Medical Code Team

MSH Chiefs, Patrick Maher

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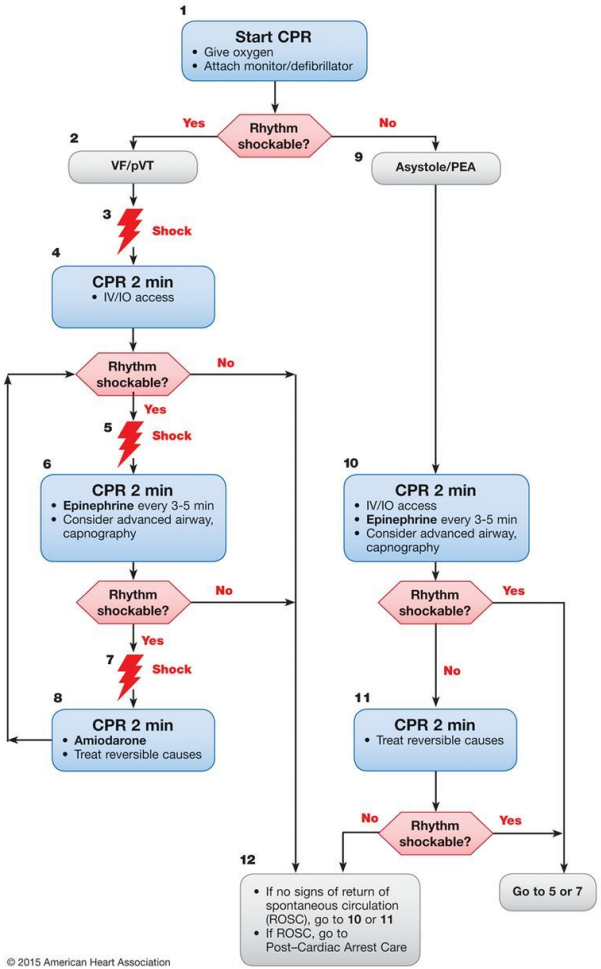
Adult Cardiac Arrest Algorithm—2015 Update



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CPR Quality

- Push hard (at least 2 inches [5 cm]) and fast (100-120/min) and allow complete chest recoil.
- Minimize interruptions in compressions.
- Avoid excessive ventilation.
- Rotate compressor every 2 minutes, or sooner if fatigued.
- If no advanced airway, 30:2 compression-ventilation ratio.
- Quantitative waveform capnography
  - If P_{ETCO_2} <10 mm Hg, attempt to improve CPR quality.
- Intra-arterial pressure
  - If relaxation phase (diastolic) pressure <20 mm Hg, attempt to improve CPR quality.

Shock Energy for Defibrillation

- **Biphasic:** Manufacturer recommendation (eg, initial dose of 120-200 J); if unknown, use maximum available. Second and subsequent doses should be equivalent, and higher doses may be considered.
- **Monophasic:** 360 J

Drug Therapy

- **Epinephrine IV/IO dose:** 1 mg every 3-5 minutes
- **Amiodarone IV/IO dose:** First dose: 300 mg bolus. Second dose: 150 mg.

Advanced Airway

- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitor ET tube placement
- Once advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions

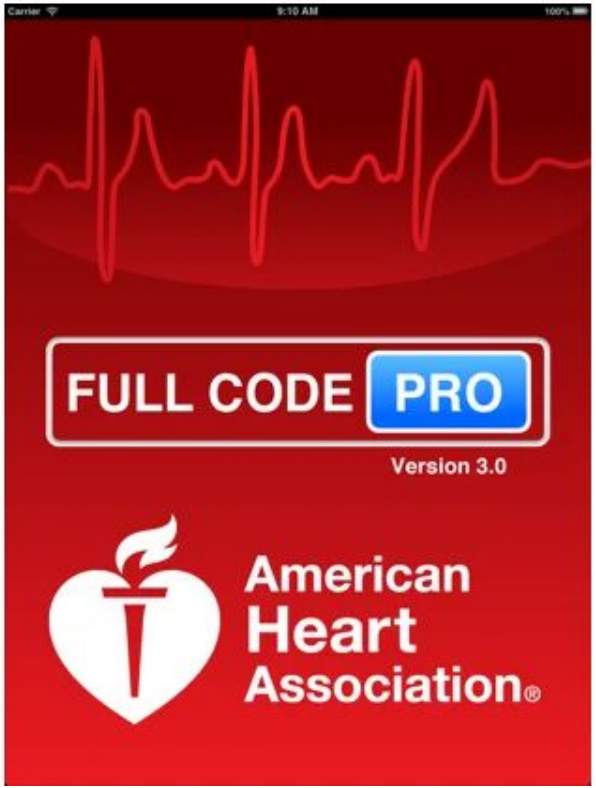
Return of Spontaneous Circulation (ROSC)

- Pulse and blood pressure
- Abrupt sustained increase in P_{ETCO_2} (typically ≥40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

