

In the name of God

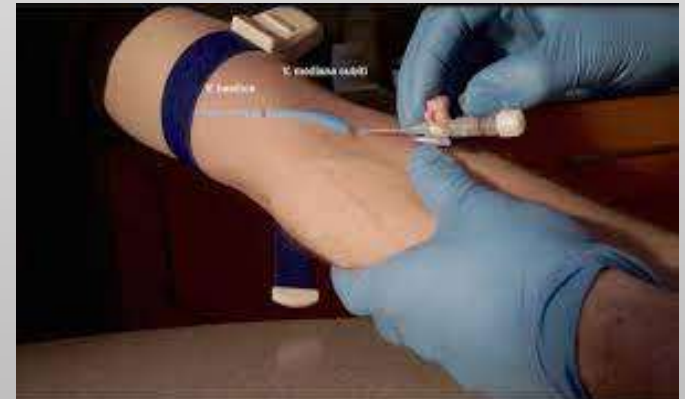
MEDICATION IN ACLS

Dr. Soudabeh Haddadi

Associate Professor of Anesthesiology and critical
care

GUMS

May. 2022



Access for medication in ACLS

- **Intravenous (IV) Route:**

- preferred route
 - # central line not required ; can interrupt CPR
- medication take 1-2 min. to reach central circulation
- give medication as IV bolus , flush with 20 ml fluid



- **Intraosseous (IO) Route:**

- secondary method
- safe & effective for administering medication, fluids, and blood as well as drawing blood
- all medication that can be given IV can be given IO
- administer medication and flush with at least 20 ml fluid (as with IV administration)



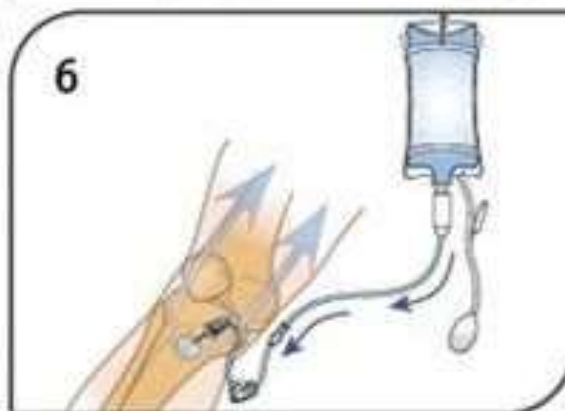
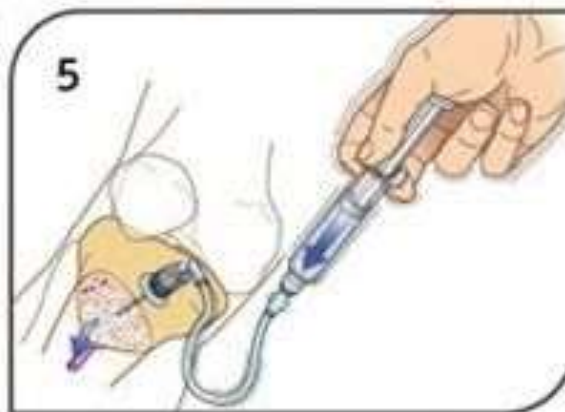
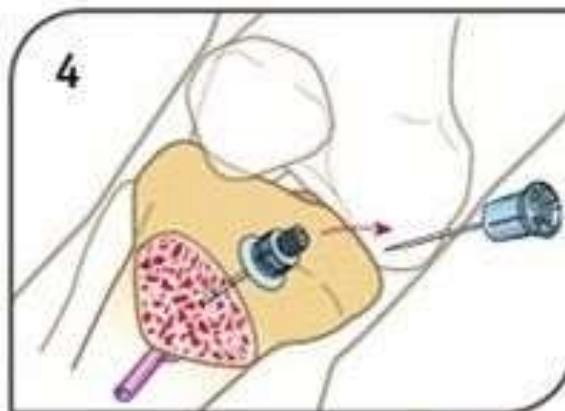


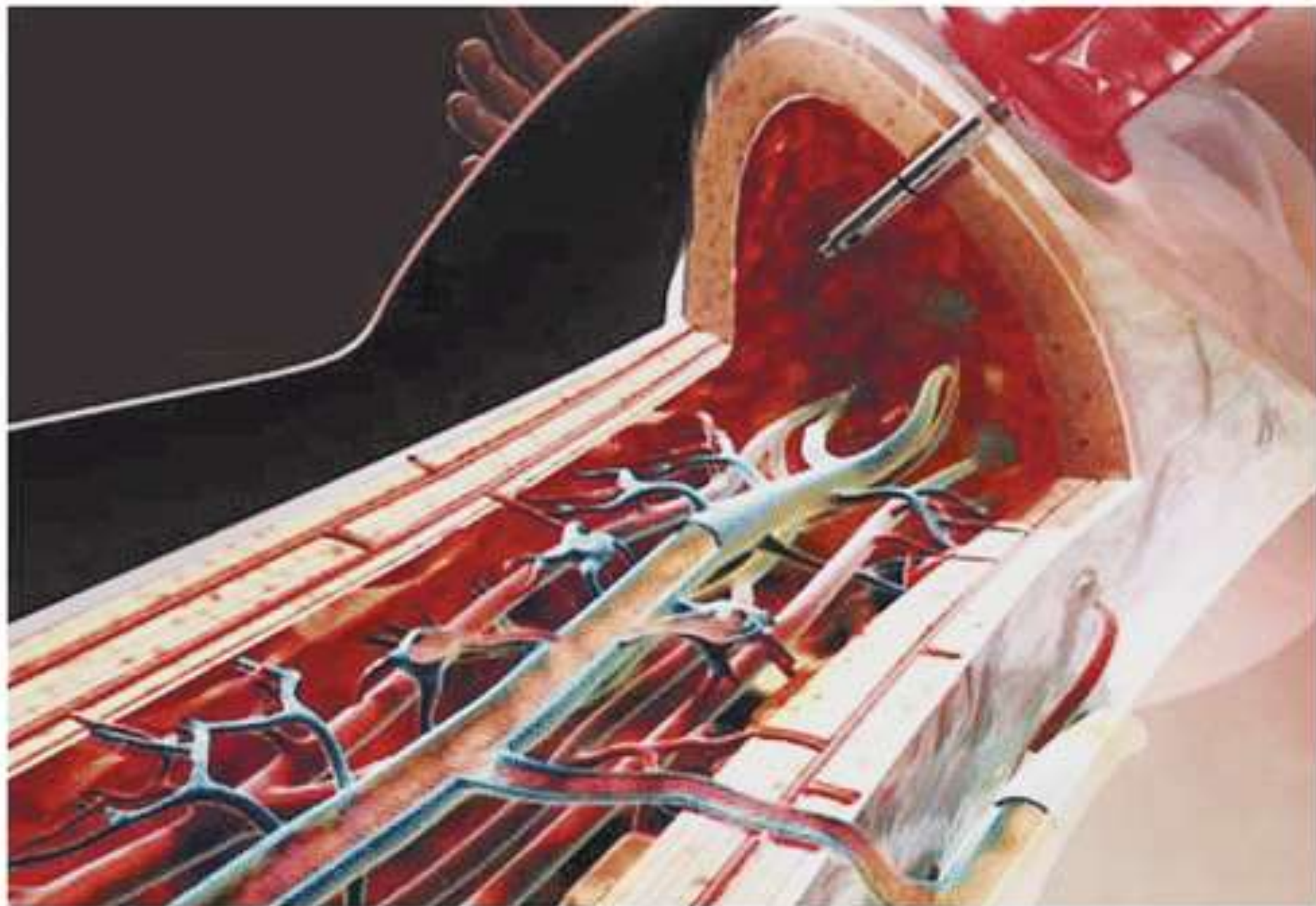


ACLS

Certification Institute

www.ACLScertification.com
ACLS, BLS, PALS and NRP
Certification Online





EZ-IO — AN EVIDENCE-BASED SOLUTION TO A UNIVERSAL PROBLEM

COMPARISON OF DIFFICULT VASCULAR ACCESS OPTIONS[†]

	INTRAOSSEROUS (EZ-IO)	CENTRAL LINE	PERIPHERAL IV ^{††}
TIME / SPEED	6-20 Seconds ^{1,2,3}	10-26 Minutes ^{4,5}	20-39 Minutes ^{6,7,8}
SAFETY PROFILE: COMPLICATIONS	< 1% ⁹	15% ¹⁰	32-70% ^{11,12,13}
RELIABILITY: SUCCESS RATE	90 - 98% ^{14,15,16}	60-89% ^{17,18}	33-77% ^{19,20,21}
RELIABILITY: FIRST ATTEMPT	90 - 97% ^{22,23}	22-86% ^{24,25}	49-71% ^{26,27}
STAFF RESOURCES	Nurse	Physician or mid-level provider and one assistant	Nurse
EQUIPMENT RESOURCES (for insertion)	driver, needle set, gloves, antiseptic, flush	Central line kit (or: catheter, guidewires, antiseptic prep, lidocaine, needles & syringes, scalpel & surgical blades, gauze), Benzoin, tape, suture, Cordis caps (prn), maximal barrier precautions (sterile gloves, sterile patient drape, sterile gowns, masks & cap for staff)	IV catheter set, gloves, antiseptic, tape, flush
FLOW RATES	Moderate to high flow rates	High flow rates	Dependent on catheter gauge
\$ COST OF PROCEDURE	\$100 ²⁸	\$290 ²⁹	\$32 per attempt ³⁰ \$96/3 attempts ³¹

Actioncard för intraosseös infart

Proximalt humerus - Vuxen

Patientens hand placeras över patientens navel, identifiera insticksställe 1 cm över "surgical neck", 45° enl. anterior plan.

