

AAEM 2019 Cruising the Literature Resuscitation 2019

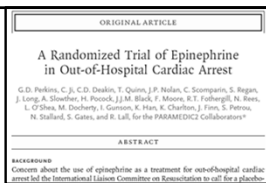
Corey M. Slovis, M.D.
Vanderbilt University Medical Center
Metro Nashville Fire Department
Nashville International Airport
Nashville, TN

Corey Slovis –
No disclosures

CPR

Epinephrine
Heads Up CPR
Arrest S/P Sex

Epinephrine



New Engl J Med 2018;379:711-21

What is the role of epinephrine in cardiac arrest?

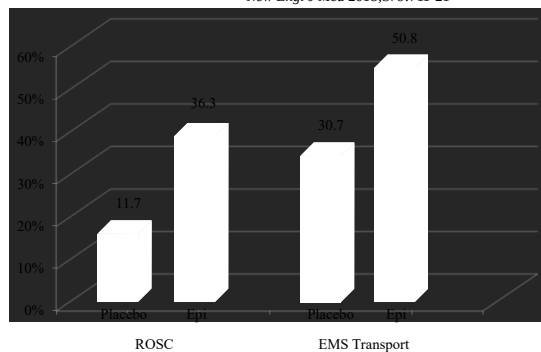
- Large double blind placebo controlled trial
- 8,014 pts, UK EMS, adults ≥ 16 yo
- 4,015 pts, 1 mg epi Q 3-5 min
- 3,999 placebo receiving patients

The study evaluated 30 day outcomes and functional neurologic outcomes at discharge and at 3 months

New Engl J Med 2018;379:711-21

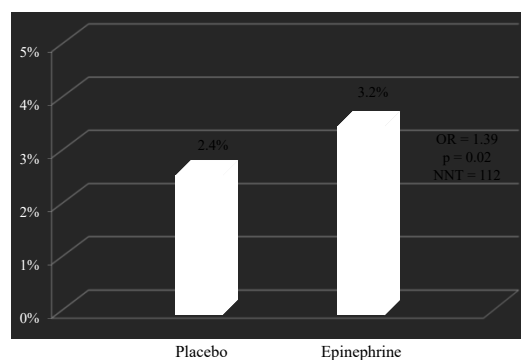
ROSC and EMS Transport

New Engl J Med 2018;379:711-21

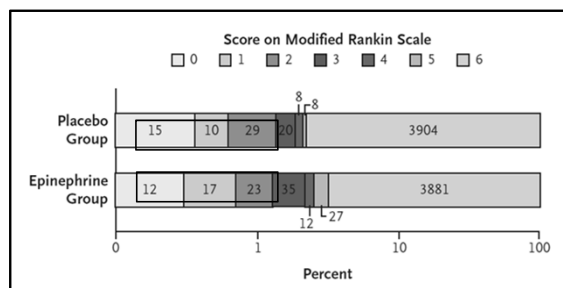


30 Day Survival

New Engl J Med 2018;379:711-21



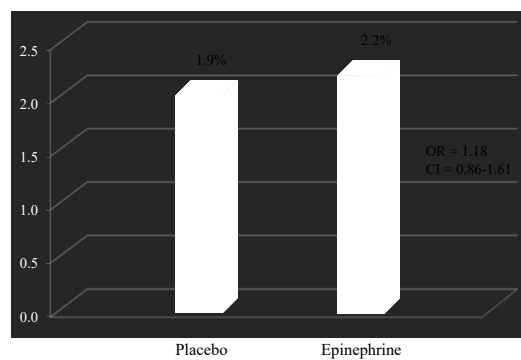
30 Day Neurologic Outcomes



New Engl J Med 2018;379:711-21

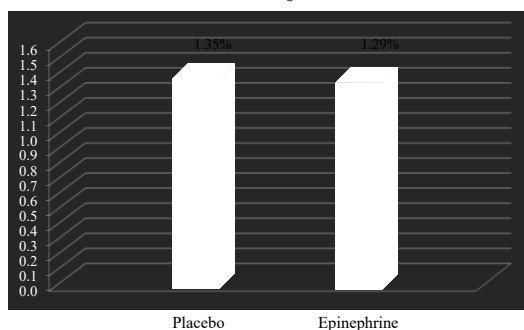
Rankin 0 - 3

New Engl J Med 2018;379:711-21



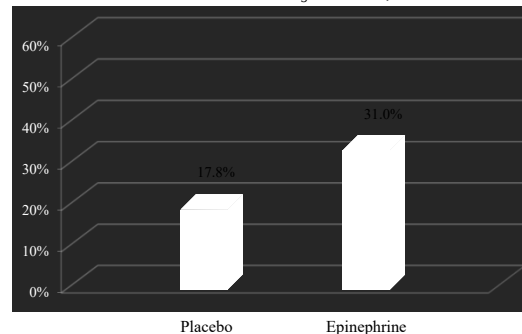
Favorable Neurologic Outcome Rankin 0 - 2

New Engl J Med 2018;379:711-21



Severe Neurologic Disability (30 d) Rankin 4, 5

New Engl J Med 2018;379:711-21



Adjusted Analysis Paramedic Witnessed

New Engl J Med 2018;379:711-21

Subgroup		OR (95% CI)	p (interaction)
Witness			0.32
None		2.62 (1.15, 5.96)	
Bystander		1.35 (0.95, 1.93)	
Paramedic		1.26 (0.60, 2.62)	

Favors Placebo

Favors Epinephrine

Adjusted Analysis VF/pVT vs Non Shockable

New Engl J Med 2018;379:711-21

Initial rhythm		OR (95% CI)	p (interaction)
Shockable rhythm		1.32 (0.95, 1.86)	0.19
Nonshockable rhythm		2.15 (1.13, 4.09)	

Favors Placebo

Favors Epinephrine

Adjusted Analysis Medical vs Traumatic

New Engl J Med 2018;379:711-21

Cause of cardiac arrest		OR (95% CI)	p (interaction)
Medical cause		1.46 (1.08, 1.97)	0.84
Non-medical cause		1.20 (0.18, 8.01)	

Favors Placebo

Favors Epinephrine

Positive Result Conclusion

Epinephrine in OOHCA arrest
improves ROSC and likelihood
for hospital discharge

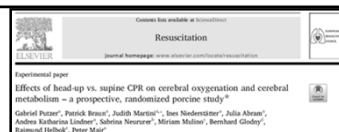
Neutral Result Conclusion

Epinephrine does not improve
neurologically intact survival
in OOHCA

Negative Result Conclusion

Epinephrine in OOHCA just increases
the likelihood of being neurologically
devastated without significantly
increasing the number of neurologically
intact survivors

Heads Up CPR



Resuscitation 2018;128:51-5

- Heads up CPR ↓ ICP and ↑ CPP
- Porcine study of 20 pigs
- Confirms ↓ ICP and ↑ CPP
- However no improvement in cerebral oxygenation and/or metabolism
- *Heads-up CPR is not yet of proven benefit in pigs or humans*

Confirming the Clinical Safety and Feasibility of a Bundled Methodology to Improve Cardiopulmonary Resuscitation Involving a Head-Up/Torso-Up Chest Compression Technique