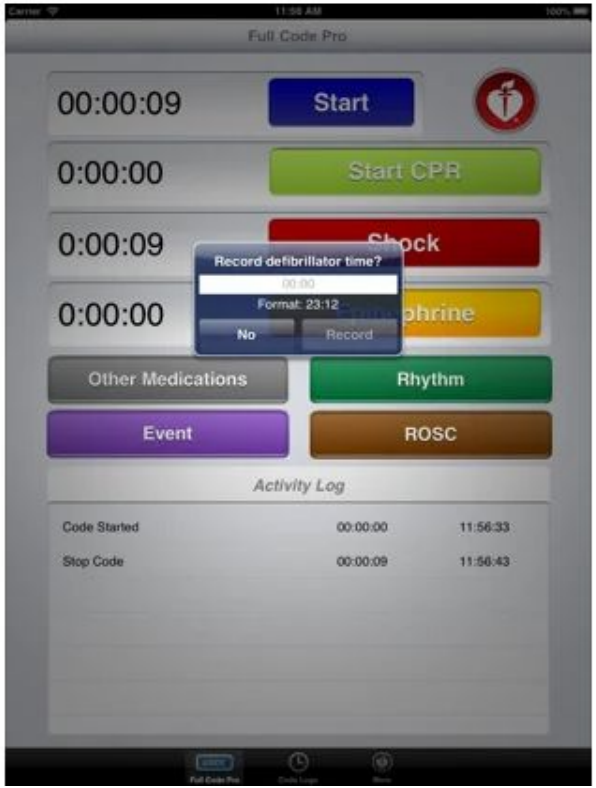
Reversible Causes

- **H**ypovolemia
- **H**ypoxia
- **H**ydrogen ion (acidosis)
- **H**ypo-/hyperkalemia
- **H**ypothermia
- **T**ension pneumothorax
- **T**amponade, cardiac
- **T**oxins
- **T**hrombosis, pulmonary
- **T**hrombosis, coronary

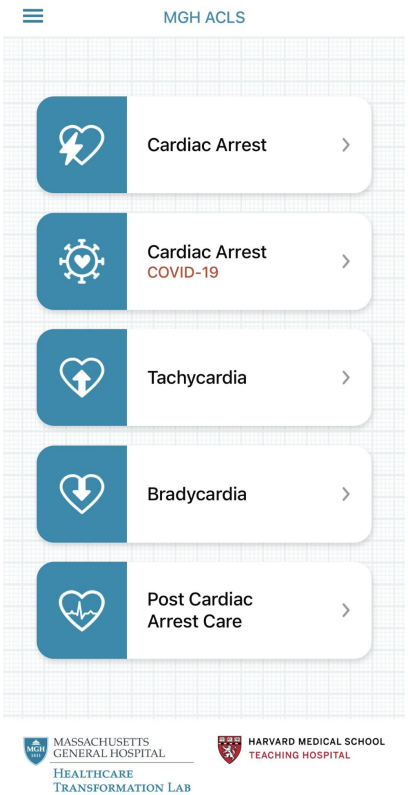
Apps - AHA

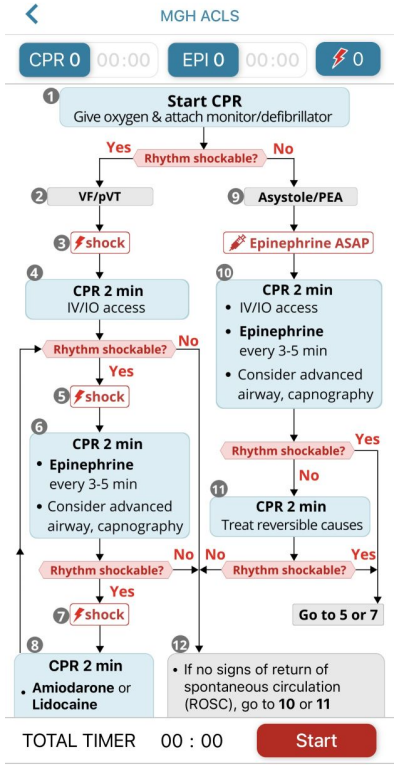

FULL CODE PRO
Version 3.0
American Heart Association®


Full Code Pro
0:00:00
Start
0:00:00
Start CPR
0:00:00
Shock
0:00:00
Epinephrine
Other Medications
Rhythm
Event
ROSC
Activity Log


Full Code Pro
00:00:09
Start
0:00:00
Start CPR
0:00:09
Record defibrillator time?
Format: 23:12
No
Record
Other Medications
Rhythm
Event
ROSC
Activity Log
Code Started
00:00:00
11:56:33
Stop Code
00:00:09
11:56:43

Apps - MGH


MGH ACLS
Cardiac Arrest
Cardiac Arrest
COVID-19
Tachycardia
Bradycardia
Post Cardiac
Arrest Care
MASSACHUSETTS
GENERAL HOSPITAL
HEALTHCARE
TRANSFORMATION LAB
HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL


MGH ACLS
CPR 0
00:00
EPI 0
00:00
0
1 Start CPR
Give oxygen & attach monitor/defibrillator
Yes
Rhythm shockable?
No
2 VF/pVT
9 Asystole/PEA
3 shock
Epinephrine ASAP
4 CPR 2 min
IV/IO access
10 CPR 2 min
• IV/IO access
• Epinephrine
every 3-5 min
• Consider advanced
airway, capnography
Rhythm shockable?
No
Yes
5 shock
6 CPR 2 min
• Epinephrine
every 3-5 min
• Consider advanced
airway, capnography
Rhythm shockable?
Yes
No
11 CPR 2 min
Treat reversible causes
Rhythm shockable?
No
Rhythm shockable?
Yes
Yes
7 shock
Go to 5 or 7
8 CPR 2 min
• Amiodarone or
Lidocaine
12
• If no signs of return of
spontaneous circulation
(ROSC), go to 10 or 11
TOTAL TIMER
00 : 00
Start

