Medication Utilization in the Rural Emergency Setting

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The Disclosure Slide

- Nothing to disclose today

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Today's Objectives

- Identify medications utilized in emergent situations
- Highlight dosing strategies for priority medications
- Distinguish agent specific administration considerations

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Hypothetical Case…

- 65 yo M on warfarin presents to Small Town Hospital in Rural, KS. BRBPR, coffee ground emesis everywhere, GCS 8. INR 7
- Vitals
  - BP: 60/40, HR 52, O2 sat 82%
- Referral Center:
  - Intubate now, start fentanyl drip, norepinephrine drip, give vitamin K 10 mg IV, FFP or PCC, transfer ASAP

Is your hospital ready to execute these orders quickly and efficiently?

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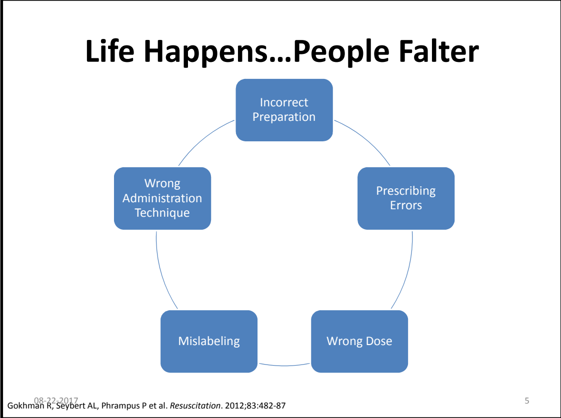
Life Happens…People Falter



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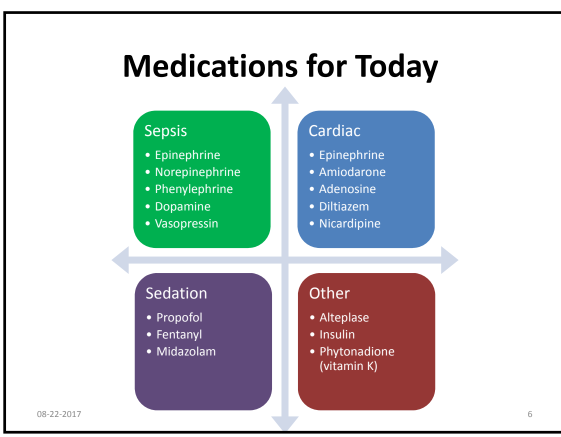
Gokhman R, Seybert AL, Phrampus P et al. *Resuscitation*. 2012;83:482-87

Medications for Today



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Epinephrine
Norepinephrine
Phenylephrine
Dopamine
Vasopressin

SEPSIS MEDICATIONS

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Vasopressors

- Sepsis = medical emergency
- Septic shock → adrenergic support imperative

Receptor Type	Location	Stimulation	Hemodynamic Effect*
Alpha-1 (α_1)	Smooth muscle	Vasoconstriction	↑ SVR, MAP
Beta-1 (β_1)	Myocardium	↑ Heart Rate	↑ CO
D_1, D_2	Kidney	↑ Heart Rate Vasoconstriction Vasodilation	↑ SVR
V_1-V_2	Smooth muscle Kidney	↑ water reabsorption	↑ SVR, MAP

D = Dopamine, V = Vasopressin, SVR = Systemic Vascular Resistance, CO = Cardiac Output, MAP = Mean Arterial Pressure

Rhodes A, Evans LE, Alhazzani W et al. Crit Care Med. 2015;45:486-552
Overgaard CB, Dzavik V. Circulation. 2008;118:1047-1056 8

Vasopressors – Dosing & Titration

Medication	Receptor Binding Affinity			Dosing Range	Titration Increment Every 5 minutes
	α1	β1	D1, D2		
Epinephrine	+++++	++++	N/A	Non-WB: 1-30 mcg/min	0.5-5 mcg/min
				WB: 0.05-2 mcg/kg/min	0.05-0.1 mcg/kg/min
Norepinephrine	+++++	+++	N/A	Non-WB: 5-80 mcg/min	0.5-5 mcg/min
				WB: 0.1-3 mcg/kg/min	0.05-0.1 mcg/kg/min
Phenylephrine	+++++	0	N/A	Non-WB: 50-200 mcg/min	25-50 mcg/min
				WB: 0.5-9 mcg/kg/min	2 mcg/kg/min
Dopamine	+++	++++	+++++	2.5-20 mcg/kg/min	2.5-5 mcg/kg/min
Vasopressin	N/A	N/A	N/A	0.01-0.04 units/min	0.01 units/min