Paul E. Pope, MD, MPH, MCCM, MACC, FAEMS^{1,2}; Kenneth A. Schepke, MD, FAEM¹; Peter M. Aschery, MD; Brent B. Crowe, PhD, NREMT³; Daniel Millstone, EMT-P⁴; Charles Conkle, EMT-P⁵; Craig Prusamky, EMT-P⁶; Sebastian Garay, EMT-P⁷; Richard Ellis, EMT-P⁸; Raymond L. Fowler, MD, FACEP, FAEMS¹; Johanna C. Moore, MD, MSP

Crit Care Med 2019;47:449-55

- 1489 consecutive patients 1/2014 – 6/2017
- Palm Beach County Florida
- Pit crew resuscitation team
- Lucas mechanical CPR + ITD
- 20° Reverse Trendelenburg positioning
- O₂ but with delayed positive pressure

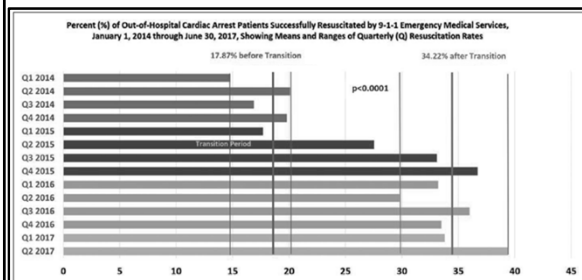
Positioning

Crit Care Med 2019;47:449-55



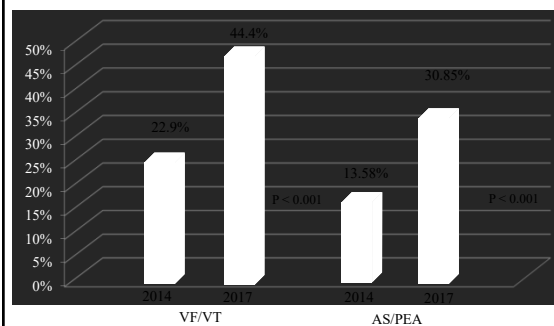
Successful Resuscitation Rates 2014 - 2017

Crit Care Med 2019;47:449-55



Successful Resuscitation Rates

Crit Care Med 2019;47:449-55



Heads Up CPR

- May make a true difference
- Not yet independently verified
- Requires mechanical CPR, ITD
- Requires compression-decompression
- Slowly raise head after priming

VFib Therapy Antiarrhythmics DSD



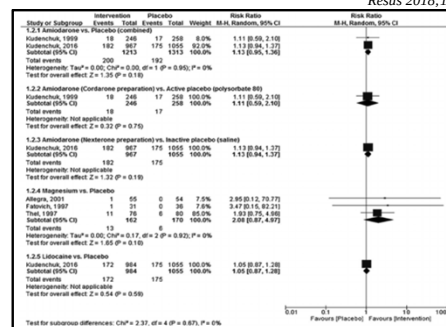
Resus 2018;132:63-72

How effective are antiarrhythmics in VF/pVT arrests?

- 14 randomized trials; 8 observational studies
- 1 additional pediatric observational study
- 1,213 pts studied with Amiodarone vs placebo
- 987 pts Amiodarone vs Lidocaine
- 19,517 pts Lidocaine vs placebo

Antiarrhythmics vs Placebo Amiodarone, Lidocaine, Magnesium

Resus 2018;132:63-72



Do Antiarrhythmics Make A Difference?

Resus 2018; 132: 63-72

No proven benefits of antiarrhythmic therapy in cardiac arrest due to shockable rhythms in OHCA when measuring survival to hospital discharge and especially when evaluating favorable neurologic outcomes and long term survival.

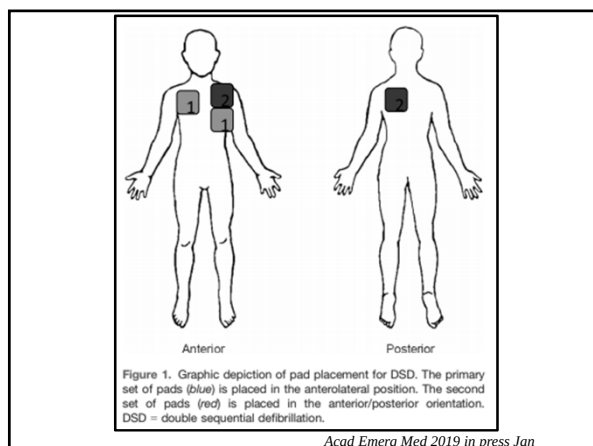
Title: Double sequential external defibrillation for refractory ventricular fibrillation out-of-hospital cardiac arrest: a systematic review and meta-analysis

Authors: Ashleigh Delorenzo, Ziad Nehme, James Yates, Stephen Bernard, Karen Smith

Resuscitation 2018, Online October

How effective is Double Sequential Defibrillation?

- Systematic Review and Meta-Analysis
- 449 pts, 19% (95) treated by DSD
- 2 retrospective trials reviewed
- 58.7% arrests were witnessed
- Evaluated ROSC, hospital d/c, 30d survival



Really a review of 2 studies, one from London, England, the other from San Antonio, TX

London : DSD s/p 6 shocks

Texas : DSD s/p after 3 or more

Title: Double sequential external defibrillation for refractory ventricular fibrillation out-of-hospital cardiac arrest: a systematic review and meta-analysis

Authors: Ashleigh Delorenzo, Ziad Nehme, James Yates, Stephen Bernard, Karen Smith

Resuscitation 2018, Online October

- No increase in ROSC
- No improvement on survival to discharge

Prehospital Double Sequential Defibrillation: A Matched Case-Control Study

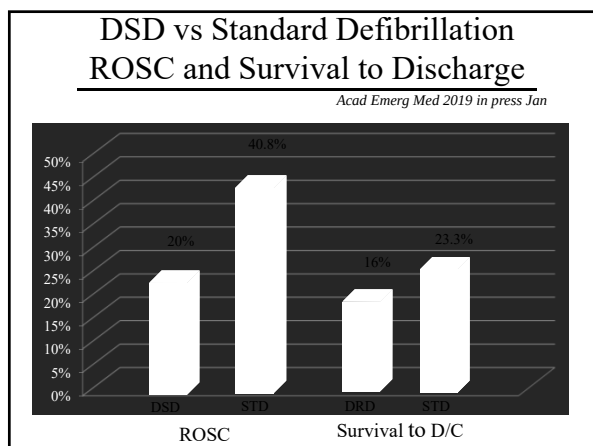
Julian G. Mapp MD, MPH, Alan J. Hans MD, Anthony M. Darrington MD, Elliot M. Ross MD, MPH, Calvin C. Ho MD, MS, David A. Miramontes MD, Stephen A. Harper MD, MPH for ... See all authors ...

First published: 10 December 2018 | <https://doi.org/10.1111/ajem.13672>

Acad Emerg Med 2019 in press Jan

Is DSD more effective in refractory VF?