App pros and cons

AHA app - can record events and can export the data

MGH app - has some notes on post arrest care

Important MSH Contact Numbers

Code - 47000

RRT - 1RRT/1778

Bedboard - 47461

Anesthesia (intubation) - 2963

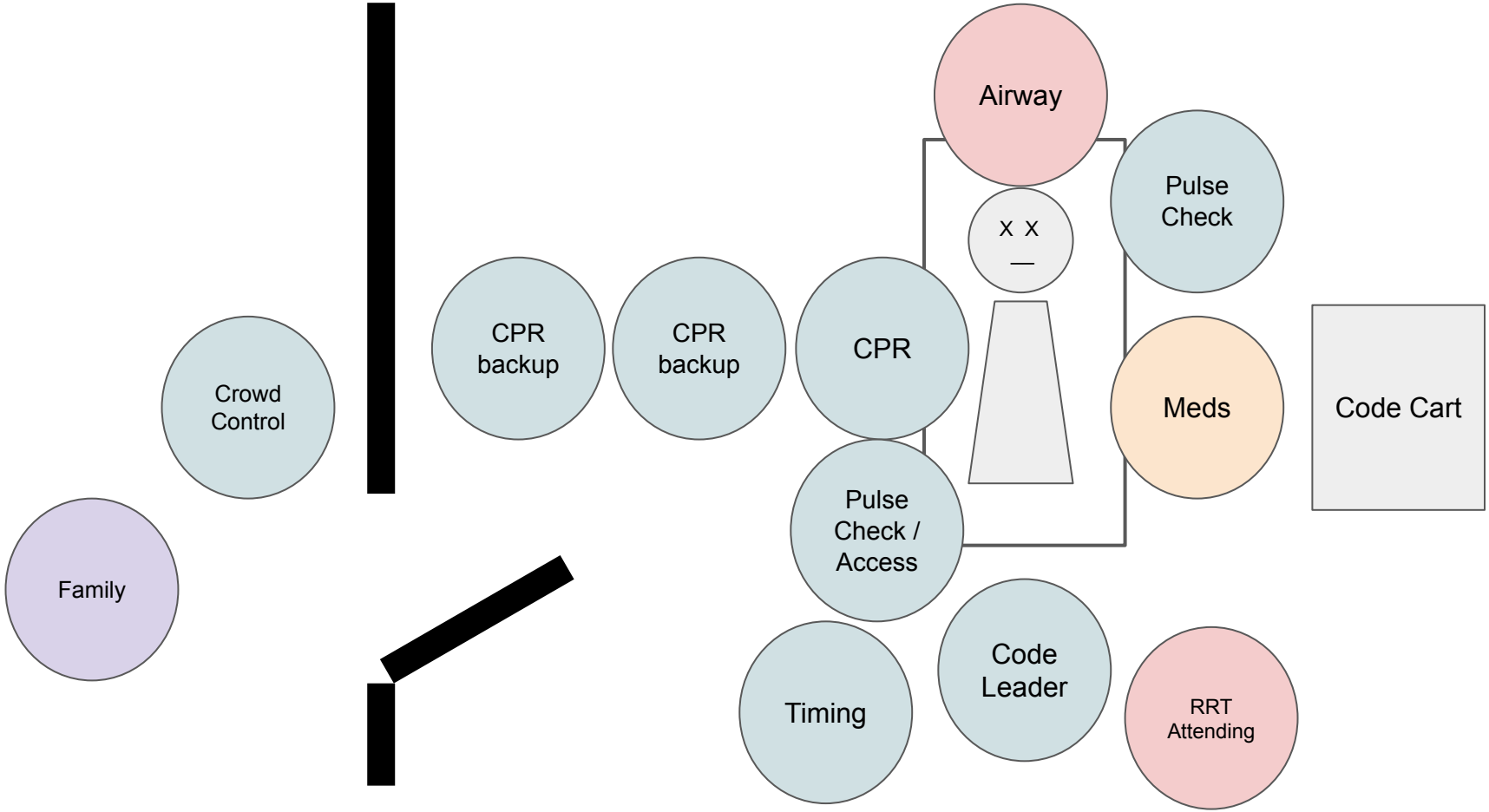
Stroke - 33333

Stat lab - 43895

Main Pharmacy - 47714

DART (difficult airway response team) - 47000

Code Positions



Code Roles: Team Leader

- Leads the code!
  - Prioritize next steps (Putting pads on for rhythm checks, CPR, airway, access)
  - Ensure that CPR is high-quality and that there is someone ready at all times to sub in
  - Decides on what meds to administer and when
  - Decides when to “call the code” and declare time of death
  - If ROSC is achieved, helps coordinate post-arrest care
- While the code leader can assist with other tasks, it’s best to designate others to take them on
- Use closed loop communication

Code Roles: CPR

- Does chest compressions
- Inform code team if you are becoming fatigued
- High quality CPR consists of chest compressions to a depth between 2 and 2.4 inches at a rate between 100-120 compressions per minute.

Code Roles: Timer

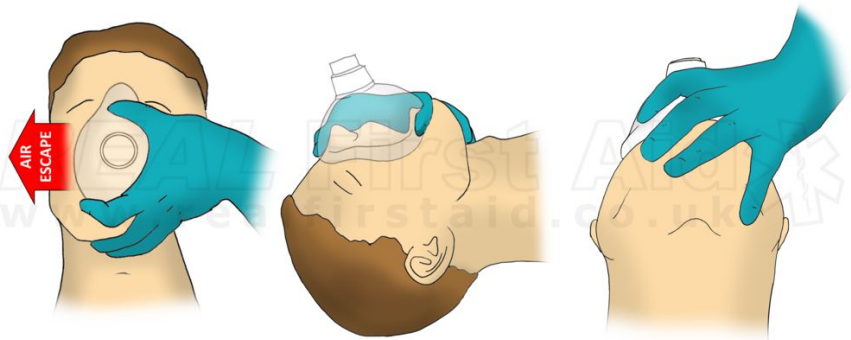
- Keeps time
- Updates code leader on time to swap person doing CPR, next epinephrine doses