Förslag till nål:

- Vuxen

Distalt femur - Endast till barn

Barn till och med 6 år. Sträck benet för att säkerställa att knät inte är böjt. Insticksställe 1 cm proximalt vid den superiora gränsen av patella och ca 1-2 cm medialt vid mittlinjen.

Förslag till nål:

- Barn till och med 6 år

Proximalt tibia - Barn

Sträck benet. Insticksställe ca 1 cm distalt vid patella och 1 cm in medialt längs det platta området på tibia.

Förslag till nål:

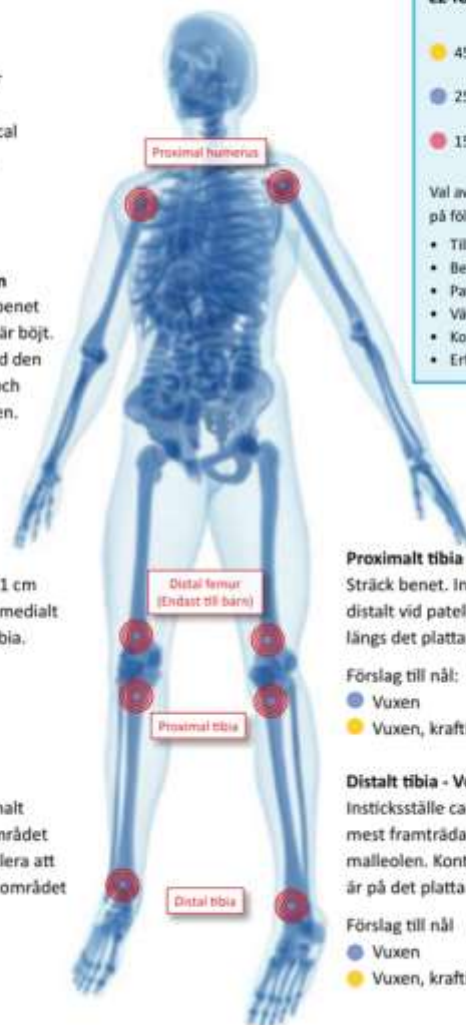
- Barn
- Barn, kraftig

Distalt tibia - Barn

Insticksställe ca 1-2 cm proximalt vid det mest framträdande området av mediala malleolen. Kontrollera att insticksstället är på det platta området av benet.

Förslag till nål:

- Barn



EZ-IO nålstorlekar



Val av insticksställe bör baseras på följande faktorer:

- Tillgänglighet
- Behandling
- Patientens storlek/ålder
- Vävnadsdjup
- Kontraindikationer
- Erfarenhet

Proximalt tibia - Vuxen

Sträck benet. Insticksställe ca 3 cm distalt vid patella och 2 cm in medialt längs det platta området på tibia.

Förslag till nål:

- Vuxen
- Vuxen, kraftig

Distalt tibia - Vuxen

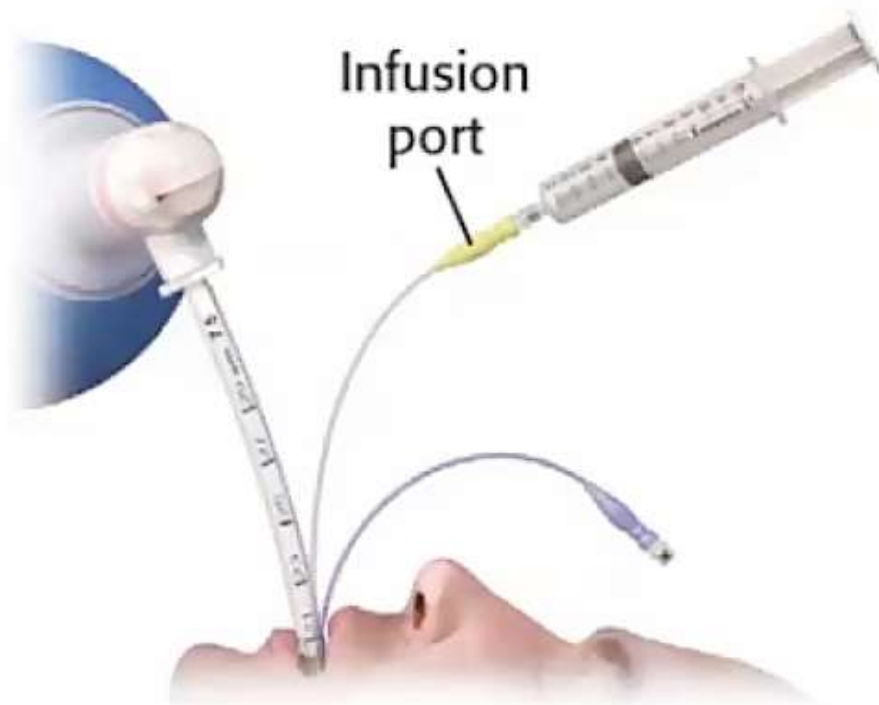
Insticksställe ca 3 cm proximalt vid det mest framträdande området av mediala malleolen. Kontrollera att insticksstället är på det platta området av benet.

Förslag till nål

- Vuxen
- Vuxen, kraftig

- **Endotracheal (ET) Route:**

- not preferred ; last resort
- medication doses are 2-2.5 times IV/IO doses
optimal dosing not known
- drugs that can be given ET:
 - 1- epinephrine
 - 2- vasopressin
 - 3- lidocaine
 - 4- atropine
 - 5- naloxone
- dilute with 5-10 ml SW/NS, administer into ET tube,
follow with several PPV



Endotracheal tubes with built-in ports can be used if available (EMT tube by Nellcor shown here).

The advantage of these tubes is that the bag-valve-mask device does not need to be disconnected during drug administration.

Drugs that can be Delivered via Endotracheal Tube

NAVEL (adults)

Naloxone

Atropine

Vasopressin

Epinephrine

Lidocaine

LANE


Lidocaine

Atropine


Naloxone

Epinephrine

ENDOTRACHEAL MEDICATION ADMINISTRATION


- 

Ventilate the patient and draw the medication and diluent into a syringe.


Attach a needle to the syringe.
- 

Remove the bag-valve-mask assembly and insert the needle into the proximal opening of the tube.


Hold the needle with one hand to prevent loss of the needle into the tube.

Inject the drug solution rapidly and forcefully.
- 


Alternatively, a fine-bore catheter (such as a pediatric feeding tube) can be used.

Advance the catheter through the endotracheal tube so that the distal end of the catheter extends 1 cm beyond the distal end of the tube.
- 


Inject the drug solution rapidly and forcefully through the catheter and into the trachea.

Inject the catheter with 5 mL of air to flush any remaining drug solution into the lungs.
- 

Endotracheal tubes with built-in ports can be used if available (EMT tube by Nellcor shown here).


The advantage of these tubes is that the bag-valve-mask device does not need to be disconnected during drug administration.
- 

Drugs can also be injected directly through the endotracheal tube wall, although this method has not been studied scientifically.

As with the ported endotracheal tubes, the bag-valve-mask device does not need to be disconnected with this method.
- 

The Mucosal Atomizer Device ET (see text) can also be used.

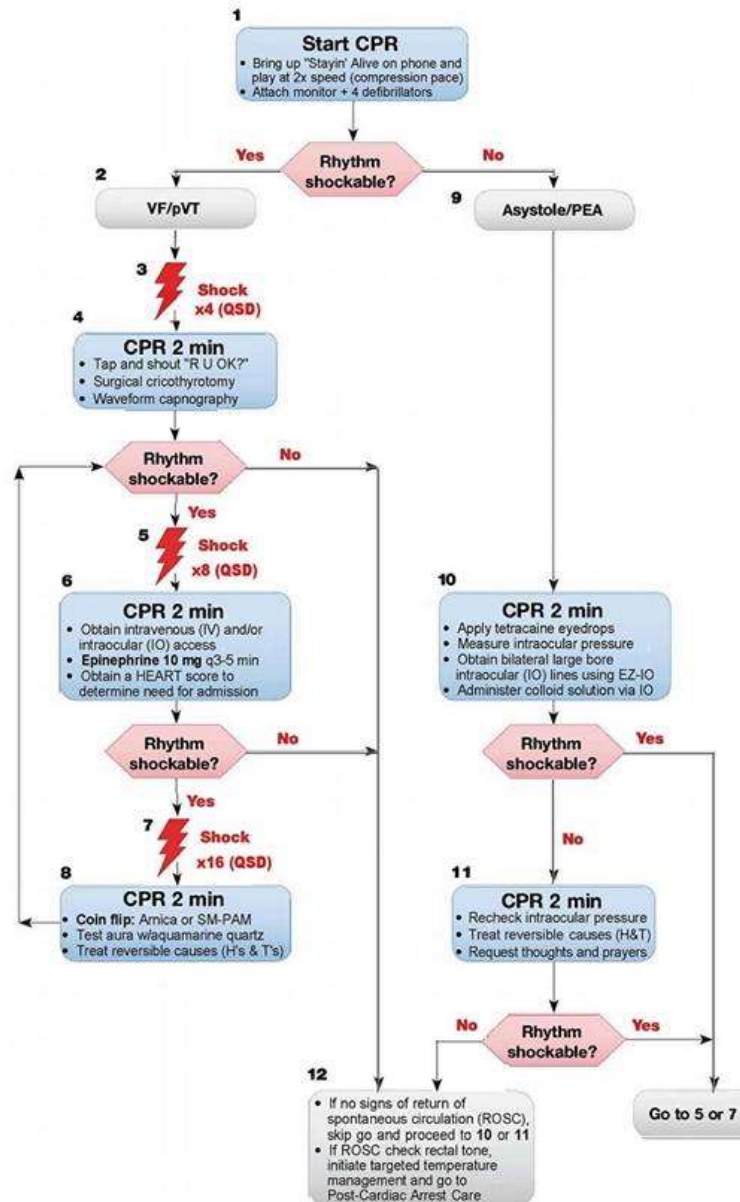
Attach the L-shaped device to the endotracheal tube and bag-valve-mask device. Insert the catheter until the black line is at the 26-cm mark (small arrow).