Non-WB = non-weight based, WB= weight based

Overgaard CB, Dzavik V. Circulation. 2008;118:1047-1056
Lexicomp Online. Accessed 28 July 2017 9

Put Your Hands Up! (For Audience Participation)

- How many present are employed by institutions that utilize “smart” pumps (e.g., Alaris)?

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Vasopressors: Preparation

- American Society of Health-Systems Pharmacists (ASHP) Standardize 4 Safety
  1. Phase I – Adult continuous infusions
  2. Phase II – Pediatric continuous infusions
  3. Phase III-IV: Intermittent, PCA/epidurals

- To be completed 2017-2018

American Society of Health-System Pharmacists. Standardize 4 Safety Initiative. https://www.ashp.org/Pharmacy-Practice/Standardize-4-Safety-Initiative accessed 30 July 2017

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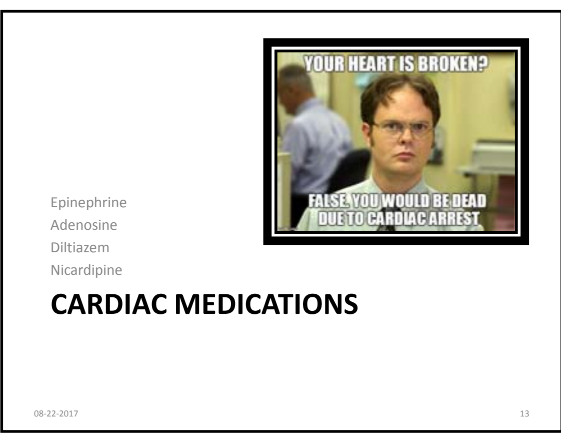
YOUR HEART IS BROKEN?
FALSE. YOU WOULD BE DEAD DUE TO CARDIAC ARREST
Epinephrine
Adenosine
Diltiazem
Nicardipine
CARDIAC MEDICATIONS
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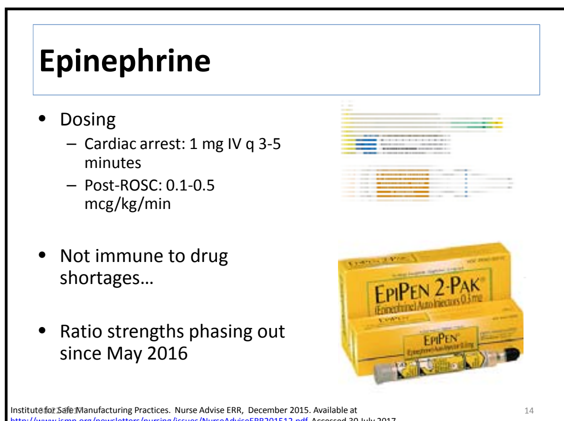
Epinephrine
Dosing
Cardiac arrest: 1 mg IV q 3-5 minutes
Post-ROSC: 0.1-0.5 mcg/kg/min
Not immune to drug shortages…
Ratio strengths phasing out since May 2016
EPIPEN 2-PAK
Institute for Safe Manufacturing Practices. Nurse Advise ERR, December 2015. Available at http://www.ismp.org/newsletters/nursing/issues/NurseAdviseERR201512.pdf. Accessed 30 July 2017
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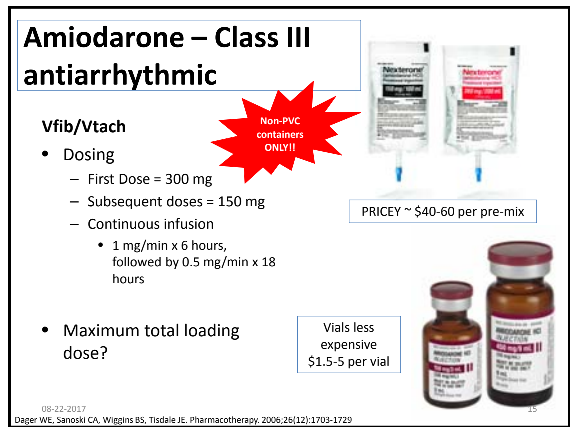
Amiodarone – Class III antiarrhythmic
Vfib/Vtach
Dosing
First Dose = 300 mg
Subsequent doses = 150 mg
Continuous infusion
1 mg/min x 6 hours, followed by 0.5 mg/min x 18 hours
Maximum total loading dose?
Non-PVC containers ONLY!!
PRICEY ~ $40-60 per pre-mix
Vials less expensive $1.5-5 per vial
08-22-2017
Dager WE, Sanoski CA, Wiggins BS, Tisdale JE. Pharmacotherapy. 2006;26(12):1703-1729
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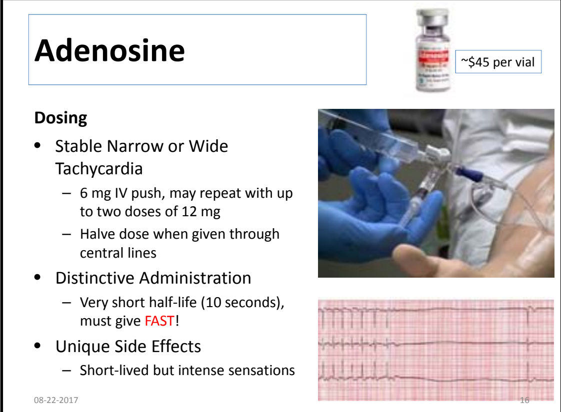

