



# Medications for Cardiac Emergencies

Zlatan Coralic, PharmD, BCPS, FASHP

EM Pharmacist

Clinical Professor

University of California San Francisco

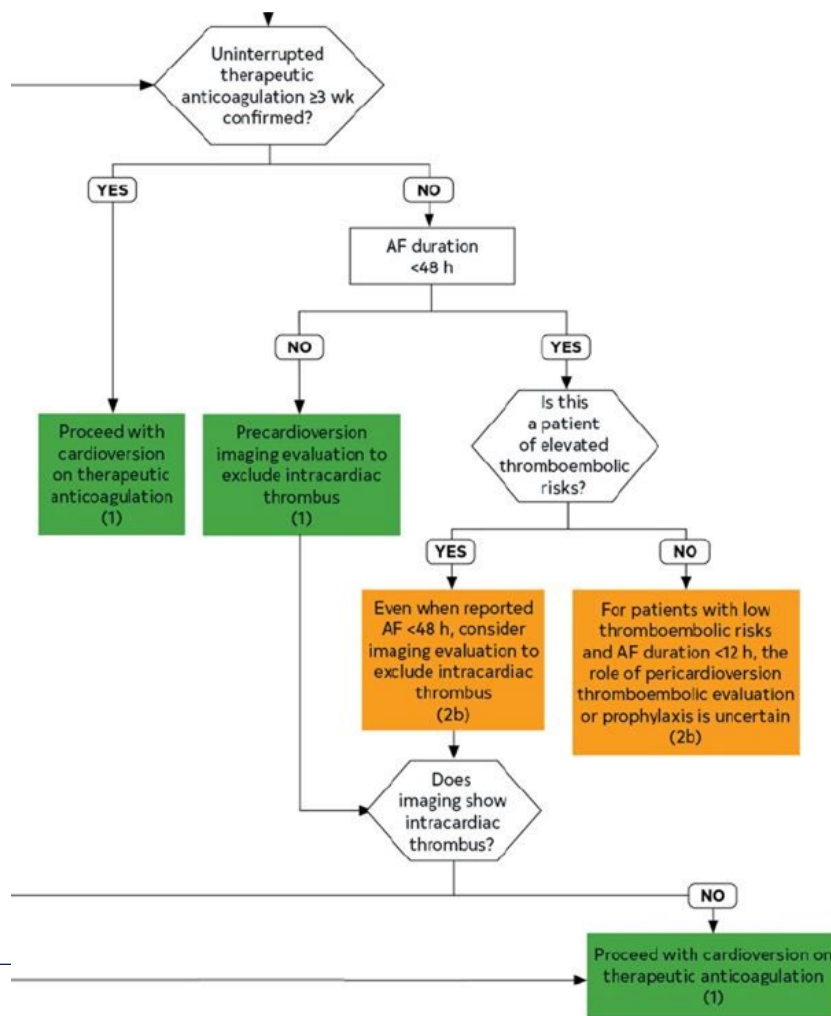


Disclosures: None

# Outline

- ⌘ Diltiazem v. metoprolol
- ⌘ Magnesium sulfate?
- ⌘ Amiodarone woes
- ⌘ WPW and procainamide
- ⌘ Bicarb & calcium

Afib RVR  
HR 168  
BP 78/35



Circulation. 2024;149:e1–e156.

