Ventricular Fibrillation/ Pulseless Ventricular Tachycardia

SHOCK FIRST x 1
(If defibrillator not immediately available start CPR then shock ASAP)
200 J Biphasic, 360 J Monophasic
↓
High Quality CPR* x 2 min
(then rhythm and pulse check)
(Ventilate, IV/IO Access)
↓
SHOCK
↓
CPR x 2 min
(Intubate, Drugs-give during CPR)
Treat reversible causes
↓
EPINEPHRINE 1 mg IV (may be given after 1st or 2nd shock) (REPEAT Q 3-5 MIN)
↓
SHOCK
↓
CPR x 2 min

AMIODARONE 300 mg IV bolus (Preferred)
(may give 2nd dose 150 mg IV)

If Refractory VF:
LIDOCAINE 1.5 mg/kg IV
(REPEAT in 3-5 min) (Max. 3 mg/kg)

If Polymorphic VT: MAGNESIUM SULFATE 2 G IV
↓
SHOCK

*High Quality CPR: Push hard (2-2.4 inches) and fast (100-120/min), complete chest recoil, minimize interruptions, avoid excessive ventilations (10/min), change compressors q2min, monitor end-tidal CO2

Targeted Temperature Management (32-36°C) recommended for resuscitated v. fib. patients who remain comatose and intubated with a BP >90.

Treat Reversible Causes: hypovolemia, hypoxia, acidosis, K, hypothermia, toxins, ischemia
WIDE COMPLEX TACHYCARDIA  (Likely VT)

ASSESS ABC’S IF STABLE, O2, MONITOR, O2 SAT, VITALSIGNS (Hx, P/E, ECG, CXR)

Almost all Wide Complex Tachycardias are VT (85-95%)

Unstable
(Chest pain, SOB, LOC, low BP, CHF, AMI)

Stable
(consider cardioversion first, as meds only revert VT 30% of the time)

- **Procainamide**
  - 20-50 mg/min (max 17mg/kg)

  **OR**

- **Amiodarone**
  - 150 mg over 10 min (repeat x2 prn)
  - Infusion: 1 mg/min x 6 hrs, then 0.5 mg/min over 24 hrs
  - (Max: 2.2m in 24 hrs)

Prepare for cardioversion
Consider premedication

SYNCHRONIZED Biphasic: 100-150-200
CARDIOVERSION Monophasic: 200–300–360

If Ventricular Tachycardia is polymorphic (Torsades) consider: magnesium 2 gm, overdrive pacing, isoproterenol, Phenytoin, Lidocaine, amiodarone.

*Avoid giving multiple antidysrhythmics sequentially (to prevent proarrhythmias). If one antidysrhythmic fails, go to electrical cardioversion.

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PAROXYSMAL SUPRAVENTRICULAR TACHYCARDIA
(AVnRT, AVRT)

STABLE

VAGAL MANOEUVRES

Adenosine 6 mg IV over 3 seconds, may repeat 12 mg in 1-2 min (Class I)
- short 10 second half life and no effects on BP

or Diltiazem 20 mg IV over 2 min, may repeat 25 mg IV in 15 min (Class I)

Other options:
Metoprolol 5 mg IV, may repeat x 2: max 15 mg total (Class I)

or Verapamil 2.5 – 5 MG I.V. over 2 min, may repeat 5-10 mg in 10 minutes (Class I)

Others to consider:

Procainamide 30mg/min to 17/kg (Class IIa)
Amiodarone 150 mg over 10 min (Class IIa)

or

SYNCHRONIZED CARDIOVERSION (with premedication)
Monophasic:,100,200,300 j
Biphasic: 70, 100, 150 j
International ACLS Guidelines 2015

Atrial Fibrillation or Atrial Flutter *

<table>
<thead>
<tr>
<th>STABLE</th>
<th>UNSTABLE ←→ CARDIOVERSION</th>
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<tbody>
<tr>
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<td>-higher risk of stroke if a.fib/flutter&gt;48 hrs and patient not anticoagulated</td>
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</tbody>
</table>

1) **Control Heart Rate if > 120**

Narrow Complex

- Diltiazem 20 mg IV
- Verapamil 2.5-5mg IV¹
- Metoprolol 5 mg IV¹
- Amiodarone 150 mg over 10 min²
- Digoxin 0.5 mg IV

Wide Complex (WPW or BBB)

- Procainamide 30 mg/min to 17mg/kg²
- Amiodarone 150 mg over 10 min²

1) Do not use verapamil or metoprolol if LV function is known to be impaired (<40%).
2) Do not use amiodarone or procainamide if fibrillation or flutter present for > 48 hours as these medications may convert the rhythm back to sinus.