Diltiazem – Calcium Channel Blocker

- Indications: Atrial fibrillation/flutter with rapid ventricular response
- Dosing: 0.25 mg/kg ABW IV push, may redose 0.35 mg/kg IV push
  - Follow with infusion of 2.5 – 15 mg/hr
- Multiple preparations available
  - 25 mg/5 mL vials = $2.62 per vial
  - 125 mg/25 mL vials = $11.13 per vial
    - 250 mg/250 mL pre-mix bags = $45.58

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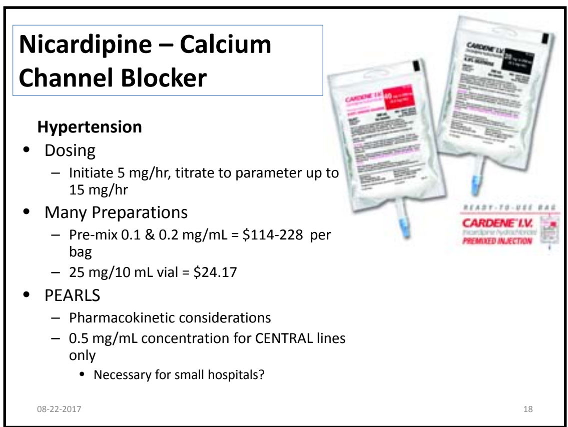

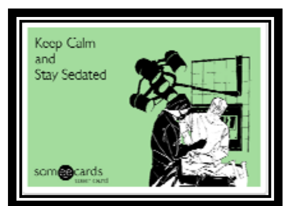

Propofol
Fentanyl
Midazolam

SEDATION MEDICATIONS

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Propofol – $GABA_A$ Agonist

- Quick procedures, post-intubation sedation
- Dosing – varies widely
  - 5-20 mcg/kg/min initially, increase 5-10 mcg/kg/min every 5 minutes
- All products = 10 mg/mL
- Forewarned is forearmed
  - Dose-dependent hypotension, respiratory depression
  - PRIS (long term infusions)
  - Egg, soy hypersensitivity

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Kam PC, Cardone D. Anaesthesia. 2007;62(7):690-701

Fentanyl – Mu opioid agonist

- Dosing
  - 25-100 mcg/hr, increase 25-50 mcg/hr every 5-10 minutes
- PEARLS
  - 100 mcg = 10 mg morphine (100x)
  - Avoid in unknown ingestions (serotonergic)
  - Hypotension possible
- Inexpensive, no pre-made products
  - 10-50 mcg/mL concentration
  - Check 503b compounding centers (e.g., PharMedium)