Afib RVR  
HR 168  
BP 145/70

RATE v. RHYTHM

# How to get into trouble with cardiac meds...

## & Rate/rhythm control in afib

- Severe anemia / bleeding
- Hyperkalemia
- Sepsis
- PE
- WPW

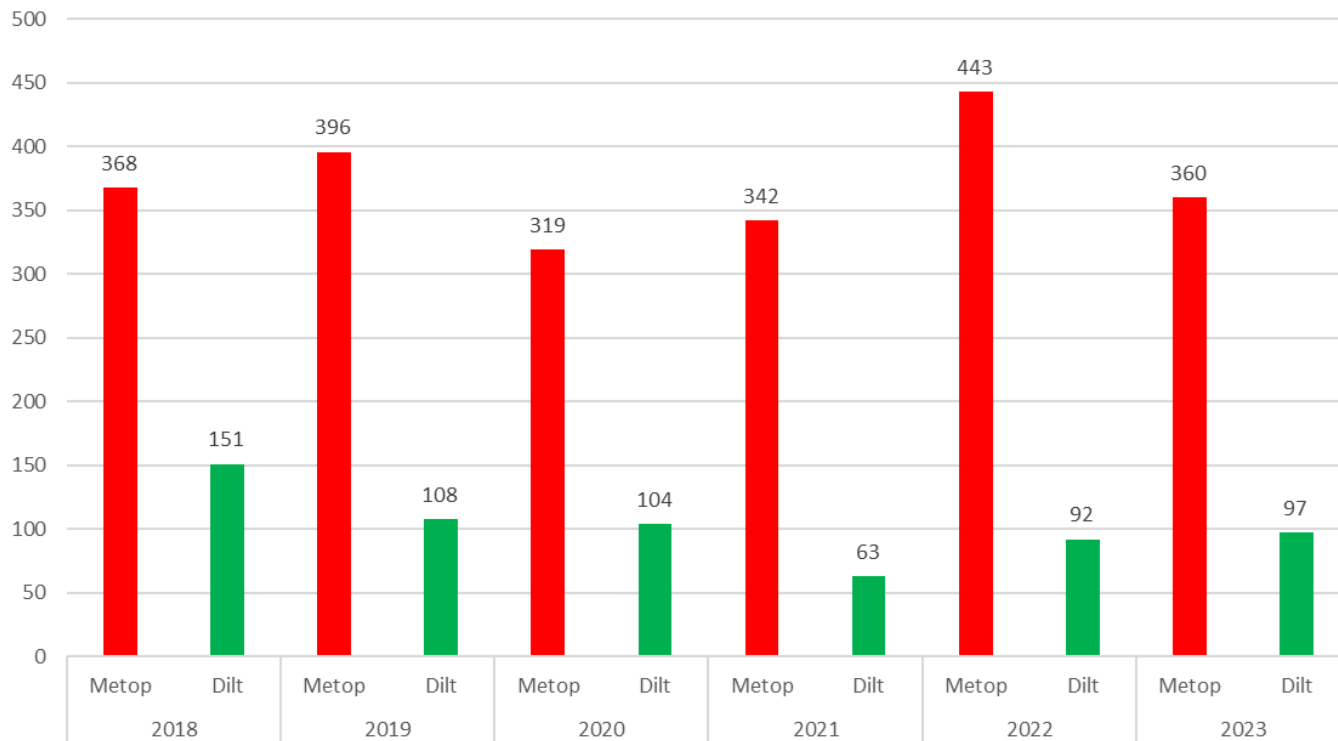
## & Dofetilide (Tikosyn)