Briskly inject the medication during ventilation.
- 

After the drug and diluent have been administered, provide five rapid ventilations to enhance drug delivery into the lungs.

1- ADULT CARDIAC ARREST ALGORITHM

Adult Cardiac Arrest Algorithm—2020 Update



CPR: Hands Only OR Breaths Only

- **Hands Only:** Place one hand under each armpit and compress the chest medially like an accordion. Push hard (at least 6 inches [15 cm]) and fast (180-220/min). Allow complete chest recoil.
- **Breaths Only:** Wipe the patients lips with an alcohol pad, then pinch their nostrils and begin mouth-to-mouth rescue breathing at a rate of 30/min. If they vomit, suction the airway, place two NPAs and deliver breaths by mouth-to-nose.
- Change compressors/breathers every 2 minutes if fatigued.
- Always minimize interruptions in compressions or ventilations.
- If PETCO₂ < 10 attempt to increase by administering a carbonated beverage via orogastric tube.

Shock Energy for Defibrillation

- **Quadruple Sequential Defibrillation (QSD):** Attach 4 defibrillators to the patient with pads encircling the chest, then administer 4 sequential shocks at maximum available energy (eg, initial dose of 200 or 360 J. All subsequent doses are doubled.

Drug Therapy

- **Epinephrine IV/IO dose:** 10 mg (1:1000) every 3-5 minutes
- **Flip a coin**
Heads = Amica IV/IO:
First dose: 0.0000003 mg/5 mL
Second dose: 0.0003 mg/10 mL
Tails = SM-PAM (synchronizing meridiversion w/pulsations of anterolateral meridian) q10 Os

Advanced Airway

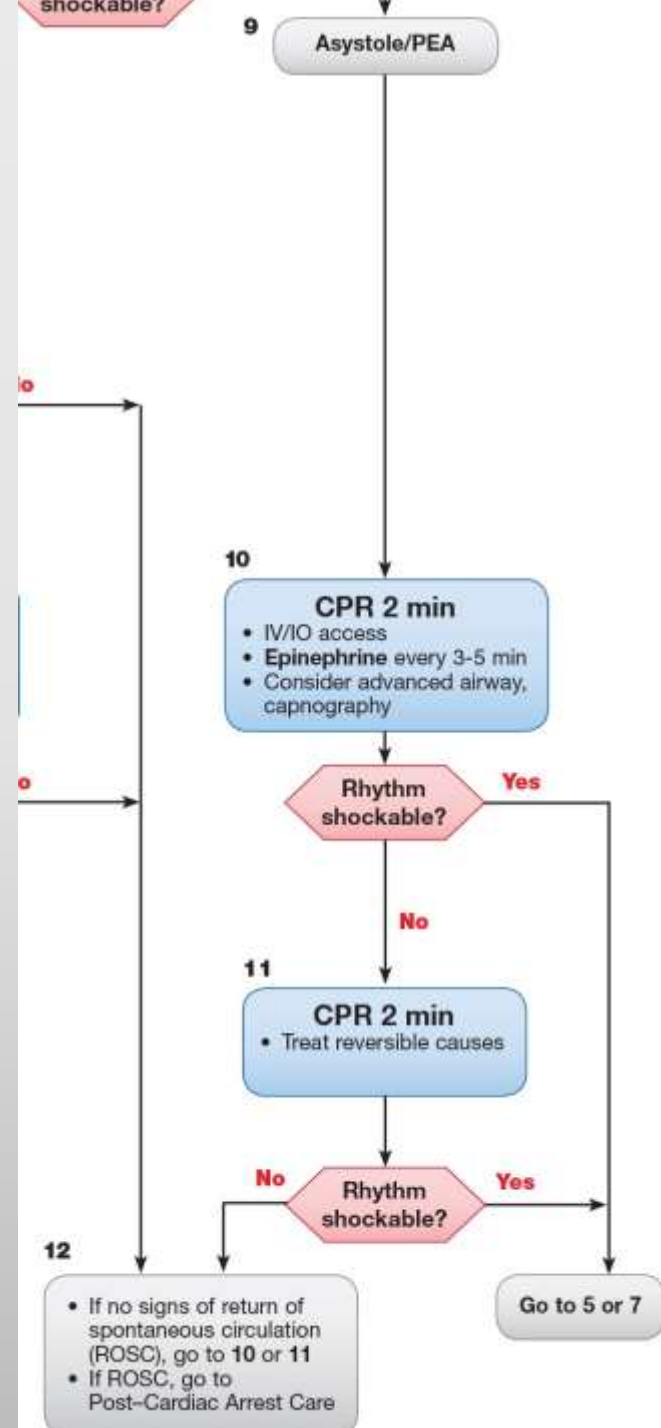
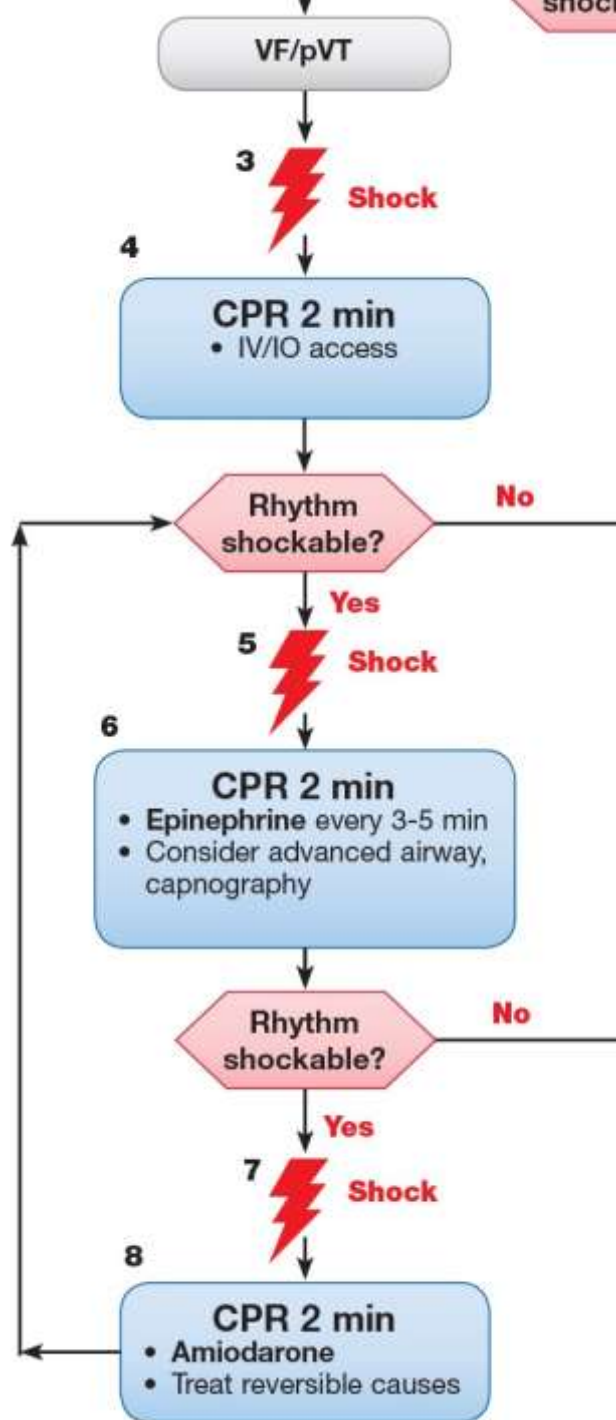
- Surgical cricothyrotomy is the **ONLY** definitive airway for a patient in cardiac arrest and should be prioritized over venous access (unless intraocular line).
- Waveform capnography **OR** percussion/auscultation to confirm and monitor ET tube placement.

Return of Spontaneous Circulation (ROSC)

- Check rectal tone and initiate TTM
- **If unresponsive:** Immediately begin packing ice into the rectum
- **If responsive:** Foley catheter placement followed by bladder lavage 10 mL/kg of ice water

