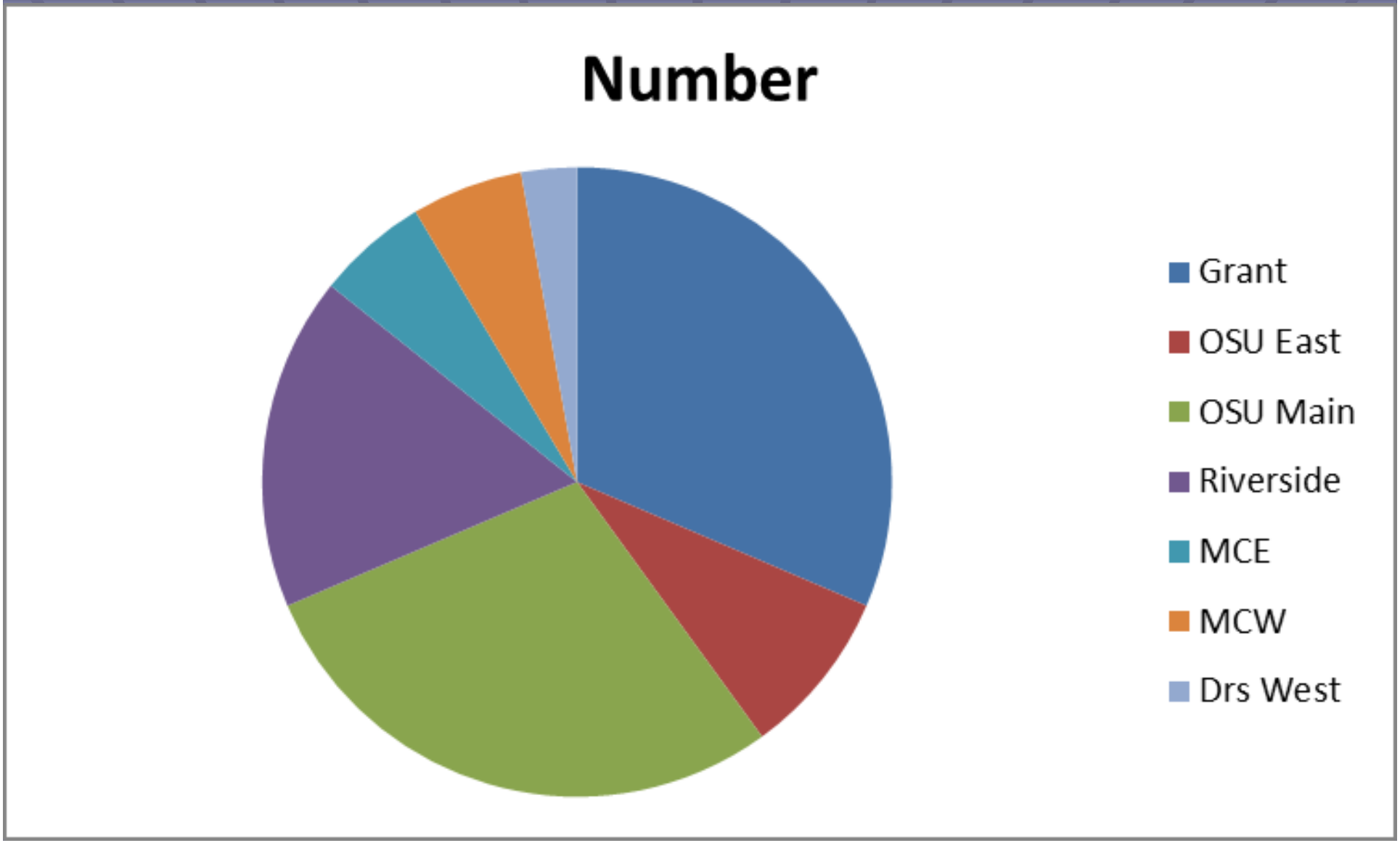


Ages of patients given Ketamine

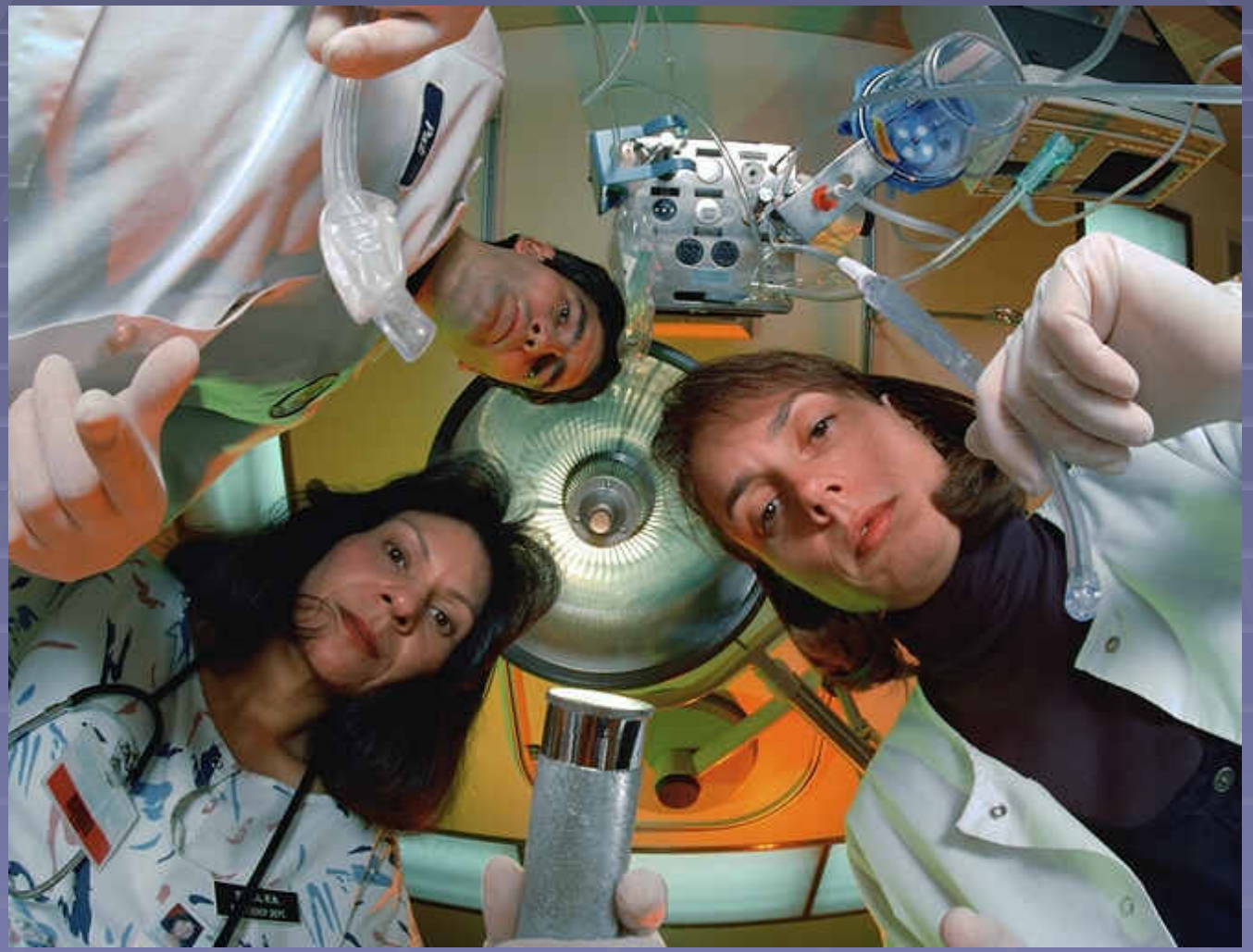


Incident Type	Number
cardiac arrest	4
Psych problem	5
ill person	6
TASER	1
Attempt	5
seizure	8
injured person	2
stabbing	1
FF in trouble	2
Conscious OD	1
Free way assignment	1

Receiving Hospitals for Ketamine patients



Ketamine patients intubated in the ED



Ketamine patients intubated in the Emergency Department-Age

Ketamine patients intubated in the Emergency Department-Call type

Ketamine patients intubated in the Emergency Department- Ketamine Dose

Ketamine patients intubated in the Emergency Department-other drugs

Name	EMS Intervention #2
Patient 1	Narcan 2 mg/Versed 5mg
Patient 2	
Patient 3	Narcan 4 mg
Patient 4	Narcan 2 mg
Patient 5	
Patient 6	
Patient 7	Narcan 2 mg

Ketamine patients intubated in the Emergency Department-ED DX

Name	ED Diagnosis
Patient 1	altered mental status
Patient 2	altered mental status
Patient 3	
Patient 4	
Patient 5	ICH
Patient 6	Ketamine OD causing CNS depression/ respiratory arrest
Patient 7	altered mental status/unresponsive

Ketamine patients intubated in the Emergency - DC DX

Name	DC Diagnosis
Patient 1	Primary respiratory failure, schizophrenia, hyperglycemia