## & Amiodarone

- Nasty drug

Count of Medication Name

## Metop vs Dilt IV @ UCSF



Years Medication Name

+ -



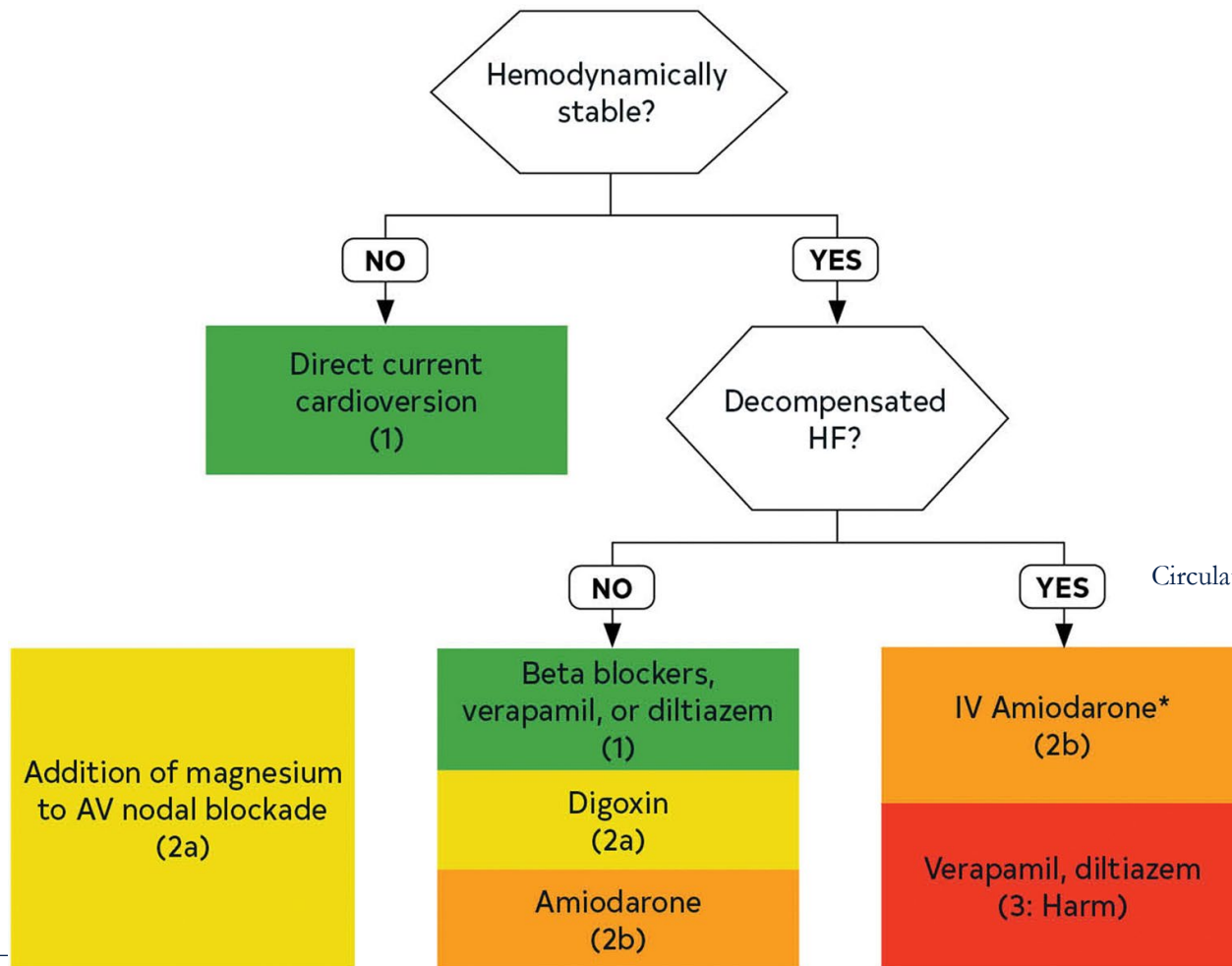


### 7.2.1. Acute Rate Control

**Recommendations for Acute Rate Control**  
Referenced studies that support the recommendations are summarized in the [Online Data Supplement](#).

COR	LOE	Recommendations
<b>1</b>	<b>B-R</b>	1. In patients with AF with rapid ventricular response who are hemodynamically stable, beta blockers or nondihydropyridine calcium channel blockers (verapamil, diltiazem; provided that EF >40%) are recommended for acute rate control (Figure 17). <sup>1-4</sup>
<b>2a</b>	<b>B-R</b>	2. In patients with AF with rapid ventricular response in whom beta blockers and nondihydropyridine calcium channel blockers are ineffective or contraindicated, digoxin can be considered for acute rate control, either alone or in combination with the aforementioned agents. <sup>5-9</sup>
<b>2a</b>	<b>A</b>	3. In patients with AF with rapid ventricular response, the addition of intravenous magnesium to standard rate-control measures is reasonable to achieve and maintain rate control. <sup>10,11</sup>
<b>2b</b>	<b>B-NR</b>	4. In patients with AF with rapid ventricular response who are critically ill and/or in decompensated HF in whom beta blockers and nondihydropyridine calcium channel blockers are ineffective or contraindicated, intravenous amiodarone may be considered for acute rate control. <sup>*12,13</sup>
<b>3: Harm</b>	<b>B-NR</b>	5. In patients with AF with rapid ventricular response and known moderate or severe LV systolic dysfunction with or without decompensated HF, intravenous nondihydropyridine calcium channel blockers should not be administered. <sup>*4,15</sup>

Circulation. 2024;149:e1–e156.