- Matched case control comparison
- 205 patients with refractory VF (3 shocks)
- 64 DSD vs 64 Standard defibrillations
- 2 blinded observers; matched same year pts
- Same epi doses, downtimes, witnessed, bystander CPR



“Our current protocol of considering DSD after the third conventional defibrillation in out-of-hospital cardiac arrest is ineffective”

Circulation
RESEARCH LETTER
Sudden Cardiovascular Arrest During Sexual Intercourse

Circulatory arrest often occurs the time of sudden cardiac arrest (SCA) during physical activity, especially that related to sexual intercourse. The extent of SCA has been rising increasingly through recent studies, and epidemiological data are scarce. A comparison of the frequency and outcomes of SCA with other SCA cases allows a better understanding.

Andreas Steriadeviciu, MD, MPH, PhD
David M. Olson, MD, PhD
Walter B. Longo, MD, PhD

Circulation 2018;137:1638-40

Only 47% received CPR in these witnessed arrests

Maybe put on defib pads and hook up AED during the warm up

ACS
NTG in AMI
Aminophylline in HB

Acute Hypotension with NTG
5 Causes

- Right Ventricular AMI
- Relative or Absolute Volume depletion
- Viagra, Levitra, Cialis
- Bezold-Jarisch Reflex
- Drug Sensitivity (valvular dsx, idiopathic)

PREHOSPITAL NITROGLYCERIN SAFETY IN INFERIOR ST ELEVATION MYOCARDIAL INFARCTION

Laurie Robichaud, MDCM, Dave Ross, MD, Marie-Hélène Proulx, PCP, MSc, Sébastien Légaré, PCP, Charlene Vacon, AEMT-CC, PhD, Xiaoping Xue, MSc, Eli Segal, MD, FRCP, CSPQ, FACEP

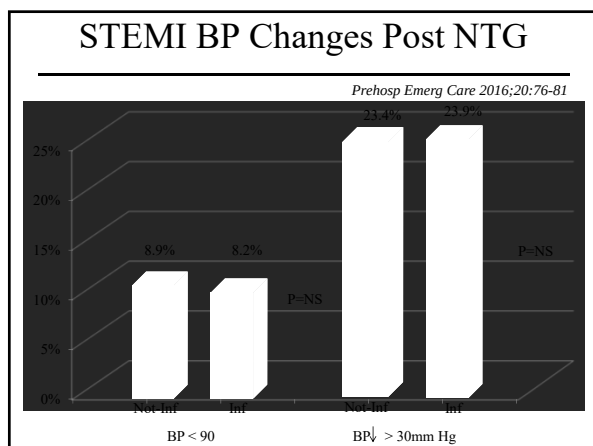
ABSTRACT

Patients with inferior ST elevation myocardial infarction (STEMI) associated with right ventricular infarction, are thought to be at higher risk of developing hypotension when administered nitroglycerin (NTG). However, current data while controlling for various factors. Over a 28-month period, we identified 1,466 STEMI cases. Of those, 821 (56.0%) received NTG. We excluded 16 cases because of missing data. Hypotension occurred post NTG in 38/466 inferior STEMIs and 30/339 non-inferior STEMIs, 8.2% vs. 8.9%; $p = 0.73$. A

Prehosp Emerg Care 2016;20:76-81

How dangerous is NTG in Inferior AMI?

- 1,466 STEMIs, 56% received NTG
- Montreal Quebec EMS 2010-2012
- Evaluated BP changes in Inf vs Non-Inf AMIs
- BP < 90 or BP↓ > 30mm Hg s/p NTG



Safety and Effectiveness of Field Nitroglycerin in Patients with Suspected ST Elevation Myocardial Infarction

Nicholas Bessan, MD, MPH, Benjamin Labrosse, MD, Jason A. Blomgren, MD, Amy H. Kay, MD, PhD, Adria Lurie, MD, MPH, Katherine Hurley, MD, MPH

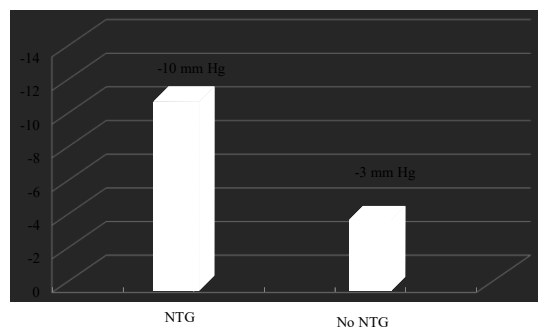
PreHospital Emerg Care 2019 online

How safe is NTG in r/o AMI and does it effectively relieve pain?

- Prospective study, 780 pts, suspected STEMI
- LA County EMS and UCLA
- “Suspected STEMI” by ECG plus paramedic
- 0.4 mg SL NTG, up to 2 more doses
- BP < 100 mm SBP pts excluded

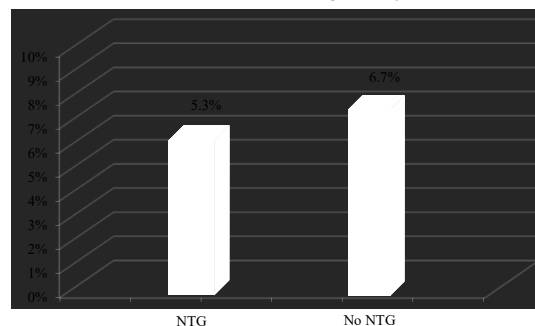
NTG in suspected STEMI Median BP Fall

PreHospital Emerg Care 2019 online



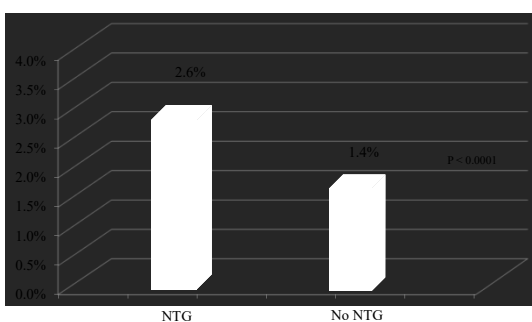
NTG in suspected STEMI Systolic BP fall > 30 mm Hg

PreHospital Emerg Care 2019 online



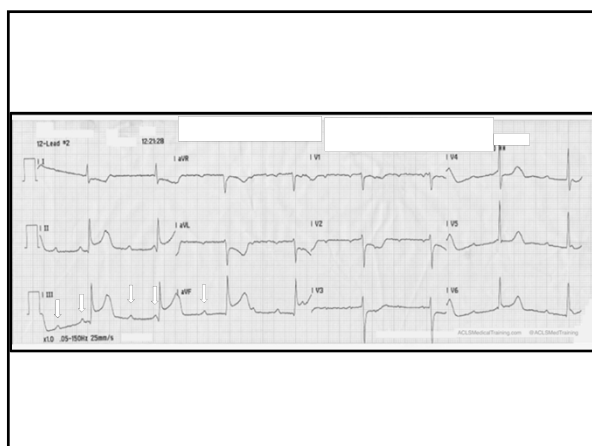
NTG in suspected STEMI Pain Relief

PreHospital Emerg Care 2019 online



NTG for r/o AMI

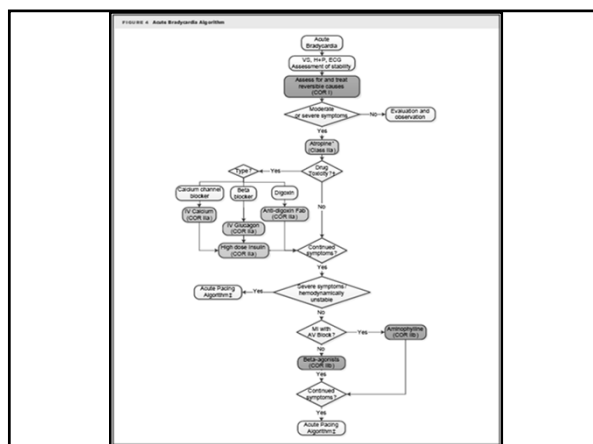
- NTG is safe in AMI
- NTG is safe in Inferior AMI
- NTG relieves Anginal pain in ACS
- *Respect NTG but use it*