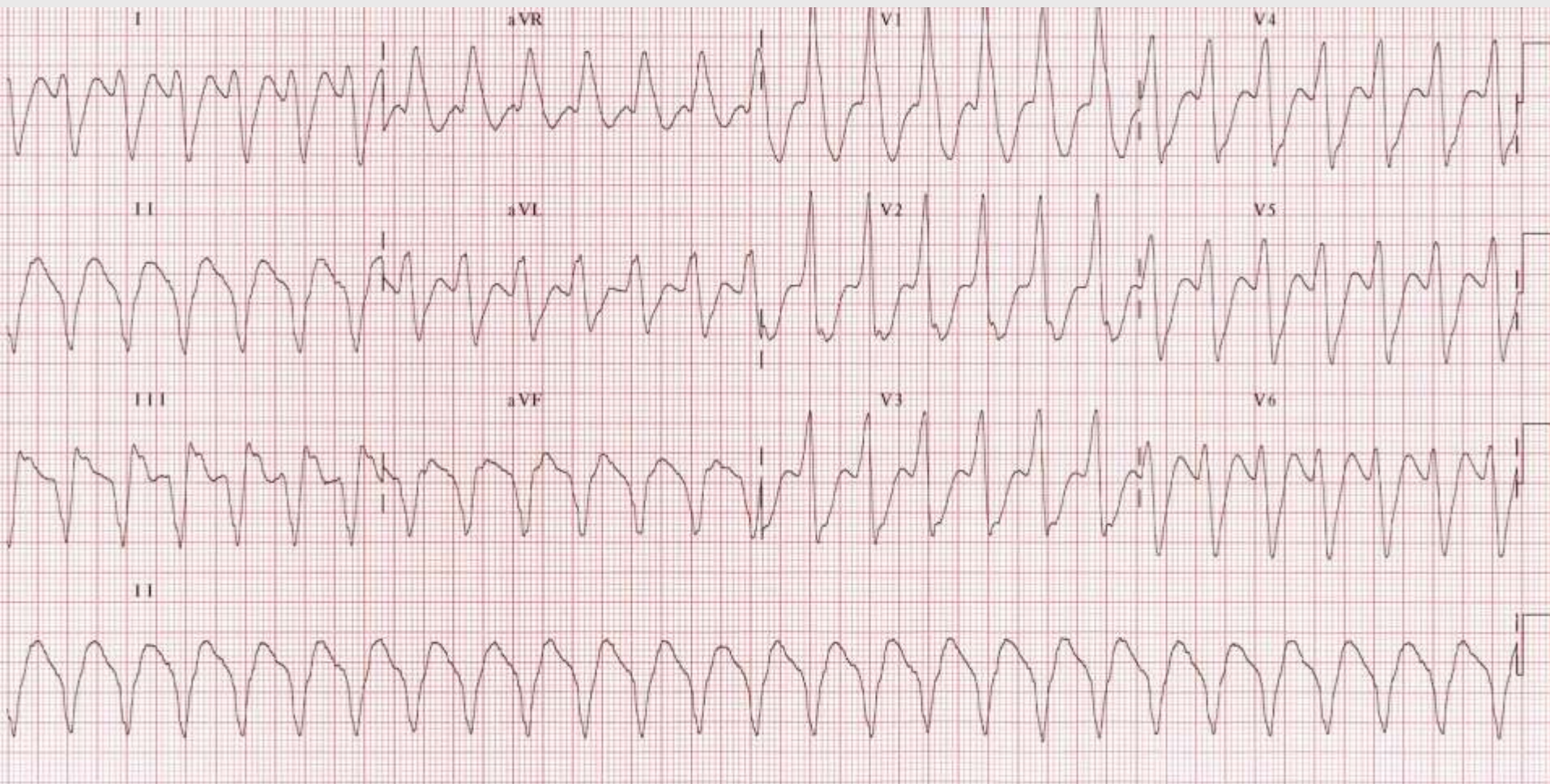
Reversible Causes

- Hydrocele
- Hydroxybut
- Hiatal hernia
- Hypertension
- Hantavirus
- Toxoplasma gondii
- Tinea pedis
- Tièche-Jadassohn nevus
- Thomas' sign (silver stool)
- Takotsubo cardiomyopathy



Medication:

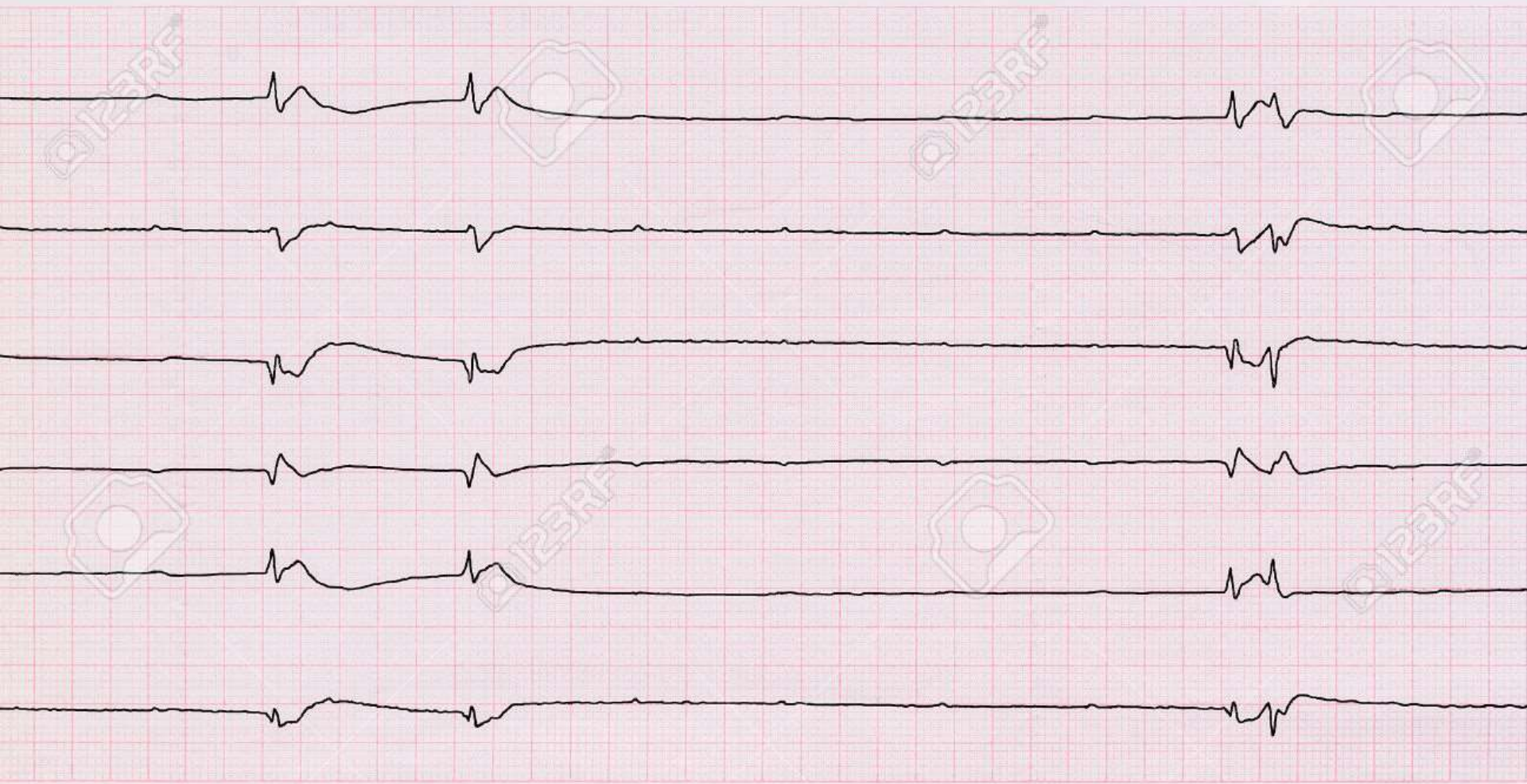
- **Ventricular fibrillation or ventricular tachycardia (VF/VT)**
 - vasopressors: epinephrine , vasopressin
 - antiarrhythmics: amiodarone
 - # not on algorithm : lidocaine , magnesium
- **Asystole/ Pulseless electrical activity (PEA)**
 - vasopressors: epinephrine , vasopressin



Ventricular tachycardia



Ventricular fibrillation



Asystole

Vasopressor medications:

- Include: epinephrine , norepinephrine , vasopressin
- Goal : increase coronary and cerebral perfusion
- Effect:
 - increase systemic arteriolar vasoconstriction
 - maintain vascular tone
 - shunt blood to heart and brain
- ONLY medication shown to improve ROSC (Return Of Spontaneous Circulation) and short term survival

Epinephrine (Adrenaline)

- MOA: α & β receptor agonist
 - α -receptor stimulation restores circulation
 - β -receptor stimulation:
 - may lower defibrillation threshold
 - increases myocardial oxygen demand
- DOSE & ADMINISTRATION:
 - IV/IO: 1 mg every 3-5 min
 - concentration 0.1 mg/ml (1:10000 or 1mg/10ml)
 - flush with 20 ml NS (central line preferred)
 - ET: 2-2.5 mg every 3-5 min
 - dilute in 5-10 ml SW/NS (use epi 1mg/ml or 1:1000)

1 in 10,000

Adrenaline-Link

**0.15 ML EUTE ADRENALINE
INJECTION**

Vasopressin (ADH)

- MOA: acts on V1 receptor to cause vasoconstriction
 - increase blood pressure & systemic vascular resistance
- Benefits over epinephrine:
 - not inhibited by metabolic acidosis
 - no β -receptor activity
- DOSE & ADMINISTRATION:
 - IV/IO : 40 Units one time (2 vials of 20 U/ml)
flush with 20 ml NS
 - ET : 80-100 units one time
dilute in 5-10 ml SW/NS



NDC 63323-302-01

30201

VASOPRESSIN

INJECTION, USP
(SYNTHETIC)

20 Units/mL

For HA of EC 1159

8.000

Antiarrhythmic medications

- Include: Amiodarone , Lidocaine , Magnesium
 - not on algorithm: lidocaine, magnesium
- GOAL: increase the fibrillation threshold
 - prevent development or recurrence of VF/VT