Code Roles: Crowd Control/Family Contact

- Ensures room only has essential members of code team
- If family present, would keep them informed about the situation
- If family absent, would attempt to contact them
- If primary team is present, they can take on the role of speaking with the family

Code Roles: Airway

- Before advanced airway
  - Bag mask ventilation: Ideally two people but, in a pinch, can do it solo
  - Make sure it's connected to O2 and the O2 is running!
  - ACLS algorithm recommends 30 compressions : 2 breaths
  - One RCT showed that continuous breath delivery was not inferior to interrupted breaths (30 compression : 2 breath ratio) for survival until discharge (PMID 26550795)
- After advanced airway
  - 8-10 breaths every minute
  - Avoid over ventilation



Code Roles: Pulse check

- Check the pulse!
  - Carotid artery is ideal but, practically speaking, femoral pulse can be used
  - Check the pulse while chest compressions are ongoing
    - With high quality chest compressions, usually a pulsation can be felt (though it feels quite different from a normal pulse)
  - Arterial lines can be used to confirm pulse and eliminate need for palpation

Code Roles: Access

- Obtain/ensure adequate access
  - If IV access is present would check with the nurse if it’s functional
  - Otherwise, would just go straight to obtaining IO access
- Any central access would be obtained by the RRT/ICU attending

Code Roles: Meds

- The preparation of medications is typically not a resident role
  - Often a nurse, pharmacist, or pharmacist trainee will be preparing the medications for administration
- Residents may be involved with the administration of the medication that is prepared by others
- Work together with whomever is at the crash cart to administer medications the code leader has ordered
- Use closed loop communication
  - For example, if epinephrine is ordered, would clearly and loudly state the the epi has been given

Code Roles: Defibrillator

- Use the defibrillator
  - Monitor the rhythm strips
  - If defibrillation is required, be prepared to change the settings to defibrillate and change the joules as needed
    - Charge the defibrillator
    - Make sure everyone is clear of the patient and shock the patient

DART

The DART (difficult airway response team) includes residents from several different departments. RRT, ENT, and Anesthesia respond to all DART pages. The DART pager is reserved for anticipated difficult airways or COVID-related airways. The pager is held by an anesthesia attending 24/7 and the team that will arrive will be an anesthesia senior resident often accompanied by an attending. Some examples of when the DART pager should be utilized rather than the standard code pager are below:

- Tracheostomy
- Prior head/neck surgery
- Prior head/neck cancer or radiation
- BMI >40
- Anticipated awake fiberoptic intubation

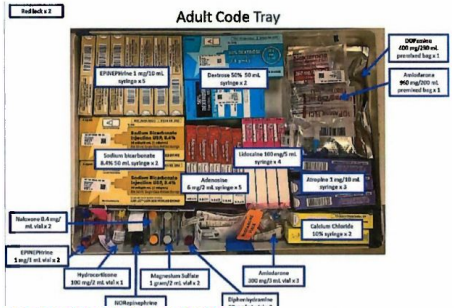
Notes on Family Presence during CPR

- 2015 AHA guidelines: “Overall, given the evidence for improved psychological benefits for families present during out-of-hospital resuscitation, and without an apparent negative effect on outcomes at hospitals that allow families to be present, family presence represents an important dimension in the paradigm of resuscitation quality.”
- However, the inclusion of families during CPR should be done methodically and thoughtfully
    - Assign someone to explain to the family what is happening to their loved one

Code Cart Contents

Drawer	Contents
1	Medications
2	Access
3	Cardiac Monitoring
4	Central access and A-lines
5	PPE
6	Airway

RED CART. DRAWER 1.



RED CART. DRAWER 2.

RED CART. DRAWER 3.

RED CART. DRAWER 4.

RED CART. DRAWER 5.

RED CART. DRAWER 6.

Mount Sinai

ADULT MEDICAL ALERT CODE CART DRIP CHART(2020)

THIS TABLE IS NOT INTENDED FOR USE IN NEONATES OR INFANTS

Drug	Usual Initial Dose	Admixture Instruction
Adenosine 6 mg/2 mL syringe	6 mg IV push rapid bolus, ,can repeat with 12 mg if not effective, can repeat with 3rd dose of 12 mg	Administer undiluted. Followed by 20 mL NS flush.
Atropine sulfate 1 mg/10 mL syringe	1mg q 3-5 min IV push, not to exceed a total of 3 mg	Administer undiluted.
Amiodarone 150 mg/3 mL vials and 360 mg/200 mL bag	Tachyarrhythmia with pulse: 150 mg in 100 mL D5W over 10 minutes (must compound) Pulseless VT/VF: 300 mg IV push/IO, can repeat 150 mg x1 Infusion rate: 1 mg/min for 6 hours followed by 0.5 mg/min	**Bolus for cardiac arrest:** 300 mg (6 mL, 2 vials) undiluted given IV push. **Infusion:** Premixed
Calcium Chloride 10%, 1 g/10 mL syringe	Hyperkalemia or hypocalcemia: 1gm IV push *central line preferred	Administer undiluted.
Dextrose 50% 50 mL syringe (25 g/50 mL syringe)	25 g (50 mL) IV push	Administer undiluted.
DiphenhydrAMINE 50 mg/mL vial	25 - 50 mg IV push over 1 to 2 minutes	Administer undiluted.
DOPamine 400 mg/250 mL D5W bag	Start at 10 mcg/kg/minute May titrate to a maximum of 20 mcg/kg/minute for desired effect	Premixed
EPInephrine (1:10,000) 1 mg/10 mL syringe	1 mg (10 mL of 1:10,000 solution) IV push	Administer undiluted.
EPInephrine 1:1000, 1 mL 1 mg/mL ampule	Anaphylaxis: 0.3 mg (0.3 mL) **INTRAMUSCULAR**	For anaphylaxis: undiluted 0.3 mg (=0.3 mL) IM **(USE 1 mL SYRINGE**
EPInephrine 1mg/250 mL D5W or NS	1 – 10 mcg/min IV infusion	1 mg (1 mL, 1 vial) in 250 mL D5W or NS
Hydrocortisone 100 mg (2 mL) act-o- vial	100 mg IV push	Dilute with 2 mL (in vial) , given as IV push
Lidocaine 100 mg/5 mL syringe	1.5 mg/kg, may repeat 0.75 mg/kg IV push, max of 3 mg/kg	Administer undiluted.
Magnesium Sulfate 1 g/2 mL vial	1 - 2 g IV administered over 2-60 minutes	Administer undiluted
Naloxone 0.4 mg/mL	0.4 mg IV push/IM (respiratory arrest)	
NORepinephrine (Levophed) 4 mg/4 mL vial	0.5 – 30 mcg/min IV infusion	8 mg (8 mL, 2 vials) in 250 mL NS
Sodium Bicarbonate 50 mEq/50 mL syringe	1 mEq/kg IV push over 1 to 3 minutes	Administer undiluted.