2018 ACC/AHA/HRS Guideline on the Evaluation and Management of Patients With Bradycardia and Cardiac Conduction Delay

JACC 2019 in press

- 2019 Guidelines for Bradycardia
- Provider recommendations for BB and CAB
- Now also recommends **bolus** aminophylline
- Excellent Flow Diagrams



Intravenous loading dosage (dosage is expressed as theophylline)

Adults, Adolescents, and Children

4.5 mg/kg IV loading dose infused over 30 minutes in a patient who has received no theophylline in the previous 24 hours will produce an average peak serum theophylline concentration of 10 mcg/mL (range 6 to 16 mcg/mL); calculate mg/kg dose based on ideal body weight. In patients who have received theophylline within the previous 24 hours, a theophylline serum concentration must be drawn and loading dose, if needed, calculated accordingly. If dosing with theophylline is continued, follow maintenance dosage below.

PDR 2019

Medication	Dosage	Comments
Symptomatic sinus bradycardia or atrioventricular block		
Atropine	0.5-1 mg IV (may be repeated every 3-5 min to a maximum dose of 3 mg) (5.3.2.4-20-53.2.4-24)	
Dopamine	5 to 20 mcg/kg/min IV, starting at 5 mcg/kg/min and increasing by 5 mcg/kg/min every 2 min (5.3.2.4-25)	Doses of >20 mcg/kg/min may result in vasoconstriction or arrhythmias
Isoproterenol	20-60 mcg IV bolus followed doses of 10-20 mcg, or infusion of 1-20 mcg/min based on heart rate response (5.3.2.4-26-53.2.4-32)	Monitor for potential development of ischemic chest pain
Epinephrine	2-10 mcg/min IV or 0.1-0.5 mcg/kg/min IV titrated to desired effect (5.3.2.4-17, 53.2.4-19, 53.2.4-33)	
Second- or third-degree atrioventricular block associated with acute inferior MI		
Aminophylline	250-mg IV bolus	
Calcium channel blocker overdose		
10% calcium chloride	1-2 g IV every 10-20 min or an infusion of 0.2-0.4 mcg/kg/h (5.3.2.4-34-53.2.4-38)	
10% calcium gluconate	3-6 g IV every 10-20 min or an infusion of 0.8-1.2 mcg/kg/h (5.3.2.4-34-53.2.4-39)	
Beta-blocker or calcium channel blocker overdose		
Glucagon	3-10 mg IV with infusion of 3-5 mg/h (5.3.2.4-37, 53.2.4-38)	
High dose insulin therapy	IV bolus of 1 unit/kg followed by an infusion of 0.5 units/kg/h (5.3.2.4-35, 53.2.4-36, 53.2.4-40, 53.2.4-41)	Follow glucose and potassium levels
Digoxin overdose		
Digoxin antibody Fragment	Dosage is dependent on amount ingested or known digoxin concentration (5.3.2.4-41-53.2.4-48)	- One vial binds approximately 0.5 mg of digoxin - Administer over at least 30 min - May be repeated
Post-heart transplant		
Aminophylline	6 mg/kg in 100-200 mL of IV fluid over 20-30 min	
Theophylline	300 mg IV, followed by oral dose of 5-10 mg/kg/d titrated to effect	- Therapeutic serum levels range from 10-20 mcg/mL - Usual posttransplant dosages average 450 mg/1000 mg/d
Spinal cord injury		
Aminophylline	6 mg/kg in 100-200 mL of IV fluid over 20-30 min (5.3.2.4-7)	
Theophylline	Oral dose of 5-10 mg/kg/d titrated to effect (5.3.2.4-6)	Effective dosages often result in serum levels below the usual effective range of 10-20 mcg/mL

Aminophylline in the treatment of atropine-resistant bradycardia

Timothy J. Mader ^{a, b, c, d}, Barry Bertolet ^e, Joseph P. Omato ^f, Jeffrey M. Guterman ^{a, b}

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[https://doi.org/10.1016/S0300-9572\(00\)00234-3](https://doi.org/10.1016/S0300-9572(00)00234-3)

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Resuscitation 2000;47:105-12

200mg IV bolus during cardiac arrest in patients with Brady-Asystole ("slow" PEA) may be effective

Aminophylline for AV Block in Inferior AMI

Resuscitation 2000;47:105-12

- Review of 5 reports of Aminophylline in Inf AMI with A-V block resistant to atropine
- Patients received 125-300mg
- Worked in 15/19 pts
- All infusions were over 10-20 minutes

Effect of Aminophylline in Patients with Atropine-Resistant Late Advanced Atrioventricular Block during Acute Inferior Myocardial Infarction

ARMANIAN ALTUN, MD, CHAI KORDAK, MD, GÜLENC ÖZBOY, MD

Cardiology Department, Faculty of Medicine, Trakya University, Edirne; *Cardiology Division, State Hospital, Edirne, Turkey

Clin Card 1998;21:754-67

- 8 Inferior AMI patients
- All with atropine resistant A-V block
- 240 mg aminophylline over 10 min

Worked in 8/8 pts, many required second dose 1 hr later. Improves AV conduction not native atrial rate

Patient No.	Age (years/sex)	AV block appearance (days)	Degree of AV block		Atrial rate		Ventricular rate	
			Before	After	Before	After	Before	After
1	69/F	5	Complete	1:1	110	98	64	98
2	70/F	4	Mobitz II	PR: 0.56	96	110	48	110
3	73/M	4	Complete	1:1	79	81	63	81
4	73/M	2	Mobitz II	PR: 0.38	120	100	60	100
5	78/M	4	Complete	PR: 0.24	100	60	44	60
6	58/M	2	Complete	1:1	100	100	48	100
7	68/F	2	Complete	PR: 0.16	130	140	68	92
8	51/M	2	Complete	Mobitz I	100	68	58	68
				3:2/5:4				
				1:1				
				PR: 0.32				
	67.5 ± 8.8				104 ± 16-95 ± 25		57 ± 9-89 ± 17	
					p = NS		p = 0.012	

Abbreviations: AV = atrioventricular, M = male, F = female, PR = PR interval (s), NS = not significant.