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Midazolam – $GABA_A$ Agonist

- Dosing: 0.01-0.05 mg/kg/hr initially, titrate up every 10-15 minutes to desired level of sedation
- PEARLS
  - Dose dependent hypotension
  - Active metabolites: caution in renal, hepatic injury
  - ↑ dose requirements: Alcoholic, status epilepticus
  - Maximum dose?
- Inexpensive, no premade products
  - 50 mg/50 mL or 100 mg/100 mL

Alteplase
Insulin
Vitamin K

MISCELLANEOUS MEDICATIONS

Alteplase – tissue Plasminogen Activator (tPA)

- Indication: Ischemic stroke, pulmonary embolism (PE)
  - Stroke: 0.09 mg/kg over 1 minute, followed by 0.81 mg/kg over 60 minutes
  - PE: 100 mg over 2 hours
- Genentech manufactures
  - 50 mg/50 mL, 100 mg/100 mL
  - $$$

Alteplase – continued

- Errors have occurred with administration
  - Establish a system to ensure consistent process
- Waste (unused medication) will need to be addressed
- At SRHC – drug mixed, waste removed, vial hung with exact dose, administered, line flushed with NS
  - Other methods exist (not removing waste from vial)

Genentech website. https://www.activase.com/ais/dosing-and-administration/reconstituting.html Accessed 9 August 2017
Chung LE, Tkach A, Lingenfelter EM et al. J Stroke Cerebrovasc Dis. 2016;25(3):565-571

Insulin

- Many uses in the ED
- Hyperkalemia cocktail - shifts potassium to intracellular compartment
  - Multiple variations, also many errors
  - 10 units regular IV push, give 25-50 g 50% dextrose before to prevent hypoglycemia
  - Consider 0.1 mg/kg in small, old, insulin naïve

Harl Z, Kamel KS. PLoS ONE. 11(5):e0154963

Final Polling Question

How does your nursing staff prepare and administer IV push insulin regular?

A. Withdraw via insulin syringe, dilute in saline flush syringe
B. Withdraw via insulin syringe, dilute in empty syringe with 0.9% NaCl vial
C. Other
D. We don't give it IV push, only sub-Q

Institute for Safe Medication Practices. 11 August 2011 issue. https://www.ismp.org/newsletters/acutecare/articles/20110811.asp

Vitamin K

Reversal of vitamin K antagonist therapy (warfarin) in acute major bleeding

1-10 mg IVPB or PO

IV push, IM, and subcutaneous administration?

Tablets now very expensive ($70/tablet), ok to use IV product for PO route

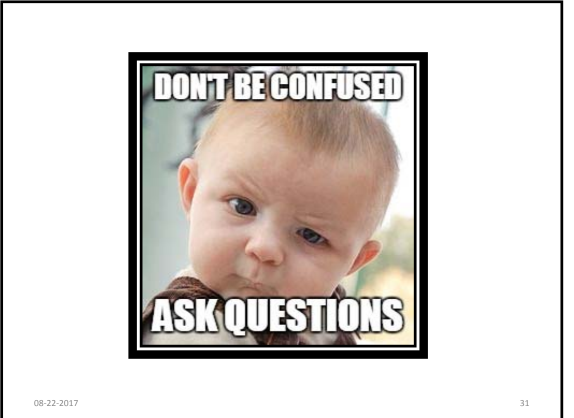
Tran HA, Chunilal SD, Harper PL, et al. Med J Aust. 2013;198(4):198-199
Baker P, Gleghorn A, Tripp T. Br J Haematol. 2006;133(3):331-336

Case Conclusion

- Patient intubated in ED
- Fentanyl, norepinephrine vials removed from pharmacy ADC, compounded by nurse in glove box to pre-specified concentration
- Medications started per protocol doses
- Titration instructions communicated to EMS
- FFP, vitamin K IVPB given
- Patient transferred lights & sirens

In Summary

- Emergent situations include a broad array of patient presentations
- Emergent medications often require careful manipulation and administration to avoid harm
- Agent specific considerations should be identified to optimize clinical and financial outcomes


DON'T BE CONFUSED
ASK QUESTIONS
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