Patient 2	Acute respiratory failure, borderline personality, polysubstance abuse
Patient 3	Primary aspiration pneumonia, depression, ETOH abuse
Patient 4	Atypical seizure vs. post-ictal state, encephalopathy
Patient 5	ICH and seizure
Patient 6	alcohol intoxication/cocaine abuse
Patient 7	respiratory failure/polysubstance abuse

Ketamine patients intubated in the Emergency Department-final disposition

Name	FINAL DISPOSITION
Patient 1	DC to self
Patient 2	DC to self
Patient 3	DC after 3 days to self
Patient 4	DC after 4 days to self
Patient 5	DC after extended hospital stay
Patient 6	discharged to home
Patient 7	discharged to home

Does giving Ketamine to Excited Delirium patients predispose them to endotracheal intubation?

- ***Is it the Ketamine or other drugs?***
- ***Is it the combination with other drugs/ETOH?***
- ***Would these patients have been intubated anyway?***
- ***Would patient bagging have prevented the ETT?***
- ***Are some hospitals "intubation happy"???***

The Wisdom of RJ Frascone MD

**Medical Director, Regions Hospital Emergency Medical Services;
Associate Professor, Department of Emergency Medicine,
University of Minnesota**

"The last drug given to a patient with Excited Delirium will be blamed for any adverse consequences"

QUESTIONS???????????????