Code Team Territories

Adult Hospital Medical Emergency

- **Hospital Medical Emergency** is the ***primary responder*** to:
  - All inpatient units on campus
  - Inpatient Psychiatry (Icahn Building, 5th Floor) areas including the adjacent ketamine infusion center
- Inpatient areas that are **NOT** primarily covered by the Hospital Medical Emergency are:
  - Intensive Care Units
  - Cardiac Catheterization Lab (May be activated as back-up)
  - EPS (electrophysiology) Lab (May be activated as back-up)
  - PACU and Operating Room
  - Emergency Department

ED Emergency Response Team With Equipment

- **ED Hospital Code Team or Pediatric Hospital Code Team** is the ***primary responder*** to:
  - All areas of the first floor lobbies and halls of Guggenheim, Annenberg, Atrium, KCC,
  - Klingenstein Pavilion, and 1184 5th Avenue
  - All areas of B1 (MC) level including halls and public areas (including B1 Dialysis Unit)
  - All areas of B3 Level of Atran Building
  - Annenberg Floors 9 and above, including the Levy Library

TPA for Cardiac Arrest with Confirmed Pulmonary Embolism

ACC/AHA Guidelines:

“In patients with confirmed PE as the precipitant of cardiac arrest, thrombolysis, surgical embolectomy, and mechanical embolectomy are reasonable emergency treatment options.”

“Thromboloysis can be beneficial even when chest compression have been provided.”

“Given the poor outcomes associated with fulminant PE in the absence of clot-directed therapy, standard contraindications to thrombolysis may be superseded by the need for potentially lifesaving intervention.”

TPA For Cardiac Arrested and Suspected Pulmonary Embolism

Thrombolytic therapy is not recommended for routine use during cardiopulmonary arrest.

ACC/AHA Recommendations: “Thrombolysis may be considered when cardiac arrest is suspected to be caused by PE.”

The decision to pursue thrombolysis in a patient without confirmed pulmonary embolism should be made in concert with the RRT attending and/or the PERT team.

Ordering TPA for PE associated with cardiac arrest

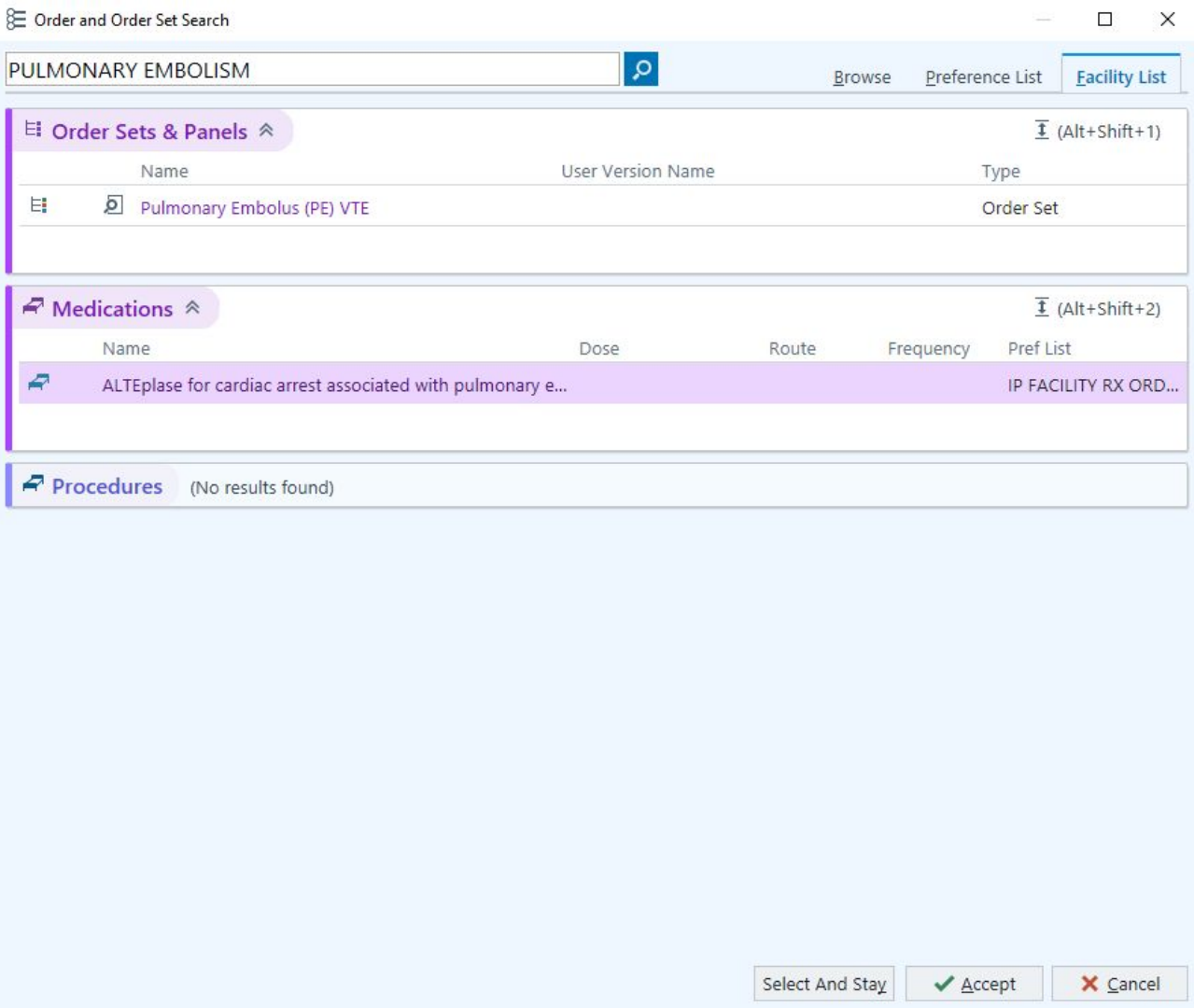
The recommended dose for TPA associated with cardiac arrest is different than for PE without cardiac arrest:

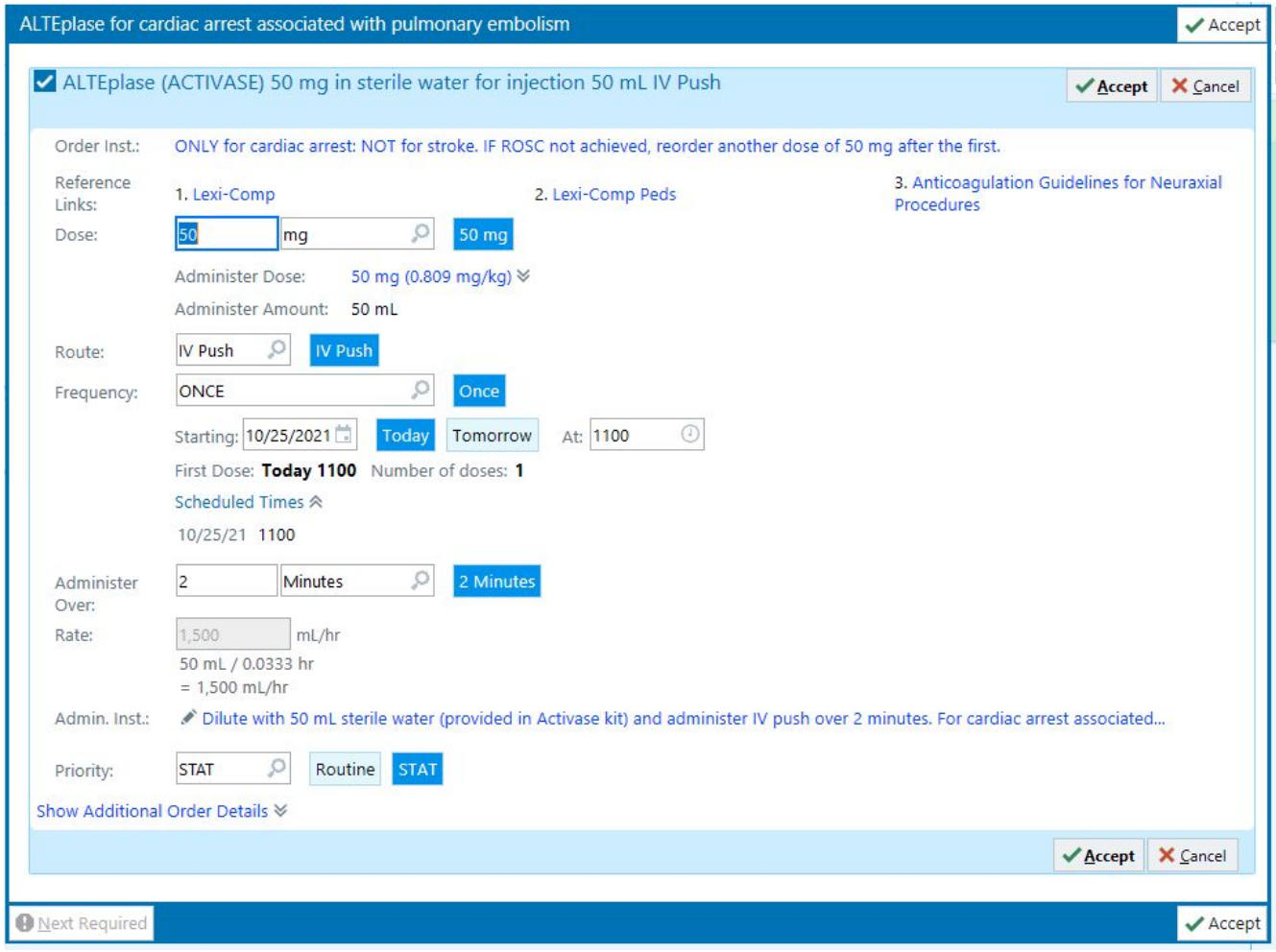
> ACC/AHA: “Contemporary examples of accelerated emergency thrombolysis dosing regimens for fulminant PE include alteplase 50 mg intravenous (IV) bolus with an option for repeat bolus in 15 minutes, or single-dose weight-based tenecteplase; thrombolytics are administered with or followed by systemic anticoagulation”

There is a specific TPA order for pulmonary embolism associated with cardiac arrest.