Atrial rate unchanged, ventricular rate normalizes

Aminophylline in Symptomatic HB

- Give slowly, if at all
- 250 mg over 10 – 20 minutes or longer
- Be careful, follow HR closely

Do NOT follow current
AHA/ACC guidelines

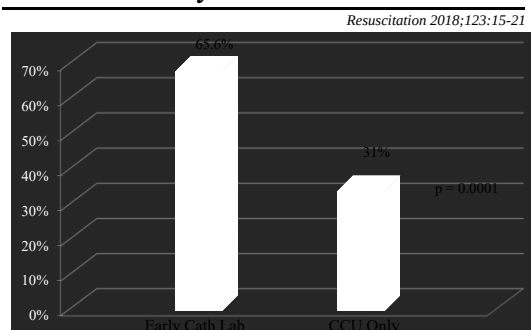
PCI S/P Cardiac Arrest



How valuable is PCI s/p cardiac arrest?

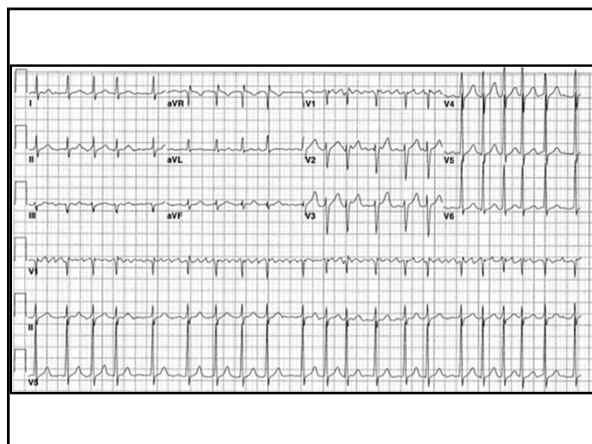
- 599 OHCA registry pts
- UPMC and Mercy Hospitals
- Early vs Later vs no Cath/PCI
- STEMI and no AMI pts

Survival to Discharge Early PCI vs CCU



Early Coronary Angiography Take Homes

- Early CCL essential to find intervenable lesions
- If PCI indicated: survival doubles with good neuro
- Non ST elevation AMI: intervenable lesions about 30% of time
- They, too, greatly benefit
- Be aggressive for high ROI



Magnesium for Atrial Fibrillation Rate Control

Low dose Magnesium sulfate versus High dose in the early management of rapid atrial fibrillation: randomised controlled double blind study (LOMAGHI study)

Wahid Bouida^{1,2}, MD Kaouther Bettahar^{1,2}, MD Mohamed Amine Moudi^{1,2}, Noussiba Azale^{1,2}, MD Houde Ben Soltane^{1,2}, MD Adel Sekine^{1,2}, MD Imen Trabelsi^{1,2}, MSc Hamdi Boukake^{1,2}, MD Mohamed Habib Grissa^{1,2}, MD Mehdi Methem^{1,2}, MD Riadh Boukef^{1,2}, MD Zahra Drid^{1,2}, MD Asma Belgutli^{1,2}, MD, MD Samir Nouira^{1,2}, MD

Acad Emerg Med 2018;in press August

Is Magnesium effective for rate control in “Rapid” Atrial Fibrillation?

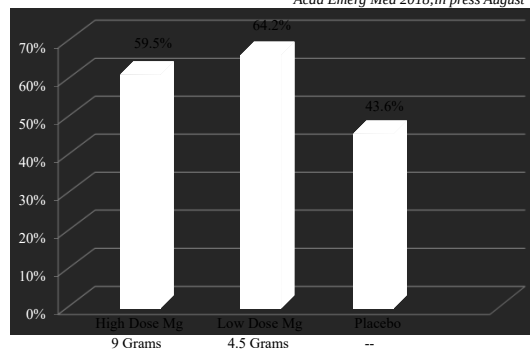
- 450 pts, double-blind, placebo controlled
- 3 groups of pts from 3 Tunisian hospitals
- High dose vs Low dose vs Placebo
- MgSO₄ 9 grams vs 4.5 grams vs Placebo
- Given over 30 minutes

Measured effectiveness as HR < 90 or rate lowering by > 20%

Acad Emerg Med 2018;in press August

Effectiveness HR < 90 or HR ↓ > 20%

Acad Emerg Med 2018;in press August



Low dose Magnesium sulfate versus High dose in the early management of rapid atrial fibrillation: randomised controlled double blind study (LOMAGHI study)

Wahid Bouida^{1,2}, MD Kaouther Bettahar^{1,2}, MD Mohamed Amine Moudi^{1,2}, Noussiba Azale^{1,2}, MD Houde Ben Soltane^{1,2}, MD Adel Sekine^{1,2}, MD Imen Trabelsi^{1,2}, MSc Hamdi Boukake^{1,2}, MD Mohamed Habib Grissa^{1,2}, MD Mehdi Methem^{1,2}, MD Riadh Boukef^{1,2}, MD Zahra Drid^{1,2}, MD Asma Belgutli^{1,2}, MD, MD Samir Nouira^{1,2}, MD

Acad Emerg Med 2018;in press August

This paper is not what it seems

- Essentially all patients got other rate control agents
- 45-50% received Digoxin
- 30% received Diltiazem
- 20% received Beta Blockade

Magnesium for Rate Control in AF Take Homes

- Adjunct? – maybe; Primary – NO
- 2.5 grams or 4.5 grams?
- 9 grams = lots of flushing (10-15%)
- Was very safe, < 1% hypotension
- Read this paper carefully

Oxygen Good or Bad?

Circulation

ORIGINAL RESEARCH ARTICLE

Association Between Early Hyperoxia Exposure After Resuscitation From Cardiac Arrest and Neurological Disability
Prospective Multicenter Protocol-Directed Cohort Study

Editorial, see p 2125

BACKGROUND: Studies examining the association between hyperoxia exposure after resuscitation from cardiac arrest and clinical outcomes.

Brian W. Roberts, MD

J. Hira Alqahtani, MD

Benjamin R. Huntley, MD

Michael A. Rybakowski, MD

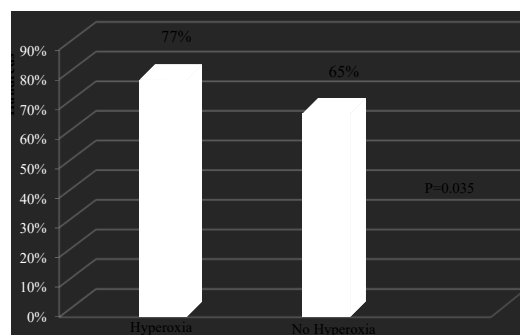
Circulation 2018;137:2114-24

Does post-resuscitation hyperoxia adversely affect neurologic outcome?

