RAPID SEQUENCE INTUBATION

I have NO
Financial Disclosures

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THE DISCUSSIONS FOR TODAY

Ketamine / Ketofol
Special Case
Interesting Idea
SUX v ROC!!!
SCCM Guidelines
Delayed Sequence Oxygenation

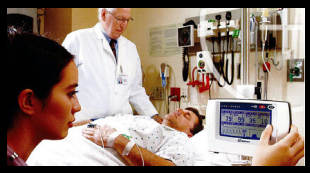
"Expertise in Procedural Sedation and Analgesia
is a Core Competency In Emergency Medicine Practice."
- ACEP Clinical Policy Guidelines

INDUCTION AGENTS

THE AIM OF RSI
To quickly and effectively induce sedation and paralysis in those at high risk for aspiration or airway compromise.

THE DRUGS USED
Reduce the time a patient's airway is unprotected and optimizes first-pass success in visualizing the vocal cords.

INDUCTION AGENTS



ETOMIDATE	KETAMINE
PROPOFOL	KETOFOL

KETAMINE

"SAFEST ANETHETIC AGENT IN THE WORLD"
Used for Pediatric Procedural Sedation for Decades
Used in the Most Rural Clinics

SMART USE OF KETAMINE
Dissociative Anesthetic
Procedures with Greater Post - Procedural Pain
Patients on Chronic Narcotics

KETAMINE

"Low Cost + Large Therapeutic Window"

MAINTAINS ALL VITALS & REFLEXES
No Histamine Release - Best CV Stability of all drugs
Allows Placement - into unobservable positions

ADDITIONAL CLINICAL EFFECTS
May Raise BP & Pulse (weakly releases norepinephrine),
Potent Bronchodilator, Intense Co-Analgesic, Sedative and
Amnestic most effective with a low-dose opioid.

KETAMINE COMPLICATIONS

INCREASED SECRETIONS
Those < 5 Years (Atropine/Glycopyrrolate)

PSYCHOTROPIC EFFECTS
Avoid in psych disease?

LARYNGOSPASM
in very young; bag!!
resolves in minutes

PATCHY ERYTHEMATOUS TORSO RASH
5% - 20%; resolves
in 20 minutes; no treatment

HYPERTONUS purposeless movements (benign)

EMERGENCE REACTION

KETAMINE

EMERGENCE REACTION
"the feared complication"

PRESENTATION
patients awaken feeling disconnected, fearful or anxious, and may report nightmares / hallucinations

INCIDENCE
50% (adults) 10% (children)

KETAMINE

EMERGENCE REACTION
> 10 years, female gender, personality disorders, rapid administration, and recovery stimulation

PREDOMINANT SYMPTOMS
25% Recall Dreams, < 1/3 Found It Unpleasant

PREVENTION/TREATMENT
Administer Ketamine: very slowly
Recover Patient: dark room with minimal stimulation
Benzodiazepines: give if symptoms develop

KETAMINE

Latest ACEP Clinical Policy
Level A (Children) Level C (Adults)

CONTRAINDICATIONS
Age < 3 Months
Prior Adverse Reactions
Active Lung Disease
Porphyria
High Intracranial Pressure
Concurrent Head Trauma
Pharyngeal Procedures

CONTRAINDICATIONS
Psychiatric Disease
Airway Compromise
Hyperthyroidism
Pregnancy
Glaucoma or Globe Injury
Altered Mental Status
Cardiovascular Disease

KETOFOL

KETAMINE
Dissociative Sedative, Analgesic and Amnestic

PROPOFOL
Sedative, Hypnotic, Anti-Emetic and Amnestic

SMART COMBINATION
Opposing Hemodynamic & Respiratory Effects

KETOFOL

TREAT PAIN FIRST
Every Single Time

DOSING
1:1 Ketamine:Propofol

ALIQUOTS
1 – 3 mL Boluses

RECOVERY
15 min; 96% in 30 min

VITAL SIGNS
modest raise in BP & HR

SUCCESS RATE
> 96%

Latest ACEP Clinical Policy
Level B Recommendation
Ketofol is safely given to CHILDREN & ADULTS.