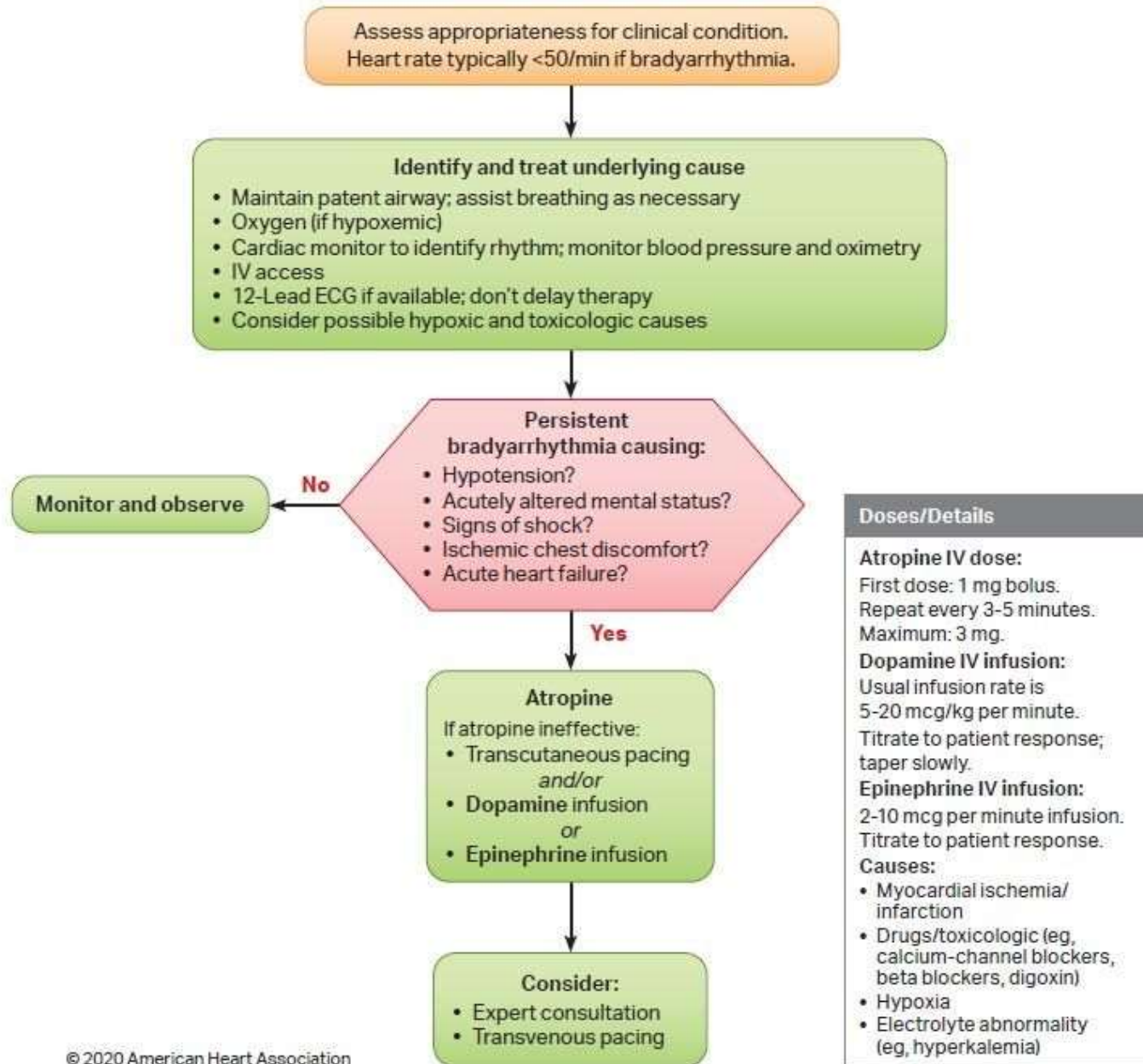
Amiodarone

- MOA: class III antiarrhythmic (K channel blocker)
inhibits α & β -adrenergic stimulation, blocks Ca channels
prolongs action potential
- Side effects: hypotension, fever, elevated LFTs, confusion, nausea, thrombocytopenia
- DOSE & administration:
 - 300 mg bolus IV/IO, follow with 150 mg in 3-5 min
 - give IV/IO push. If possible dilute in 20-30 ml D5W
 - amiodarone vial concentration is 50 mg/ml
 - flush with 20 ml
 - central line preferred
 - incompatible with Na-Bicarbonate



2-ADULT BRADYCARDIA ALGORITHM (with pulse)

Adult Bradycardia Algorithm



3

**Persistent
bradyarrhythmia causing:**

- Hypotension?
- Acutely altered mental status?
- Signs of shock?
- Ischemic chest discomfort?
- Acute heart failure?

Yes

5

Atropine

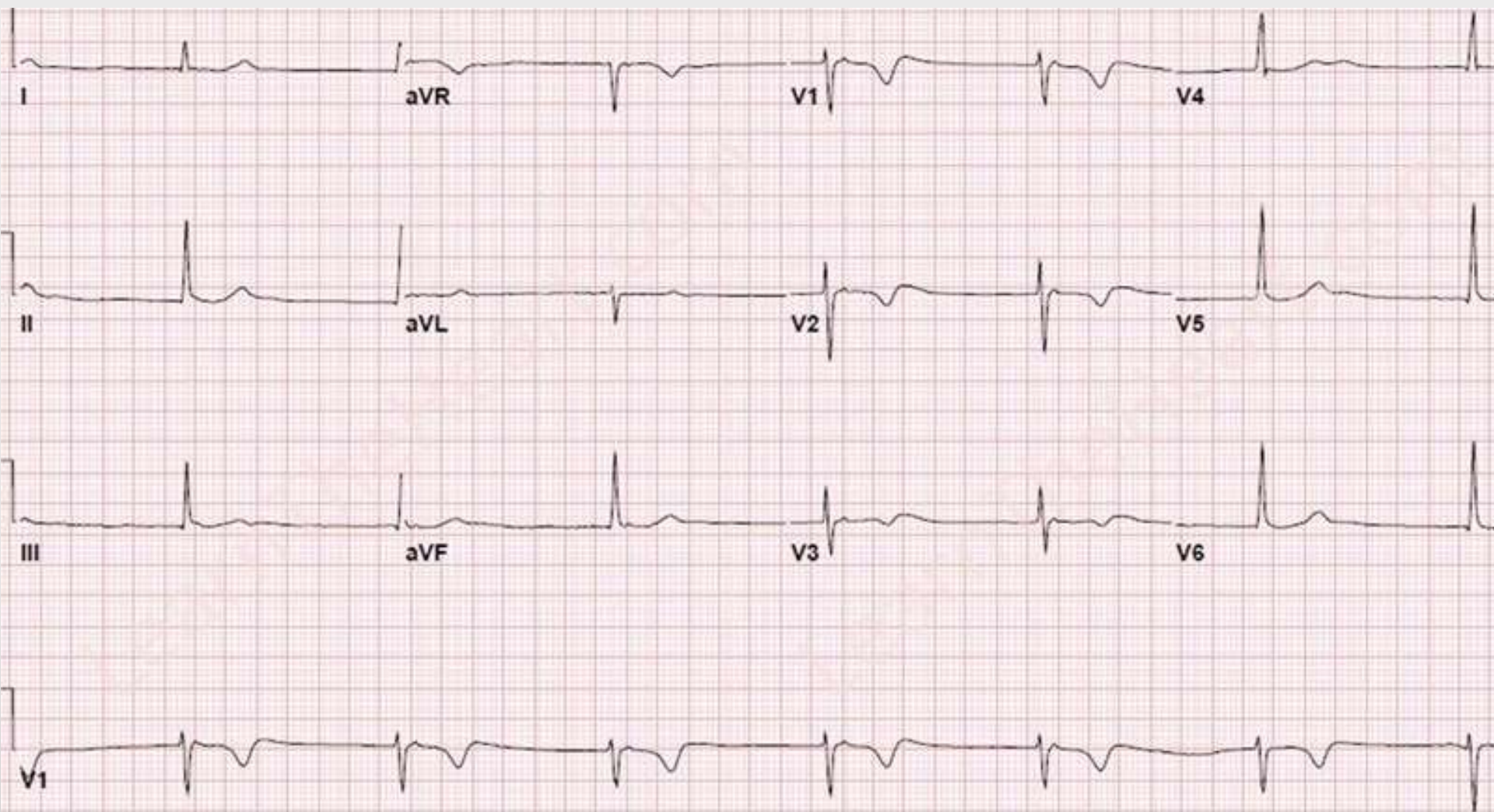
If atropine ineffective:

- Transcutaneous pacing
or
- **Dopamine** infusion
or
- **Epinephrine** infusion

6

Consider:

- Expert consultation
- Transvenous pacing



Junctional bradycardia

Atropine

- MOA: anticholinergic agent, blocks acetylcholine at M2-receptor of heart
- DOSE & ADMINISTRATION:
 - 0.5 mg IV/IO bolus, repeat every 3-5 min
 - Max 3 mg total dose
- CONTRAINDICATION:
 - evidence of a high degree (2 or 3 degree) AV block
 - may be harmful in cardiac ischemia

Dopamine

- MOA: adrenergic & dopaminergic receptor agonist, stimulation of β_1 -receptors increase HR
- DOSE & ADMINISTRATION:
 - 2-10 μ /kg/min IV/IO infusion (up to 20 μ /kg/min)
 - titrate to response, increase by 5 μ /kg/min every 10-30 min as needed
 - central line preferred
 - incompatible with Na-bicarbonate



5 mL Single-dose

DOPamine HCl Inj., USP

200 mg (40 mg/mL)

**CAUTION: MUST BE DILUTED.
FOR I.V. USE.**

Rx only

HOSPIRA, INC., LAKE FOREST, IL 60045 USA

LOT 42-388-DK EXP 1/11

Epinephrine

- MOA: adrenergic agonist, stimulation of β_1 -receptor increase HR
- DOSE & ADMINISTRATION:
 - 2-10 μ /min IV/IO infusion
 - titrate to response
 - central line preferred
 - incompatible with Na-bicarbonate



3- ADULT TACHYCARDIA ALGORITHM (with pulse)

Adult Tachycardia With a Pulse Algorithm

1

Assess appropriateness for clinical condition.
Heart rate typically $\geq 150/\text{min}$ if tachyarrhythmia.

2

Identify and treat underlying cause

- Maintain patent airway; assist breathing as necessary
- Oxygen (if hypoxemic)
- Cardiac monitor to identify rhythm; monitor blood pressure and oximetry

3

Persistent tachyarrhythmia causing:

- Hypotension?
- Acutely altered mental status?
- Signs of shock?
- Ischemic chest discomfort?
- Acute heart failure?