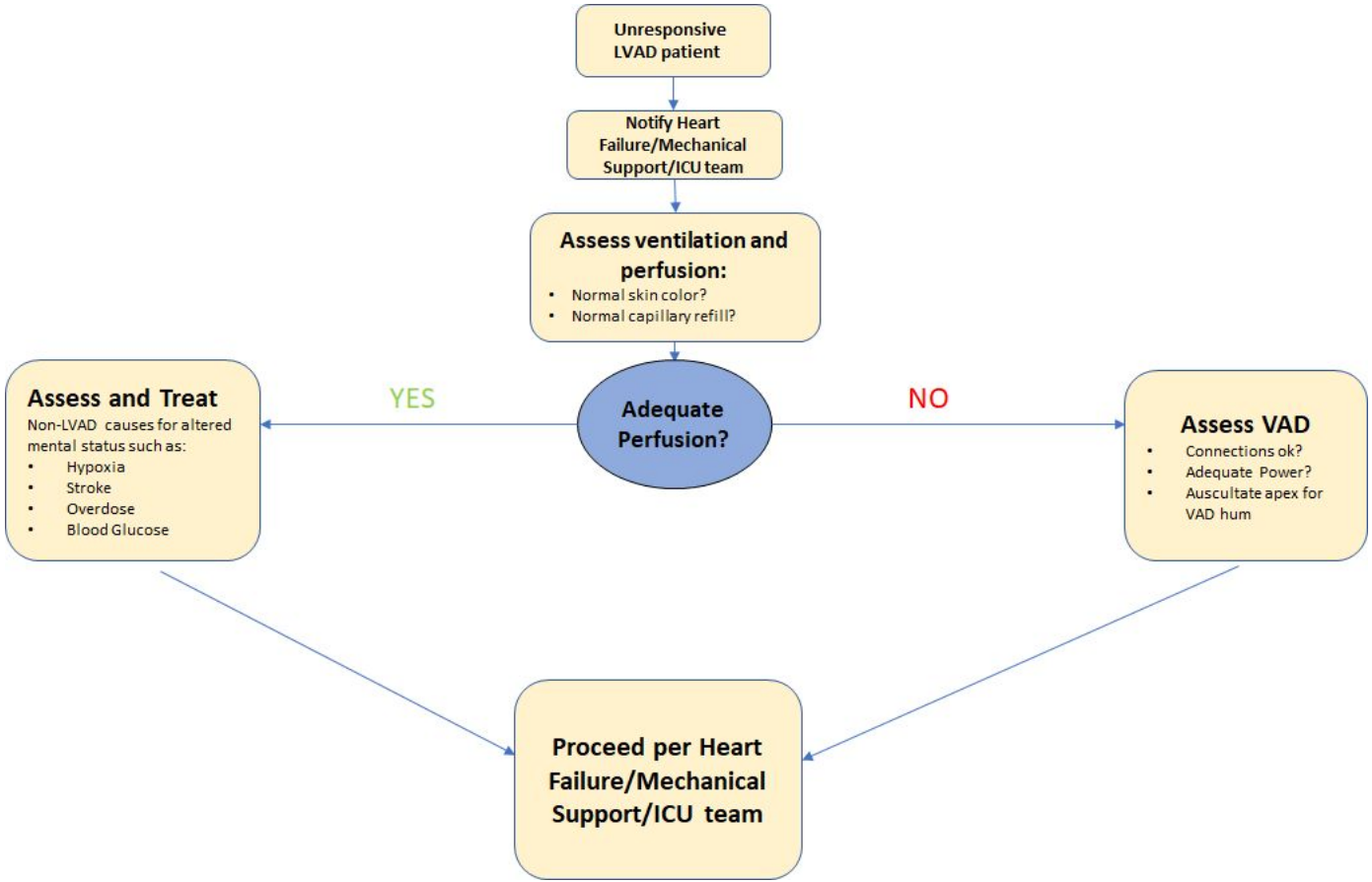
It can be accessed by typing “pulmonary embolism” into orders (see next two slides).

Once ordered: Call the closest pharmacy, if unknown call 47714 and say: “This is Dr./PA/NP”..”, we need ALTEplase for a cardiac arrest/code immediately.” Please given the pharmacist the patient’s name/DOB and location.


Order and Order Set Search
PULMONARY EMBOLISM
Browse
Preference List
Facility List
Order Sets & Panels
(Alt+Shift+1)
Name
User Version Name
Type
Pulmonary Embolus (PE) VTE
Order Set
Medications
(Alt+Shift+2)
Name
Dose
Route
Frequency
Pref List
ALTEplase for cardiac arrest associated with pulmonary e...
IP FACILITY RX ORD...
Procedures
(No results found)
Select And Stay
Accept
Cancel