KETOFOL

BENEFITS
Low Incidences of Hypotension, Vomiting, Aspiration, Bradycardia, or other Adverse Outcomes or Sequelae

COMPLICATIONS
Mild Emergence - Treat with Midazolam
Hypoxemia - Airway Alignment or Bagging
Muscular Rigidity - No Intervention Required

THE FUTURE
Ketamine:Propofol @ 1:2, 1:3 or 1:4
Increases Cardiorespiratory Stability and Relaxation
Decreases Emergence Reaction

NOW, A SURPRISE

INTERESTING CASE

A 28 y/o man w/o PMHx is BIB EMS. He was found, highly agitated and pulled a steak knife on responding officers. He is in 4-point restraints but is not resisting any longer.
Vital Signs are BP 78/56 (MAP = 63), HR 82, RR 22, T 98.8 ºF.

The patient appears exhausted, dehydrated, and altered. EMS relates that police requested sedation upon their arrival.

His BP does not respond to IVFs or Narcan. GCS is 10.
Why is the patient not responding to your interventions?

KETAMINE USE IN THE CRITICALLY ILL

Be aware of catecholamine depletion in the critically ill.
Ketamine has a direct biphasic myocardial effect.

The first response is direct myocardial depression.
The second response is direct myocardial stimulation.

It is thought that direct sympathetic stimulation makes ketamine an attractive option for unstable patients

KETAMINE USE IN THE CRITICALLY ILL

However, there may not be a secondary response that will increase in myocardial stimulation and blood pressure.

Ketamine's intrinsic myocardial depression may predominate in those with massive stress-induced catecholamine depletion.

Ketamine's secondary effect of myocardial stimulation is dependent upon intrinsic beta-adrenergic tone.

Comparative Study > Acta Anaesthesiol Scand. 1996 Mar;40(3):338-41.
doi: 10.1111/j.1399-6576.1996.tb04442.x.

In vitro myocardial depression by ketamine or thiopental is dependent on the underlying beta-adrenergic tone

T A Thurston [1], B P Mathew

Affiliations + expand

PMID: 8721465 DOI: 10.1111/j.1399-6576.1996.tb04442.x

CATECHOLAMINE DEPLETION

Manifested by Anxiety, Somnolence or Psychotic states

SIMULANT USE
Methamphetamine and Cocaine

CONGESTIVE HEART FAILURE
Disturbed Cardiac Norepinephrine Homeostasis (Depletion)

LEWY BODY DISEASES
Dementia and Parkinsonism

SEPSIS OR SHOCK

KETAMINE MECHANISMS OF ACTION

DISASSOCIATIVE ANESTHETIC
NMDA receptor complexes binding (neuro-inhibition)
partial agonist opiate mu binding (sedation and comfort)

HEMODYNAMIC EFFECTS
mediated through catecholamine release
catecholamine-depleted patients may be unprotected
from the unopposed direct myocardial depressant effects

CLINICAL KETAMINE IS RACEMIC!!
R-Ketamine is used in studies of depression. S-Ketamine increases cardiac output. The metabolite S-norketamine reduces cardiac excitation in a dose dependent manner.

BACK TO THE PATIENT

How would you treat this catecholamine-depleted patient with recalcitrant hypotension?

Use Phenylephrine (Neo synephrine®)

Hey!! What About Norepinephrine (Levophed®)

INTERESTING IDEA

KETAMINE
Provides a positive CV profile and has been suggested for hypotensive patients.

Direct inhibitory CV effect and caution has been advised for hypotensive pts.

Lower dose may improve CV profile during this critical period.

MIDAZOLAM
Used with ketamine but may cause hypotension.

LIDOCAINE
Enhances effect of thiopentone, propofol, midazolam and volatile agents w/o negative CV effects.

HYPOTHESIS
Use lidocaine with lower dose ketamine during induction in those with septic shock to provide a better hemodynamic profile.