4

Synchronized cardioversion

- Consider sedation
- If regular narrow complex, consider adenosine

Yes

No

5

Wide QRS? ≥ 0.12 second

Yes

No

6

- IV access and 12-lead ECG if available
- Consider adenosine only if regular and monomorphic
- Consider antiarrhythmic infusion
- Consider expert consultation

7

- IV access and 12-lead ECG if available
- Vagal maneuvers
- Adenosine (if regular)
- β -Blocker or calcium channel blocker
- Consider expert consultation

Doses/Details

Synchronized cardioversion:

Initial recommended doses:

- Narrow regular: 50-100 J
- Narrow irregular: 120-200 J biphasic or 200 J monophasic
- Wide regular: 100 J
- Wide irregular: defibrillation dose (*not* synchronized)

Adenosine IV dose:

First dose: 6 mg rapid IV push; follow with NS flush.

Second dose: 12 mg if required.

Antiarrhythmic Infusions for Stable Wide-QRS Tachycardia

Procainamide IV dose:

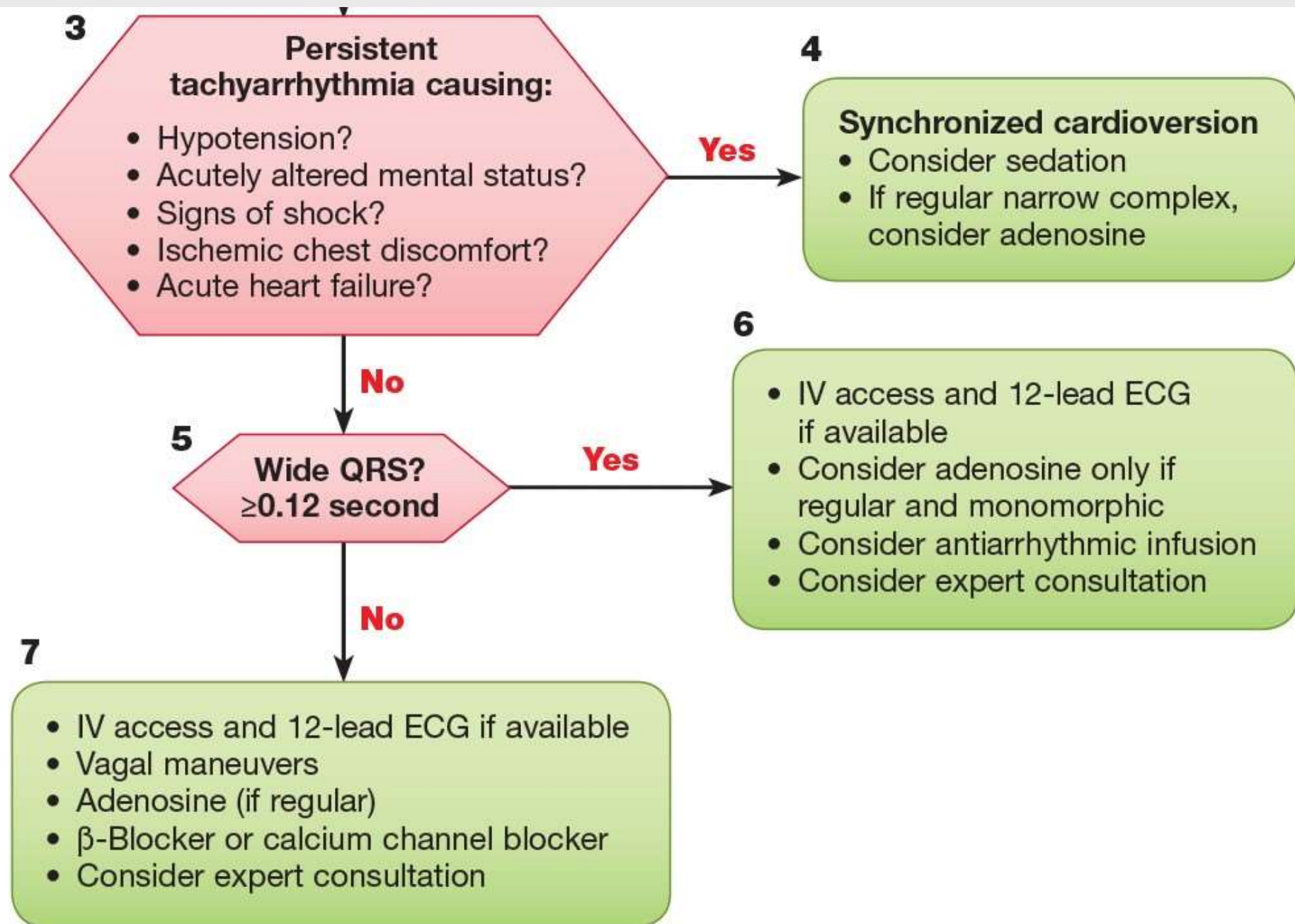
20-50 mg/min until arrhythmia suppressed, hypotension ensues, QRS duration increases $>50\%$, or maximum dose 17 mg/kg given. Maintenance infusion: 1-4 mg/min. Avoid if prolonged QT or CHF.

Amiodarone IV dose:

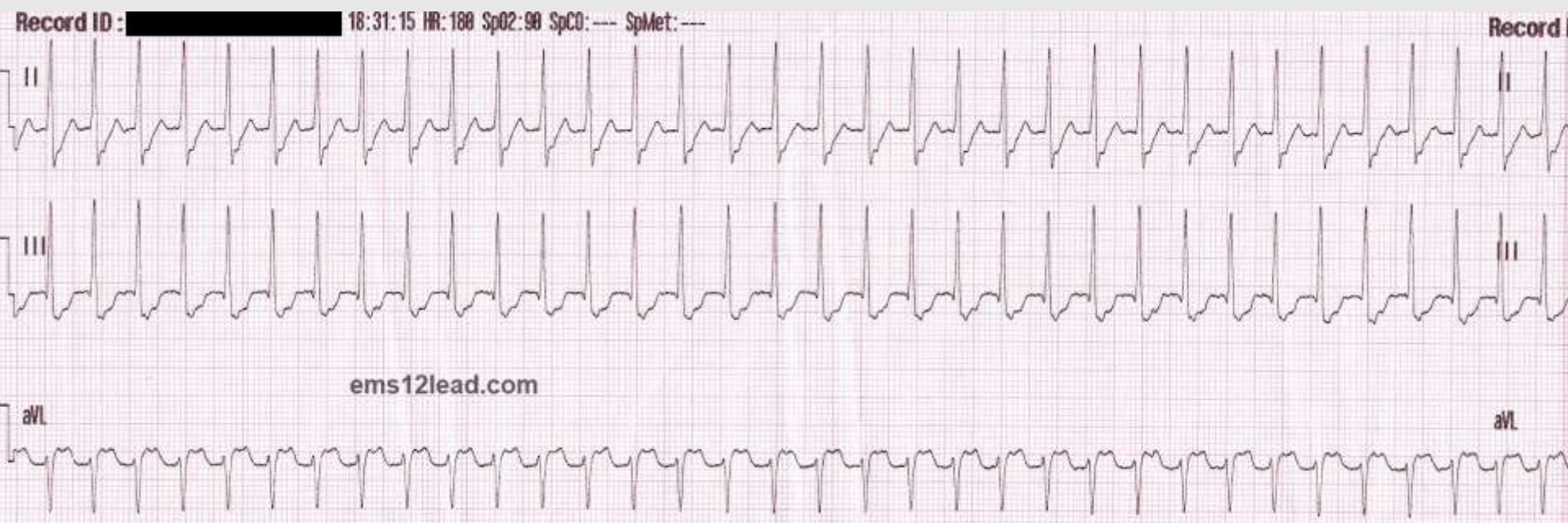
First dose: 150 mg over 10 minutes. Repeat as needed if VT recurs. Follow by maintenance infusion of 1 mg/min for first 6 hours.

Sotalol IV dose:

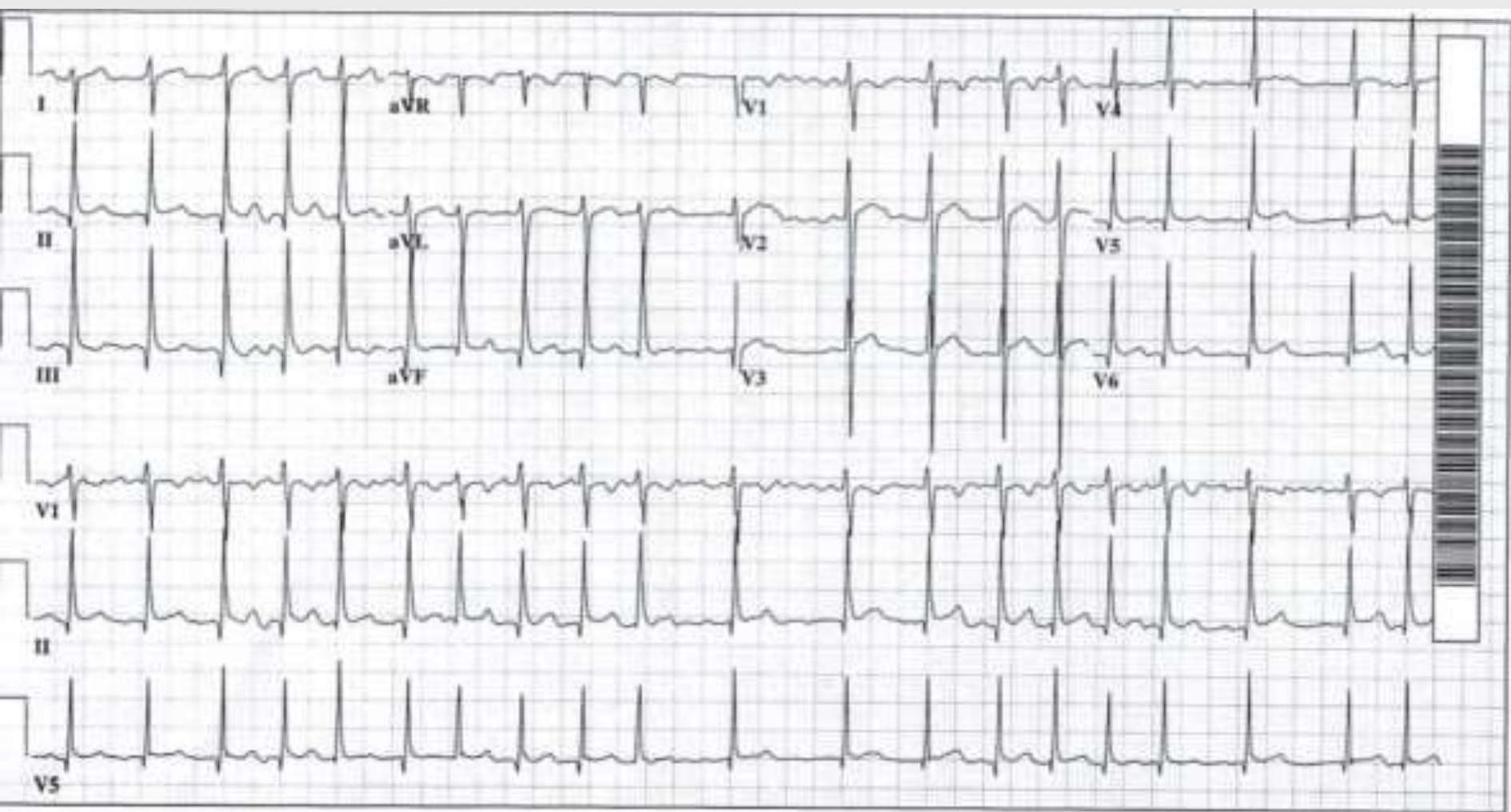
100 mg (1.5 mg/kg) over 5 minutes. Avoid if prolonged QT.