- 280 pts, multicenter prospective trial
- 38% (105 pts) were hyperoxic: $\text{PaO}_2 > 300$
- All pts comatose, ventilated, received TH
- 55% overall survival, 70% overall poor neuro

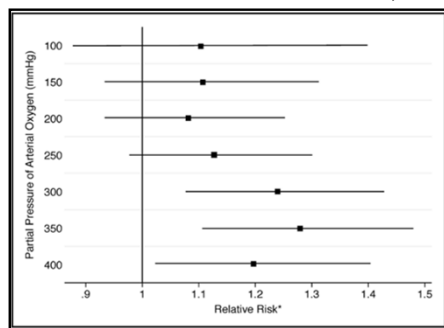
Poor Neurologic Outcome

Circulation 2018;137:2114-24



Hyperoxia and Poor Neurologic Outcome Adjusted Relative Risk

Circulation 2018;137:2114-24



Each hour of hyperoxia is independently associated with a 3% increase in poor neurological outcome

Oxygenation S/P Arrest Once ROSC Obtained

- Maintain O₂ saturation below 100%
- Aim for 95-96%
- Await further refinements

100% by non-rebreather s/p arrest in normotensive patients is no longer good care

Is the Liberal Use of Oxygen Associated With Worse Outcomes Among Critically Ill Patients?
Michael Gottlieb MD (EBEM Commentator), Corey Goldstein MD (EBEM Commentator), Edward J. Ward MD, MPH (EBEM Commentator)

Annals of Emerg Med 2018 ePub Dec

Is high flow O₂ really deleterious at 6-8L O₂ by face mask or via ETI?

- Meta-analysis: 25 studies, 16,037 pts
- ICU, Sepsis, CVA, AMI, CPR studies
- 4 nasal prong, 13 face mask, 8 ETI studies
- Conservative = RA or low flow nasal O₂

High Flow Oxygen in Critical Illness

Annals of Emerg Med 2018 ePub Dec

- Increased Hospital mortality 21%
- Increased 30 day mortality 14%
- Increased long term mortality 10%

High Flow O₂ Take Homes

Once a pulse has returned,
maintain O₂ saturation at 93-95%
and 89-92% in COPD

Apneic oxygenation reduces hypoxemia during endotracheal intubation in the pediatric emergency department ✨
Adam A. Valicenti MD, MEd ✨, R. Holly R. Hanson MD, MSc ✨, Shalby L. Murphy MD ✨, Daniela Mercurio DO ✨, Craig A. Shewdy MD ✨, Donald H. Arnold MD, MPH ✨ ✨
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AJEM 2019;37:27-37

Do nasal prongs significantly decrease incidence of hypoxia during ETI?

- 149 children before and after study

Apneic oxygenation decreases hypoxia by almost 50% during ETI from almost 50% to less than 25%

Intubation and Airway Management

Bag-Mask Ventilation during Tracheal Intubation of Critically Ill Adults

Jonathan D. Casey, M.D., David R. Janz, M.D., Derek W. Russell, M.D., Derek J. Vonderhaar, M.D., Aaron M. Joffe, D.O., Kevin M. Dischert, M.D., Ryan M. Brown, M.D., Aline N. Zouk, M.D., Swati Gulati, M.B., B.S., Brent E. Hiedeman, M.D., Michael G. Lester, M.D., Alexandra H. Toporek, M.D., Itay Bentov, M.D., Ph.D., Wesley H. Self, M.D., Todd W. Rice, M.D., and Matthew W. Semler, M.D., for the PreVent Investigators and the Pragmatic Critical Care Research Group*

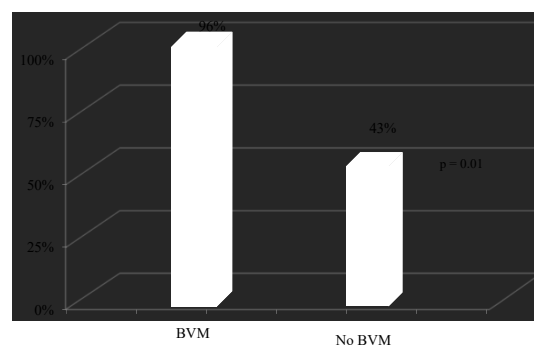
NEJM 2019 epub

Does BVM with 100% O₂ pre-intubation decrease hypoxia during ETI?

- Multicenter trial, 401 pts
- 100% O₂ by BVM vs No Assigned Ventilations
- Evaluated changes in O₂ saturation
- Also measured incidence of hypoxemia

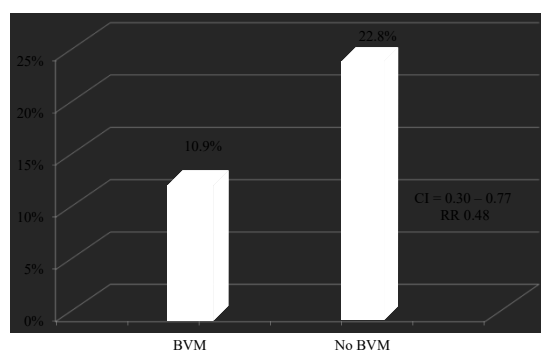
Change in O₂ Saturation

NEJM 2019 epub



Incidences of Hypoxemia

NEJM 2019 epub



Comments and Limitations

- ICU trial not ED or EMS
- No nasal O₂ during study period
- No ↑ in aspirations (2.5% vs 4%)

Take Homes

Be sure to provide 100% O₂ by nasal prongs during ETI
whether you use BVM or not

Effectiveness of Apneic Oxygenation During Intubation: A Systematic Review and Meta-Analysis

Lucas Oliveira J. e Silva; Daniel Cabrera, MD; Patricia Barrionuevo, MD; Rebecca L. Johnson, MD; Patricia J. Erwin, MLS; M. Hassan Murad, MD, MPH; M. Fernanda Bellotti, MD, MS*

*Corresponding Author. E-mail: danielc@fmarccollege.edu; Twitter: @danielc12

Annals Emerg Med 2017; 70:483-494

- Meta-analysis: 8 studies; 1837 pts

Apneic oxygenation decreases hypoxemia by 1/3 and significantly increases first pass success in ETI



Resus 2018 Aug 30; epub ahead of print

How many endotracheal intubations during cardiac arrest does it take to be competent at ETI?



Resus 2018 Aug 30; epub ahead of print

- How long to become “Qualified”
 - ETI < 60 sec during CPR
 - No complications
- How long to become “Highly Qualified”
 - ETI < 30 sec during CPR
 - No complications
- CPR interruptions must < 10 sec
- Required a 90% success rate



Resus 2018 Aug 30; epub ahead of print

- First study to prospectively evaluate
- Began with 1st year Korean ED residents
- Utilized video review of ETIs
- Direct laryngoscopy only, no video DL

Expertise in ETI during CPR

Resus 2018 Aug 30; epub ahead of print

90% successful ETI < 60 sec requires at least 137 patient attempted intubations

Expertise in ETI during CPR

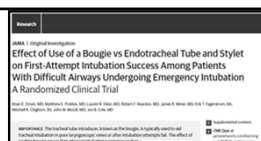
Resus 2018 Aug 30; epub ahead of print

90% successful ETI < 30 sec requires at least 243 attempted intubations

ETI Expertise during CPR

Take Home

Becoming an expert in invasive airway management requires years, not months, and hundreds of invasive airway attempts



JAMA May 2018;319:2171-84

Does routine Bougie use improve likelihood of first pass endotracheal intubation success?