ALTEplase for cardiac arrest associated with pulmonary embolism
Accept
ALTEplase (ACTIVASE) 50 mg in sterile water for injection 50 mL IV Push
Accept
Cancel
Order Inst.:
ONLY for cardiac arrest: NOT for stroke. IF ROSC not achieved, reorder another dose of 50 mg after the first.
Reference Links:
1. Lexi-Comp
2. Lexi-Comp Peds
3. Anticoagulation Guidelines for Neuraxial Procedures
Dose:
50
mg
50 mg
Administer Dose:
50 mg (0.809 mg/kg)
Administer Amount:
50 mL
Route:
IV Push
IV Push
Frequency:
ONCE
Once
Starting:
10/25/2021
Today
Tomorrow
At:
1100
First Dose: Today 1100
Number of doses: 1
Scheduled Times
10/25/21 1100
Administer Over:
2
Minutes
2 Minutes
Rate:
1,500
mL/hr
50 mL / 0.0333 hr
= 1,500 mL/hr
Admin. Inst.:
Dilute with 50 mL sterile water (provided in Activase kit) and administer IV push over 2 minutes. For cardiac arrest associated...
Priority:
STAT
Routine
STAT
Show Additional Order Details
Accept
Cancel
Next Required
Accept
Place new orders or order sets
New
Standard
Next
New Orders
ALTEplase for cardiac arrest associated with pulmonary embolism
ALTEplase (ACTIVASE) 50 mg in sterile water for injection 50 mL IV Push
50 mg (0.809 mg/kg), IV Push, Administer over 2 Minutes, ONCE, today at 1100, For 1 dose
ONLY for cardiac arrest: NOT for stroke. IF ROSC not achieved, reorder another dose of 50 mg after the first.

LVAD Code



*Follow typical ACLS protocols in the coding LVAD patient but replace pulse checks with doppler MAP checks

ECPR

- ECPR stands for extracorporeal cardiopulmonary resuscitation
- It consists of the use of a machine that:
  - Removes blood from the venous system
  - Performs gas transfer (oxygenation and ventilation)
  - Pumps blood back into the arterial system

ECPR

- The use of ECPR should be considered on a case-by-case basis
- Think about ECPR if:
  - The suspected etiology of arrest is acute MI or PE
  - The patient is less than 65 years old
  - The patient is otherwise healthy
- Call as soon as the first shock/pulse check is unsuccessful
- Activate by calling the page operator and asking for the ECMO CPR team (will go live tentatively in January 2022)

Termination of Resuscitation suggestions - AHA guidelines

Out of Hospital Cardiac Arrest - The National Association of EMS Physicians (NAEMSP) suggested that resuscitative efforts could be terminated in patients who do not respond to at least 20 minutes of ALS care

An ALS termination of resuscitation rule was derived from a diverse population of rural and urban EMS settings. This rule recommends considering terminating resuscitation when ALL of the following criteria apply before moving to the ambulance for transport:

- (1) arrest was not witnessed
- (2) no bystander CPR was provided
- (3) no ROSC after full ALS care in the field
- (4) no AED shocks were delivered

In Hospital Cardiac Arrest - In the hospital the decision to terminate resuscitative efforts rests with the treating physician and is based on consideration of many factors, including witnessed versus unwitnessed arrest, time to CPR, initial arrest rhythm, time to defibrillation, comorbid disease, pre-arrest state, and whether there is ROSC at some point during the resuscitative efforts.

Post-Code Debriefs

- The CPR committee has created an initiative to encourage debriefing after codes
- This is a nursing led initiative
- You will be asked to participate in a debrief shortly after the code
- The expectation is that the debrief is shorter than 10 minutes

Targeted Temperature Management Protocol (last revised 2019)

1. Start Induction of TTM AS SOON AS posc OCCURS using Arctic Sun Cooling system
   a. 33-36∘C is the target
   b. If already at a temp <36∘C do not rapidly warm
2. Maintain Target Temp for 24 hours
   a. Water temp <10∘C should be considered a fever
   b. Labs should be performed every 6 hours or more and K should be repleted to 3.5
3. Treat Shivering Aggressively
   a. All patients receive: Tylenol 650mg q4h, Buspar 30mg q8h, BAIR Hugger set at 43∘C
   b. 1st tier: Mg++ infusion and Meperidine IV (avoid if suspicion of seizures)
   c. 2nd tier: Dilaudid infusion, Propofol or Midazolam infusion
   d. 3rd tier: NM blockade
   e. If BSAS >1 move on to next tier of treatment
4. Rewarm no faster than 0.2∘C /hr to goal 37∘C
   a. Maintain at 37∘C for additional 72 hours
   b. Send neuron specific enolase daily on days 3-5
   c. MRI w/o contrast once stable at 37∘C
5. Ongoing assessment
   a. Temperature including patient and Artic sun water temp every hour
   b. Assess for signs or shivering q1hL palpate masseter, deltoids and pectoralis muscles

BEDSIDE SHIVERING ASSESSMENT SCALE (BSAS)
0 - NONE - no shivering
1 - MILD - localized to neck, thorax, may only be seen on EKG
2 - MODERATE - intermittent involvement of upper extremities +/- thorax
3- SEVERE - generalized shivering or sustained upper extremity shivering

TTM Protocol (continued)

- Indications
  - Cardiac arrest regardless of the initial rhythm with a return of spontaneous circulation (ROSC)
  - Must be within 6 hours of the cardiac arrest
  - Appreciable decline in the patient's mental status relative to baseline. If the patient is not following commands, they will qualify for TTM/TH.
  - Blood pressure must be stable on no more than 1 vasopressor infusion unless an Attending Intensivist determines otherwise
- Contraindications to TTM
  - Traumatic etiology of arrest
  - Large area of burns over torso or legs
  - Active severe or intracranial bleed
  - Pediatric patient (<18)
  - History of cryoglobulinemia
  - Severe bradycardia
  - Refractory acidosis with no reversible etiology
- When to abort TTM
  - Unstable arrhythmia refractory to standard treatment
  - Hemodynamic instability that cannot be managed medically
  - Hemodynamically significant hemorrhage
- Adverse effects of TTM
  - Coagulopathy/Bleeding, decrease in clotting factors and platelet function
  - Infection
  - Insulin resistance
  - Arrhythmia, Bradycardia, electrolyte imbalance