- **Regular narrow complex:**
 - adenosine
 - Ca-channel blocker or β -blocker
- **Irregular narrow complex:**
 - Ca-channel blocker or β -blocker
 - amiodarone
- **Regular wide complex:**
 - adenosine
 - Ca-channel blocker or β -blocker
 - antiarrhythmics: procainamide, amiodarone, sotalol
- **Irregular wide complex:**
 - antiarrhythmics: procainamide, amiodarone, sotalol
 - polymorphic VT, torsades de pointes: magnesium

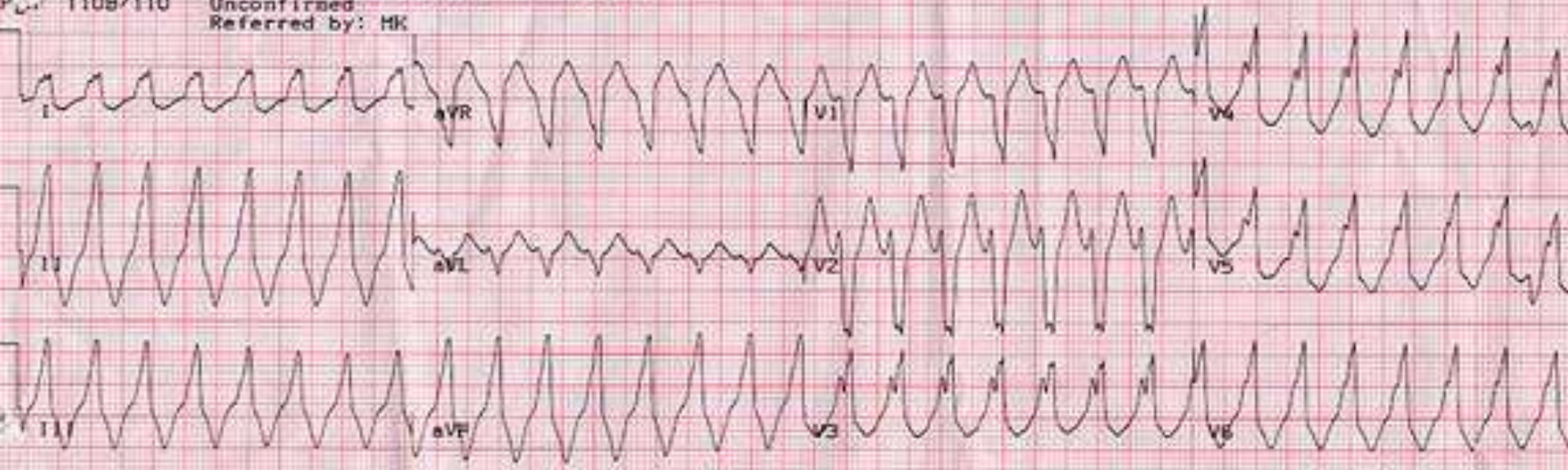


Regular narrow complex



Irregular narrow complex

45yr Ht: Ht: Med: Unknown
Sex: F Race: Cauc Loc: 23 Room: G1020
Option: 4 Vent. rate 106 BPH
Cart: 20 Tech: 4 PR interval * ns
 QRS duration 200 ns
 QT/QTc 320/560 ns
 P-R-T axes * 75 249
2 w/s 10mm/mV 100Hz
P 1108/110 Unconfirmed
 Referred by: HK

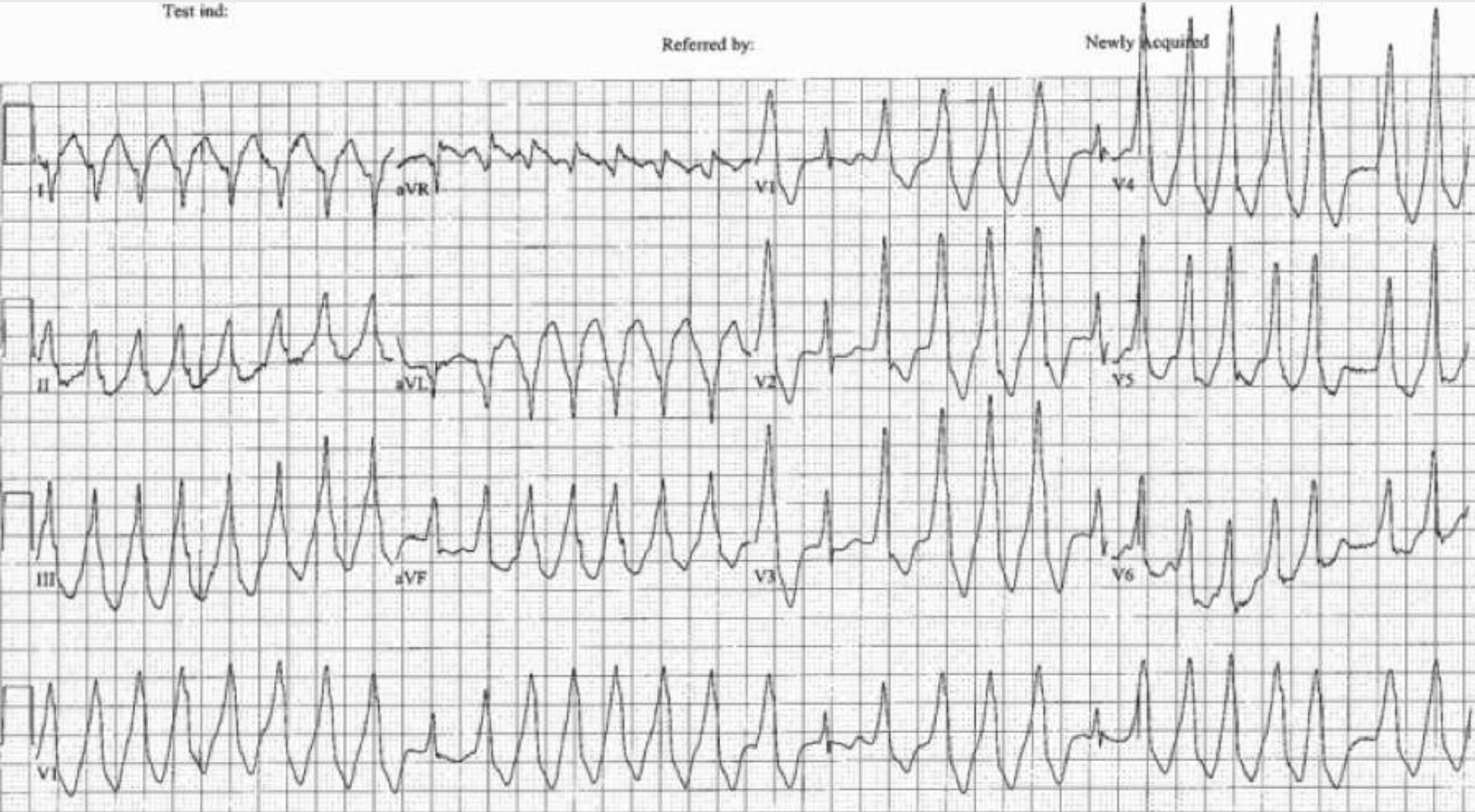


Regular wide complex

Test ind:

Referred by:

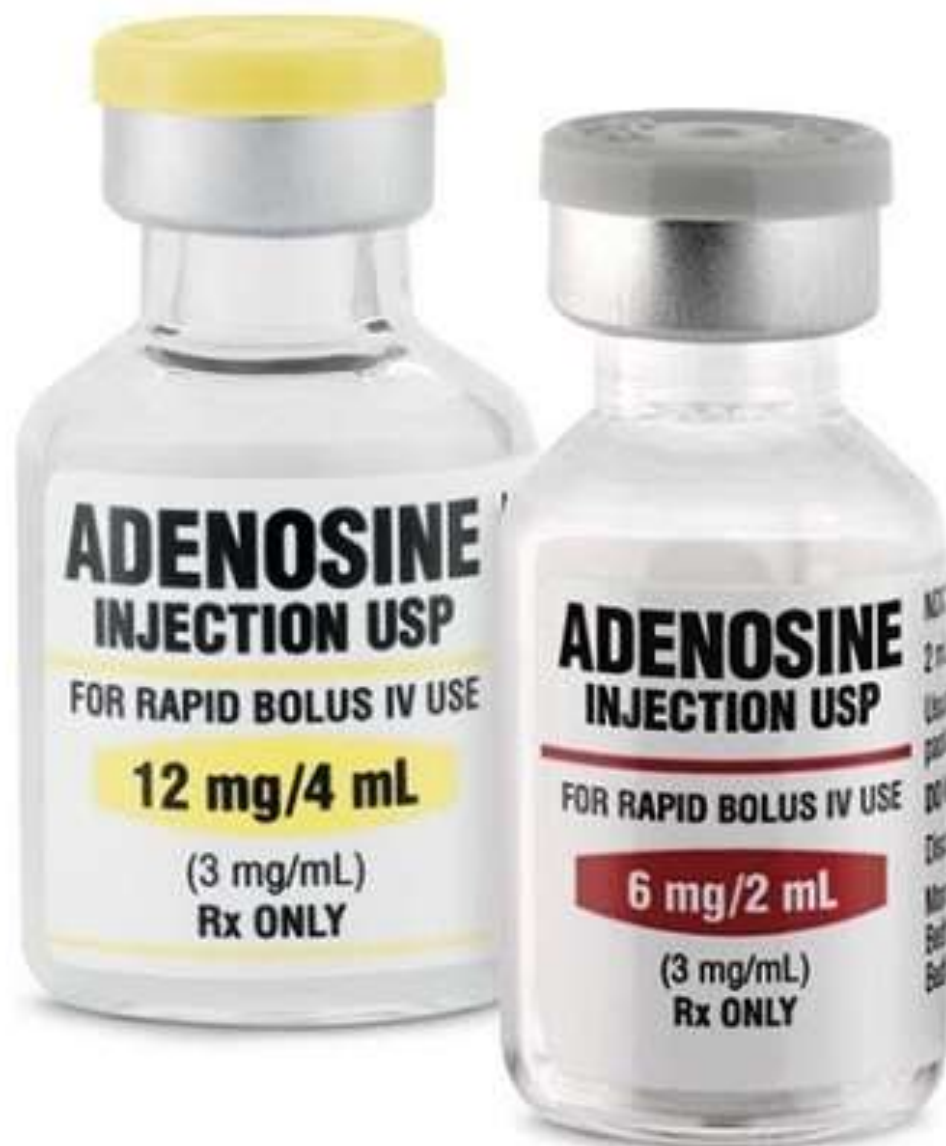
Newly Acquired



Irregular wide complex

Adenosine

- DOSAGE & ADMINISTRATION:
 - 6-12 mg IV into large proximal vein – fast
 - flush with 20 ml immediately, elevate limb
 - extremely short half life
 - may repeat 2nd & 3rd dose of 12 mg
 - larger doses (18 mg) , if theophylline or caffeine be used
 - smaller doses (3 mg) if dipyridamole or carbamazepine be used, or transplanted heart, or into a central vein
- Side effects:
 - chest discomfort, dyspnea, flushing
- Monitoring:
 - continuous ECG recording during administration



**ADENOSINE
INJECTION USP**

FOR RAPID BOLUS IV USE

12 mg/4 mL

(3 mg/mL)
Rx ONLY

**ADENOSINE
INJECTION USP**

FOR RAPID BOLUS IV USE

6 mg/2 mL

(3 mg/mL)
Rx ONLY

Diltiazem

- First choice for acute AF with RVR (rapid ventricular resp.)
 - DOSE & ADMINISTRATION:
 - bolus 15-20 mg IV push over 2 min (0.25 mg/kg)
 - repeat with 20-25 mg IV push over 2 min after 15 min (0.35 mg/kg)
 - IV infusion 5-10 mg/h, titrate up by 5 mg/h as needed
 - Monitor :
 - ECG , BP
- # diltiazem vials 5mg/ml



**DILTIAZEM
HCl INJECTION**

FOR DIRECT IV BOLUS
INJECTION AND
CONTINUOUS IV INFUSION

50 mg/10 mL

(5 mg/mL)

**DILTIAZEM
HCl INJECTION**

FOR DIRECT IV BOLUS INJECTION
AND CONTINUOUS IV INFUSION

125 mg/25 mL

5 mg/mL
Rx ONLY.

**DILTIAZEM
HCl INJECTION**

FOR DIRECT IV BOLUS
INJECTION AND
CONTINUOUS IV INFUSION

25 mg/5 mL

(5 mg/mL)

Verapamil

- DOSE & ADMINISTRATION:
 - 2.5-5 mg IV push over 2 min
 - repeat with 5-10 mg over 2 min after 15-30 min
 - max. total dose 20 mg
- Monitor:
 - ECG , BP

verapamil vials 2.5 mg/ml



4 mL Single-dose

VERAPAMIL

Injection, USP

10 mg (2.5 mg/mL)

Hospira, Inc., Lake Forest, IL 60045 USA

Esmolol

- DOSE & ADMINISTRATION:
 - 500 μ /kg IV push over 1 min (may repeat)
 - IV infusion 50 μ /kg/min for 4 min
 - titrate by 50 μ /kg/min every 4 min
 - max. 200 μ /kg/min
 - repeat in 10 min
- Monitor:
 - ECG , BP

esmolol vials 10 mg/ml



NDC 63323-652-10

605210

**ESMOLOL
HYDROCHLORIDE
INJECTION**

100 mg/10 mL

(10 mg/mL)

For Intravenous Use
Rx only

10 mL

Single Dose Vial

Preservative Free

Discard unused portion.
Do not add water for injection.
Do not use after the expiration date.

Procainamide

- Class 1a antiarrhythmic (Na channel blocker)
- DOSE & ADMINISTRATION:
 - IV infusion 20 mg/min
(alternate dosing: 100 mg IV over 2 min every 5 min)
 - continue until the arrhythmia is suppressed, or:
 - hypotension
 - QRS widens 50% beyond baseline
 - max. dose of 17 mg/kg
 - maintenance infusion 1-3 mg/min
- Monitor:
 - ECG, QT interval, pulse, BP

One/NDC 0409-1902-01

Rx only

10 mL

Multiple-dose

**PROCAINAMIDE
HYDROCHLORIDE**

Injection, USP

**1 gram/10 mL TOTAL
(100 mg/mL)**

Warning: Contains Metabisulfites

Hospira, Inc.
Lake Forest, IL 60045 USA



Amiodarone

- DOSE & ADMINISTRATION:
 - 150 mg IV over 10 min, repeat for recurrence
 - follow IV infusion 1 mg/min for 6 hours, then 0.5 mg/min IV for 18 hours
 - max. 2.2 g/24h
 - central line preferred
 - incompatible with Na-bicarbonate
- Monitor:
 - ECG, pulse, BP



Magnesium

- Torsades de pointes
- DOSE & ADMINISTRATION:
 - Mg-sulfate 50% vials : 1-2 g IV
 - dilute to 10 ml (NS)
 - administer over 5-20 min
 - maintenance infusion 0.5-1 g/h
- Monitor:
 - hypotension, respiratory & CNS depression



NDC 0517-2650-25

MAGNESIUM SULFATE

INJECTION, USP

50% (0.5 g/mL)

25 grams/50 mL

(4.06 mEq/mL Magnesium)

50 mL SINGLE DOSE VIAL

FOR IM USE

FOR IV USE AFTER DILUTION

Rx Only

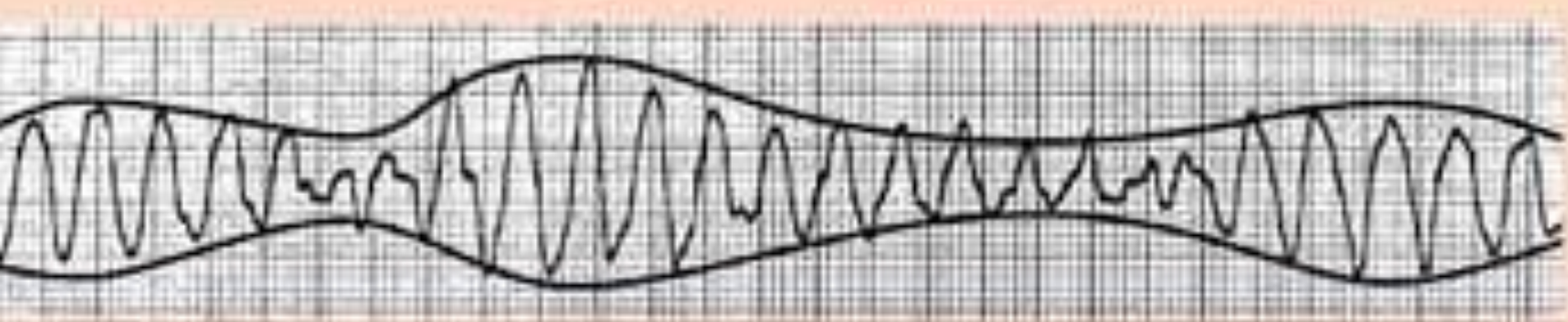
AMERICAN REGENT, INC.
SHIRLEY, NY 11967

Each mL contains
Sulfate (MgSO₄)
Water for Injection
pH adjusted with
and is Sodium
4.06 mEq/mL
Contains no preservatives
12.500 mg
WARNING:
SOLUTION FOR
UNUSUAL
20-25°C (68-77°F)
Consult package insert
Directions for use
Insert

Torsades de Pointes



outline looks like a party streamer



Thank
you