- 757 patients randomized, Hennepin Med Center
- Bougie first vs ETT with Stylet
- Done with Mac blades and Storz C-MAC
- 58% DL; 21% all video; 20% video passage
- ½ (380) of pts had difficult airway characteristics

JAMA | Original Investigation
Effect of Use of a Bougie vs Endotracheal Tube and Stylet on First-Attempt Intubation Success Among Patients With Difficult Airways Undergoing Emergency Intubation: A Randomized Clinical Trial

David C. Dwyer, MD, Matthew E. Pribaznik, MD, Lauren R. Olson, MD, Robert T. Neundorfer, MD, James R. Moore, MD, Erik T. Lagerstrom, BA, Michael R. Ongly, BS, John W. McCall, MD, and R. Cody Wells

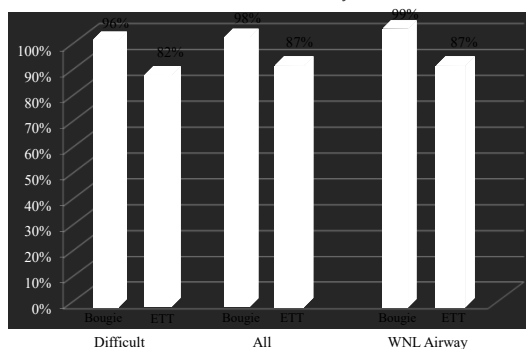
JAMA May 2018;319:2171-84

Bougie vs ETI with Stylet Comparison Groups

- Difficult vs All vs WNL airways
- Difficult = 1 or more:
 - Body fluids obscuring view
 - Airway obstruction or edema
 - Obesity, short neck
 - Small mandible, large tongue
 - Cervical spine immobilization

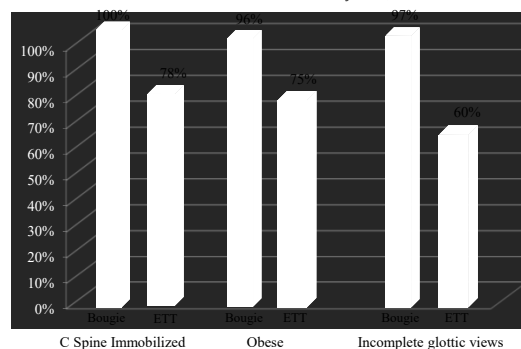
Bougie vs ETI with Stylet

JAMA May 2018;319:2171-84



Most Difficult Airways

JAMA May 2018;319:2171-84



Bougie Use for ETI Take Homes

- Use bougies more
- They are central to airway management
- Start with a bougie on difficult airways
or go to one quickly after first look

Effect of Cricoid Pressure Compared With a Sham Procedure in the Rapid Sequence Induction of Anesthesia: The IRIS Randomized Clinical Trial

Alexander Brimacombe, MD, David Haggis, MD, PhD, Sabine Rothe, MD, Alexandre Meudica, MD, Mathilde Farris, MD, Philippe Corbelli, MD, PhD, Aurélien Robin, MD, Vincent Compagnon, MD, PhD, Dan Berthiaume, MD, Baptiste Riou, MD, PhD, Remy Mercier, MD, Sabine Brimacombe, MD, François Lefebvre, MD, PhD, Bruce Ross, MD, PhD, for the IRIS Investigators Group

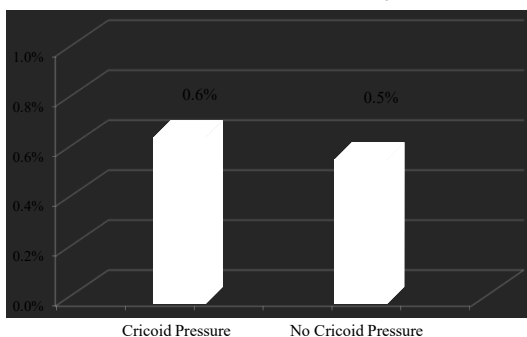
JAMA Surg 2019;154:9-17

How valuable is cricoid pressure?

- Randomized double blind study, 3472 pts
- Pulmonary aspiration measured
- Used laryngoscopy or tracheal aspiration
- Also evaluated effect on ETI

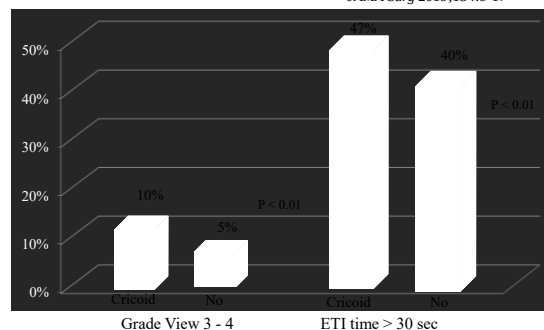
Aspiration and Airway Difficulty Cricoid Pressure

JAMA Surg 2019;154:9-17



Airway Difficulty Cricoid Pressure vs Control

JAMA Surg 2019;154:9-17



How Helpful is Cricoid Pressure Using the Sellick Maneuver Take Homes

- It won't help decrease aspiration
- But it will make your intubation harder

Airways and ETI

- Aggressive nasal O2
- Have or use Boujie
- No Cricoid
- BVM??
- Use video

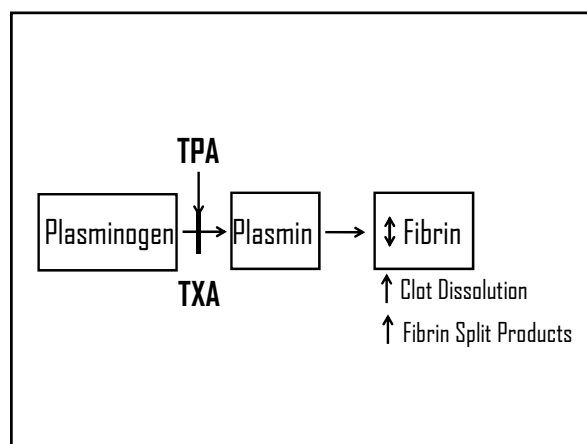
TXA

Tranexamic Acid TXA

- **An anti-fibrinolytic**
- Blocks fibrin clot dissolution
- TXA binds to plasminogen
- Blocks plasminogen – fibrin interaction
- FDA approved in 1989 for hemophilia

TXA Decreasing Blood Loss

- Tooth extractions in hemophilia
- Refractory nose bleeds
- Decrease surgical blood loss
(orthopedics: spine and hip; ob/gyn: hysterectomy)
- During cardiopulmonary bypass
- Post major trauma?