Circulation. 2024;149:e1–e156.

# Metop and Dilt Pearls

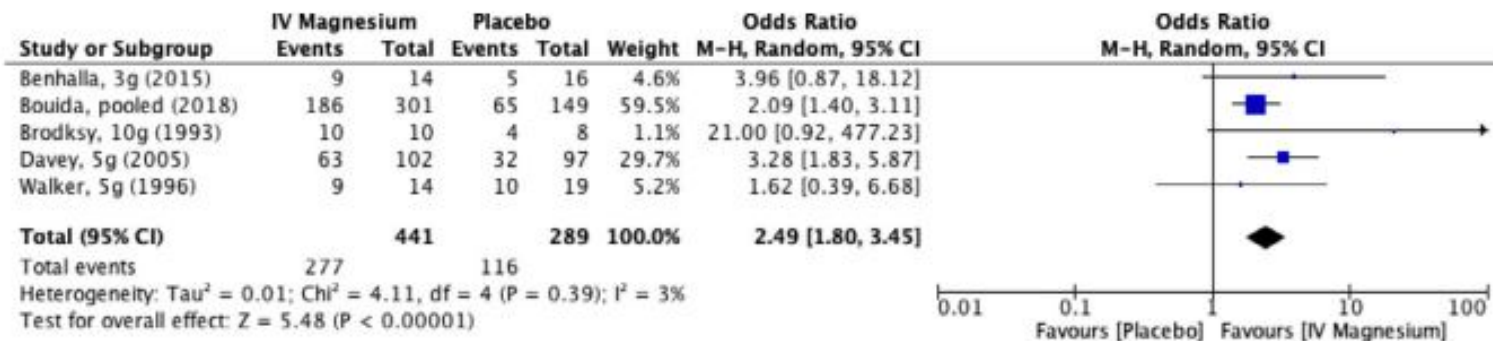
- ⌘ Diltiazem is more satisfying
- ⌘ Metoprolol has concrete secondary benefits (mortality, LV remodeling)
- ⌘ IV diltiazem dosing:
  - 0.25 mg/kg IV over 2 minutes; wait 15 minutes
  - Not working-> 0.35 mg/kg IV over 2 minutes
  - Continuous infusion? PO dosing? (HL ~4 hours)
  - Soft pressures, ok to start lower boluses (e.g., 10 mg)
- ⌘ IV metoprolol dosing
  - 2.5-5 mg IV q5min up to 3 doses
  - Start PO 25 mg po BID
- ⌘ Hypotension?
  - Give some calcium?
  - Push-dose pressors?
- ⌘ Dilt didn't work, switch to metop?

# Magnesium Sulfate

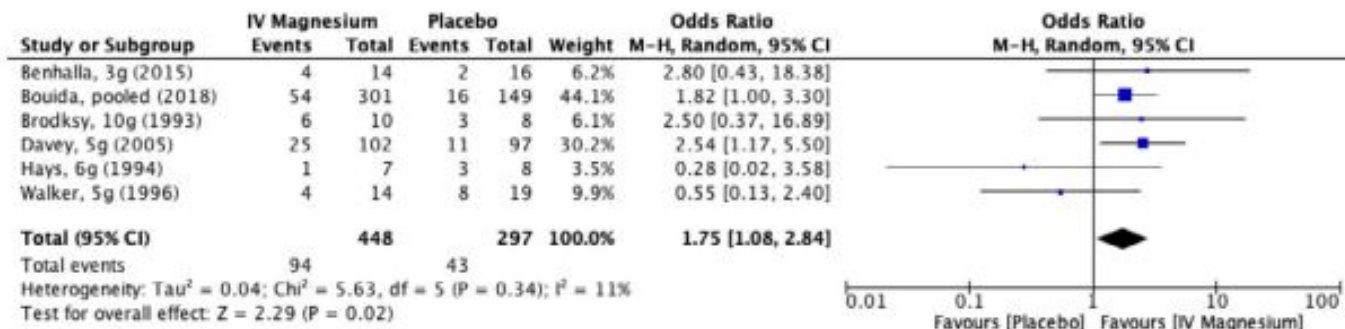
**Table 1**

Profile of studies included for meta-analysis.