ELSEVIER

February 2021

Double-Blinded

Original Article

The benefit of adding lidocaine to ketamine during rapid sequence endotracheal intubation in patients with septic shock: A randomised controlled trial

HYPOTHESIS
Septic shock pts may require intubation. **Hypotension** may seriously complicate **anesthesia induction** for patients in circulatory failure.

METHODS - Compares two RSI Protocols
1 mg/kg ketamine
versus
0.5 mg/kg ketamine + 1 mg/kg lidocaine
0.05 mg/kg midazolam for each group (n=22)

PRIMARY OUTCOME = MAP

OTHER OUTCOMES
Post-Induction Frequency of Hypotension, Heart Rate, and Cardiac Output

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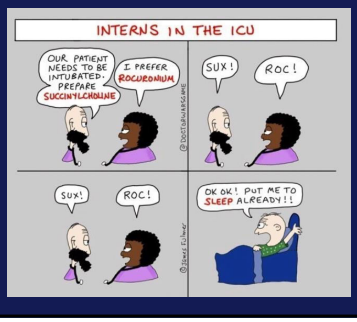
The benefit of adding lidocaine to ketamine during RSI endotracheal intubation in patients with septic shock: A randomized controlled trial.

	Ketamine	Ketamine / Lidocaine	*P* Values
MAP @ 5 min	73 +/-10.2 mm Hg	82.8 +/- mm Hg	< 0.001
Post-Intubation Hypotension	17 patients (77%)	1 patient (5%)	< 0.001

The ketamine-lidocaine group showed higher MAP in almost all readings after induction compared to the ketamine group.

Cardiac output and heart rate were comparable between groups.

SUX versus ROC!!!



NEUROMUSCULAR BLOCKERS

SUCCINYLCHOLINE MECHANISM OF ACTION

ACh analogue that stimulates ALL cholinergic receptors (parasympathetic and sympathetic), causing continuous stimulations, fasciculations, followed by muscular paralysis.

ROCURONIUM MECHANISM OF ACTION

A nondepolarizing paralytic agent with competitive antagonism at the ACh receptor. It is a superior, less tachycardiac and histamine releasing alternative to pancuronium.

SUX v ROC!!

DOSE	SUX
Dose	1-1.5 mg/kg
Onset	Rapid 45-60 sec
Duration	4-6 min
½ Life	Unknown
Metabolism	Unknown

CONFIRMATION OF SAFETY CONSIDERATIONS

2015 Cochrane Review , 50 Trials (n = > 4,000)

High Dose Roc = Sux Dose for 1st Pass Success Rates

SUX vs ROC!!!

	SUX	ROC
Cost of Vial	$40/200 mg	$40/100 mg
Storage	2 weeks	12 weeks
Side Effects	Hyperkalemia Malignant Hyperthermia Fasciculations Bradycardia	Liver Toxicity
Contraindications	Prior Stroke Baseline NM Disease Recent Burns CKD	Liver Disease

SUX versus ROC

SCCM
Looked at 30 Studies, Found No Difference
Succinylcholine has Contraindications

EM EXPERTS
Succinylcholine for Quick On / Quick Off Scenarios
Neck or Airway Masses Brain Injury Checks (CVA or TBI)

SAFE APNEA TIME (SAT)

SAT is the Time Required for a Patient to desaturate < 88% after paralysis

ROCURONIUM SAFE APNEA TIME
40 seconds longer compared to succinylcholine

PROPOSED MECHANISM
Increased Muscle O_2 Consumption
Fasciculations with Succinylcholine

MEAN RECOVERY TIME POST-APNEIC HYPOXIA
Rocuronium's time is significantly less

DELAYED SEQUENCE OXYGENATION

Procedural Sedation for Pre-Oxygenation

TARGET PATIENTS
Agitated, Delirious, Combative

SCCM
Low Quality Conditional Recommendation that would
Increase Safe Apnea Time

EM EXPERTS
NRB first, dexmedetomidine (Precedex) or Ketamine
and Prepare Your Team.

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