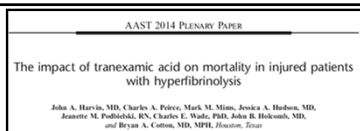
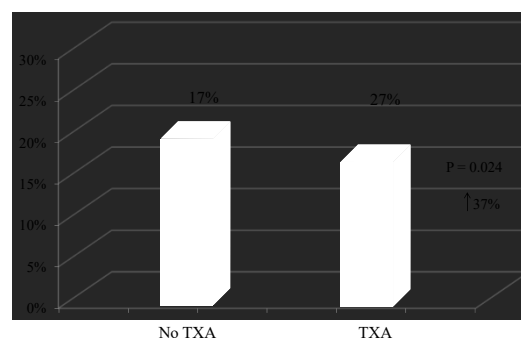


J Trauma and Acute Care 2014;76:1373

- 1217 Level 1 trauma patients - Miami FL
- All required immediate OR or blood
- TXA 1 gram IV then 1 G over 8 hours
- 54% penetrating trauma, 25% TBI
- 150 TXA pts and 150 matched controls

Mortality TXA vs Standard Care

J Trauma and Acute Care 2014;76:1373



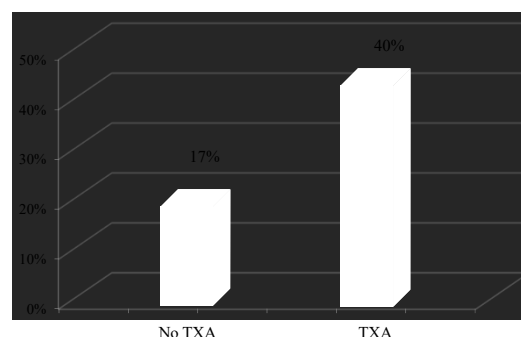
J Trauma Acute Care Surg 2015;78:905-9

Does TXA decrease mortality in trauma patients with proven fibrinolysis?

- 98 Level 1 trauma patients, retrospective study
- Herman Hospital Houston TX
- Compared to 934 non-TXA patients
- All pts had LY30 ≥ 3%

Mortality in Hyperfibrinolysis

J Trauma Acute Care Surg 2015;78:905-9





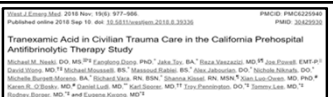
J Surg Res 2017;220:438-43

- 232 consecutive pts, Denver Health, 43 MTP
- Compared 3 fibrinolytic states
- Shutdown vs Physiologic vs Systemic fibrinolysis
- Compared each group of fibrinolysis types
- Analysis done with matching for injury severity



J Surg Res 2017;220:438-43

“The role of TXA in mature trauma systems remains unclear and emerging data supports it may have adverse effects”



West J Med 2018;19:977-986

Is TXA beneficial for civilian US trauma? The Cal-PAT study

- 724 patients retrospective matched comparison
- 362 patients received TXA ($\bar{x}$ = 33 min)
- June 2012-2017 multi-centered California trial
- Propensity matched Trauma Registry controls
- Mortality, ICU stay, and Blood use studied

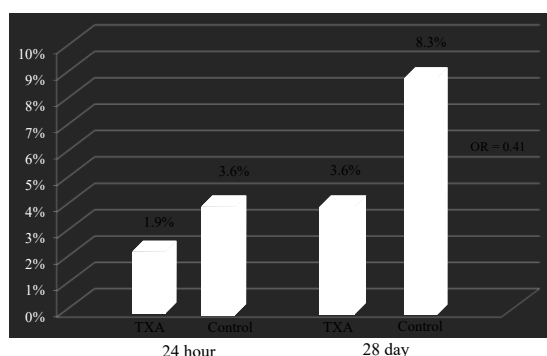
Inclusion

West J Med 2018;19:977-986

- San Bernardino, Riverside, Alameda counties
- 8 Level I and II Trauma Centers
- 30 EMS Agencies
- Blunt or Penetrating trauma > 18yo
- Signs of hemorrhagic shock

24 hour and 28 days mortality

West J Med 2018;19:977-986



TXA vs Control Additional Results:

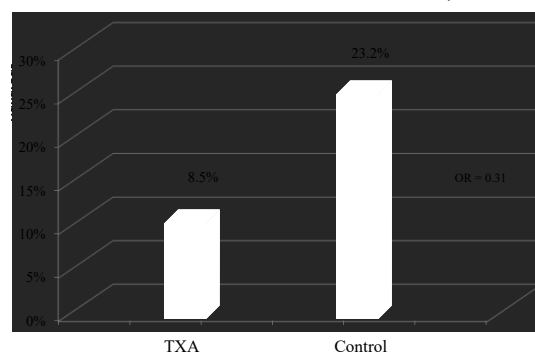
West J Med 2018;19:977-986

- Less Blood use with TXA (average use 1 vs 3)
- Lower ICU time with TXA (average LOS 4d vs 5d)
- Lower Hospital LOS with TXA (average 4d vs 8d)
- No increased DVTs or PEs (2 cases in each group)
- Same % of Penetrating Trauma (63% in each group)

TXA significantly decreased mortality in those patients who received more than 10 units of blood

Mortality if > 10 units of blood

West J Med 2018;19:977-986



TXA use for Trauma Take Homes

- Retrospective Matched Controls
- Not a randomized trial
- Very Impressive Results
- Divergent from Denver and Miami
- Fuel to the TXA Fire!

Tranexamic acid administration is associated with an increased risk of posttraumatic venous thromboembolism

Myers, Sara P, MD; Kutcher, Matthew E, MD; Rosengart, Matthew R, MD; Sperry, Jason L, MD; Peitzman, Andrew B, MD; Brown, Joshua B, MD; Neak, Matthew D, MD
Journal of Trauma and Acute Care Surgery January 2019 - Volume 86 - Issue 1 - p 20-27
doi:10.1097/TA.0000000000002061
PAST 2018 PODIUM PRESENTER

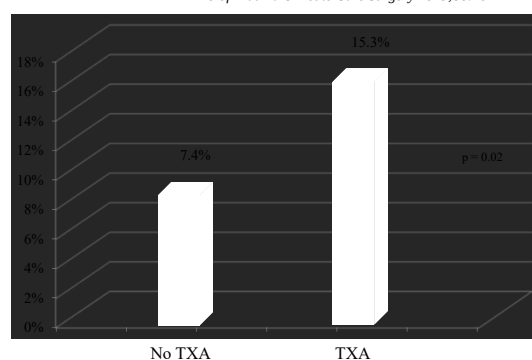
J of Trauma & Acute Care Surgery 2019;86:20-27

Does TXA use in Trauma patients increase PE and DVT incidence?

- 189 paired Level 1 Trauma pts
- Retrospective Study 2012-16
- University of Pittsburgh; high propensity matching
- Drew from 217 TXA treated pts
- No increase in survival with TXA

VTE Prevalence with TXA

J of Trauma & Acute Care Surgery 2019;86:20-27



Tranexamic acid administration is associated with an increased risk of posttraumatic venous thromboembolism

Myers, Sara P, MD; Kutcher, Matthew E, MD; Rosengart, Matthew R, MD; Sperry, Jason L, MD; Peitzman, Andrew B, MD; Brown, Joshua B, MD; Neak, Matthew D, MD
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PAST 2018 PODIUM PRESENTER

J of Trauma & Acute Care Surgery 2019;86:20-27

After adjusting for care mix index, TXA use was associated with more than a threefold incidence of VTE

TXA and VTE Take Home

This study suggests TXA increases VTE risk but the groups are not truly equal and this is a retrospective study

Summary

Summary

Epi ↑ survival but ↑ bad Neuro too

PCI all VF/VT survivors

Not witnessed, no shock, no ROSC

DSD: no

Not ready for Heads Up CPR

Summary

Don't bolus aminophylline

NTG relatively safe

Magnesium in AF: adjunct

Hyperoxygenation bad

Nasal prongs great

Summary

ETI expertise takes time

Use Bougies

Cricoid sucks

TXA: still unsure

Use tourniquets