Study (Year) Country	JADAD Score (Blinding)	Treatment Arms (n)	Included Rhythms (HR criteria)	Definition of Rate Control	Outcome Measures	Time to Outcome Measure (h)
Bouida et al. (2018) Tunisia	5 (DB)	4.5g Mg (148) vs. 9g Mg (153) vs. placebo (149)	AF (HR > 120)	HR < 90 or reduction of HR by 20% from baseline	Rate control, Rhythm control	4, 24
Davey et al. (2005) Australia	5 (TB)	5g Mg (102) vs placebo (97)	AF (HR > 120)	HR < 100	Rate control, Rhythm control	2.5
Brodsky et al. (1993) USA	3 (DB)	10g Mg (10) vs. placebo (8)	AF (HR 100 - 200)	HR < 90 for over 60 min or completion of 24 hours	Rate control, Rhythm control	24
Walker et al. (1996)* Australia	3 (DB)	5g Mg (14) vs. placebo (19)	AF, Aflutter (HR > 100)	HR < 100	Rate control, Rhythm control	4
Hays et al. (1994) USA	3 (DB)	6g Mg (7) vs. placebo (8)	AF (HR > 99)	Decrease in mean ventricular rate	Rhythm control	4
Benhalla et al. (2015) Morocco	1 (UB)	3g Mg (14) vs. placebo (16)	AF (N/A)	HR <100	Rate control, Rhythm control	N/A



**Fig. 2.** Forest plot comparing the effect of IV magnesium vs placebo in rate control of rapid atrial fibrillation.



**Fig. 3.** Forest plot comparing the effect of IV magnesium vs placebo in rhythm control of rapid atrial fibrillation.

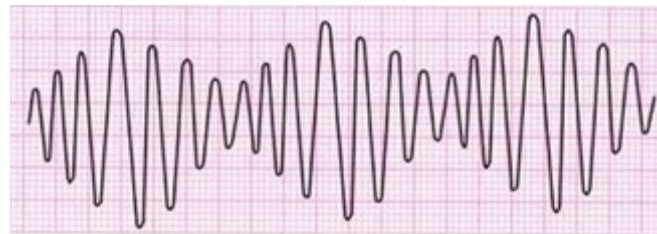
# How much and how fast?

Study	Dose & Rate	Other Meds in Studies
Bouida	4.5 g or 9 g over 30 minutes	Digoxin, diltiazem, beta-blockers
Davey	5 g over 20 minutes, then 2.5 grams over 2 hours	Digoxin, verapamil, beta-blockers
Brodsky	2 g over 15 minutes, then 8 grams over 6 hours	Digoxin
Walker	2.5 g over 15 minutes	Digoxin
Hays	2 grams over 1 minute, then 1 gm/hr x 4 hours	Digoxin

“Subgroup analysis showed the superiority of a lower dose ( $\leq 5$  g) compared with the higher dose ( $>5$  g)”

# Magnesium Sulfate in EM (review)

- ⌘ Asthma/COPD
  - 2 g IV over 20 min
- ⌘ Pre/eclampsia
  - 4-6 g IV over 15 min
- ⌘ Torsades (pulseless)
  - 2 g IVP
- ⌘ Atrial fibrillation?
  - 2-4 gram IV over 15 min
- ⌘ Caution with electrolyte replacement default orders
  - Default infusions to 1 hr



# Why is Amiodarone Nasty?

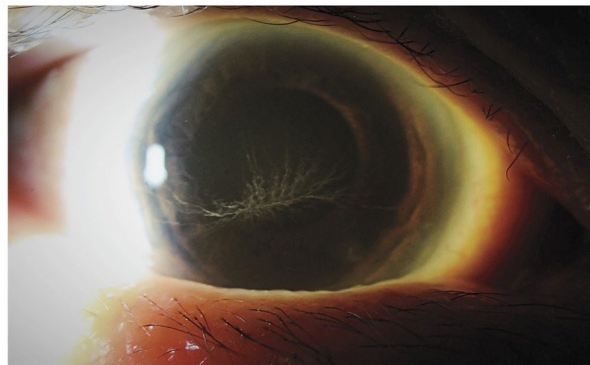
- ⌘ Drug interactions (warfarin, apixaban, rivaroxaban, Paxlovid)
- ⌘ QTc prolonger
- ⌘ Heavy iodine load (3 mg for each 100 mg of drug)
- ⌘ Hepatotoxicity
- ⌘ Blue man photosensitivity ( $\sim 10^0\%$ )





# Why is Amiodarone Nasty?

- ❧ Lung damage / pulmonary fibrosis (2-17%)
- ❧ Lung phospholipidosis (~50%)
- ❧ Vortex epithelial keratopathy (most pts)
- ❧ Super super long HL (PO ~60 days, IV ~30 days)



# Additional Box Warning

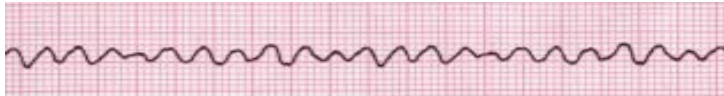
**Only indicated for patients with life-threatening arrhythmias because of risk of substantial toxicity. Alternative therapies should be tried first before using amiodarone. Patients should be hospitalized when amiodarone is initiated.**

# Amiodarone Dosing

## No Pulse

300 mg IVP<sub>x1</sub>

May repeat 150 mg IVP<sub>x1</sub>



## Pulse

150 mg IV *infusion over 10-15 minutes*

May f/u w/gtt over 24 hours

## Sterile

Each mL contains: 50 mg amiodarone HCl, 100 mg polysorbate 80, and 20.2 mg benzyl alcohol in water for injection.

Usual Dosage: See package insert.

**Recommendations for WPW and Preexcitation Syndromes**  
Referenced studies that support the recommendations are summarized in the [Online Data Supplement](#).

COR	LOE	Recommendations
1	B-NR	1. Patients with AF with rapid anterograde conduction (preexcited AF), and hemodynamic instability should be treated with electrical cardioversion. <sup>1,2</sup>
1	B-NR	2. For patients with AF with rapid anterograde conduction (preexcited AF), catheter ablation of accessory pathways (APs) is recommended. <sup>3-7</sup>
1	C-LD	3. In patients with AF with rapid anterograde conduction (preexcited AF) and hemodynamic stability, pharmacological cardioversion with intravenous ibutilide or intravenous procainamide is recommended as an alternative to elective cardioversion. <sup>1,8,9</sup>
3: Harm	B-NR	4. For patients with AF with anterograde accessory pathway conduction (preexcited AF), pharmacological agents that block atrioventricular nodal conduction (verapamil, diltiazem, amiodarone, digoxin, adenosine, or beta blockers) are contraindicated due to risk of precipitating VF or hemodynamic deterioration. <sup>10-14</sup>

**NO:**

**A** miodarone/adenosine

**B** eta-blockers

**C** alcium-channel blockers

**D** igoxin



# Ottawa Aggressive Protocol

Patients	Intervention	ED LOS	Success	HOME	ADR	Return
660 A fib <48 hrs Mean 65 yo	Procainamide	3.9 hrs	58%	97%	7.6%	8.6%
	followed by					
	Electricity	6.5 hrs	92%			

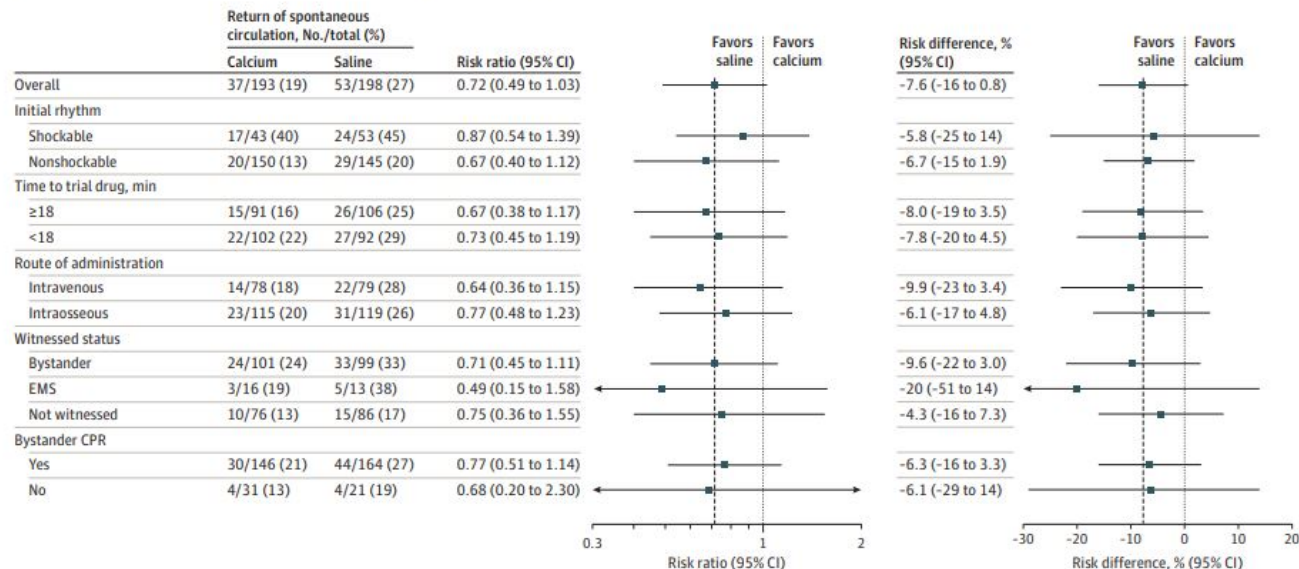
Procainamide 1 g IV over 60 minutes  
Hold if SBP <100 mm Hg

Recommendations for Nonvasopressor Medications		
COR	LOE	Recommendations
2b	B-R	1. Amiodarone or lidocaine may be considered for VF/pVT that is unresponsive to defibrillation.
2b	C-LD	2. For patients with OHCA, use of steroids during CPR is of uncertain benefit.
3: No Benefit	B-NR	3. Routine administration of calcium for treatment of cardiac arrest is not recommended.
3: No Benefit	B-R	4. Routine use of sodium bicarbonate is not recommended for patients in cardiac arrest.
3: No Benefit	B-R	5. The routine use of magnesium for cardiac arrest is not recommended.



# Routine Calcium During Resus?

Figure 2. Subgroup Results for the Primary Outcome of Sustained Return of Spontaneous Circulation



Results are presented for the 5 predefined subgroups. The time from cardiac arrest to trial drug administration was dichotomized at the median. Only cardiac arrests not witnessed by emergency medical services (EMS) were included in the bystander cardiopulmonary resuscitation (CPR) subgroup. The vertical dashed lines represent the

estimated effect in the primary outcome analysis. The vertical dotted lines represent no difference between the calcium and saline groups.

Outcome	Calcium chloride	Saline
ROSC	37 (19%)	53 (27%)
Alive @ 30d	10 (5.2%)	18 (9.1%)
Fav. neuro outcome @ 30d	7 (3.6%)	15 (7.6%)
Hypercalcemia	26 (74%)	1 (2%)











# Dofetilide (TIKOSYN) Drug Interactions

HYDROCHLOROTHIAZIDE

PROCHLORPERAZINE

VERAPAMIL

SMX/TMP

LEVO/MOXI/CIPROFLOXACIN

ONDANSETRON

PROMETHAZINE

AZITHROMYCIN

PAXLOVID



# Summary

- ⌘ Dilt vs metop - up to you!
  - Caution with HF & dilt
- ⌘ Amiodarone == lidocaine for ACLS
- ⌘ WPW -> procainamide, chemical cardioversion for all afib?
- ⌘ No routine calcium, bicarb, or magnesium during resus
- ⌘ Careful with pts on dofetilide for rhythm control