2) **Convert rhythm back to NSR**

- atrial flutter < 48 hours requires electrical cardioversion

A fib < 48 hours

- Cardiovert Electrically or with Drugs
- Procainamide (drug of choice for IV route)
- Amiodarone (less effective for acute conversion)
- Propafenone 600 mg po

A fib or flutter > 48 hrs duration

- 1) Anticoagulate x 3 weeks prior to and 4 weeks after cardioversion
- OR Heparinize, do TEE, cardiovert if no clot, or then anticoagulate x 4 wks post cardioversion

- 2) Long term rate control with beta or calcium channel blocker

Consider long term anticoagulation with recurrent episodes, if in high risk group for stroke: CHAD65 score 1 or greater: previous stroke or TIA, diabetes, CHF, age > 65, hypertension

*N.B. Medications are not effective in converting atrial flutter back to NSR and the treatment of choice is electrical cardioversion if < 48 hrs duration

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International ACLS Guidelines 2015

ELECTRICAL CARDIOVERSION ALGORITHM

INDICATIONS:
- RE-ENTRANT TACHYCARDIA should be > 150/min (with signs and/or symptoms)
- Ex. PSVT (it is uncommon to have to cardiovert a patient with SVT)
  ATRIAL FIBRILLATION
  ATRIAL FLUTTER
  VENTRICULAR TACHYCARDIA

CHECK:
- Use Sedation Guidelines if available
- Personnel: One to take care of airway, one for cardioversion
- IV LINE
- SUCTION
- O2 SAT
- B.V. MASK
- INTUBATION EQUIPMENT

SEDATE: APPROPRIATELY ex 1) Midazolam 1-5 mg, with or without Fentanyl 50-200 mcgm
  2) Propofol 50-150 mg IV
  3) Ketamine 0.25-1.5 mg/kg IV
  4) Etomidate 20 mg IV

SYNCHRONIZED CARDIOVERSION:

PSVT-ATRIAL FLUTTER Monophasic: 100 - 200 - 300 – 360 Joules
Biphasic: 50-100-150

V. TACH, A. FIB. Monophasic: 200 – 300 – 360 Joules
Biphasic: 100-200 joules
ASYSTOLE

ASYSTOLE SHOULD BE CONFIRMED IN TWO LEADS

Witnessed Arrest  →  NO  →  ACLS Futile
                      Consider pronouncing death

↓

Yes.

CONTINUE CPR
INTUBATE
ESTABLISH IV ACCESS
↓

CONSIDER POSSIBLE CAUSES
  - Hypoxia
  - Hyperkalemia
  - Hypokalemia
  - Acidosis
  - Drug Overdose
  - Hypothermia

EPINEPHRINE, 1 mg IV PUSH Q 3 – 5 MIN

↓

CONSIDER EARLY TERMINATION OF EFFORTS IF REVERSIBLE CAUSE NOT FOUND
PULSELESS ELECTRICAL ACTIVITY
PEA

Continue CPR

↓

Intubate, IV access

↓

TREAT REVERSIBLE CAUSES
(eg. cardioversion for shockable rhythms and pacing for bradycardias)
Perform cardiac ultrasound if available

↓

CONSIDER POSSIBLE CAUSES
(5 H’s and 5 T’s)

<table>
<thead>
<tr>
<th>Hypovolemia</th>
<th>Tablets (overdose)</th>
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<tbody>
<tr>
<td>Hypoxia</td>
<td>Tamponade, cardiac</td>
</tr>
<tr>
<td>Hydrogen ion-acidosis</td>
<td>Tension pneumothorax</td>
</tr>
<tr>
<td>Hyper/hypokalemia</td>
<td>Thrombosis, coronary</td>
</tr>
<tr>
<td>Hypothermia</td>
<td>Thrombosis, pulmonary*</td>
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↓

EPINEPHRINE 1 mg IV PUSH Q 3-5 MIN

*Cardiac Arrest and Suspected Pulmonary Embolus:
-Consider thrombolysis with tPA 0.6mg/kg bolus over 2 minutes.
BRADYCARDIA (SLOW H.R. < 60/MIN)

ASSESS ABC’S, O2, I.V. MONITOR

BRADYCARDIA (< 60/MIN)

SERIOUS SIGNS OR SYMPTOMS?

- Hypotension
- Chest pain, dyspnea, LOC
- CHF, acute MI

No Serious Signs or Symptoms

TYPE II 2º AV BLOCK
OR 3º AV BLOCK

NO

YES

OBSERVE

PREPARE FOR TRANSVENOUS PACING

↓

APPLY TRANSCUTANEOUS PACING PADS UNTIL TRANSVENOUS PACING AVAILABLE

YES: Serious Signs and Symptoms

ATROPINE 0.5 mg q 3-5 MIN
(MAX 3 mg) (0.04 mg/kg)
(atropine is not effective for 3º heart block with wide complex escape idioventricular rhythm)

- Transcutaneous Pacing
  (if available)
  (PREPARE FOR IV PACING)
  ↓
  OR
- DOPAMINE 2 – 10 microgm/kg/min
  OR
- EPINEPHRINE 2 – 10 microgm/min

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## RULE OF 250 FOR DRUG INFUSIONS

Mix one ampoule of any drug into 250 cc and run at:

<table>
<thead>
<tr>
<th>30 cc/hr</th>
<th>3 cc/hr</th>
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<tbody>
<tr>
<td><strong>Antiarrhythmics</strong></td>
<td><strong>Vasodilators</strong></td>
</tr>
<tr>
<td>Lidocaine (1 gm) 2 mg/min</td>
<td>Nitroglycerin (50 mg) 10 micgm/min</td>
</tr>
<tr>
<td>Procainamide (1gm) 2 mg/min</td>
<td>Nitroprusside (50 mg) 10 micgm/min</td>
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<tr>
<td>Mag S04 (5gm) 0.6 gm/hr</td>
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<tr>
<th><strong>Adrenergic agents</strong></th>
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<tr>
<td>Epinephrine (1mg) 2 micgm/min</td>
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<tr>
<td>Dopamine (200 mg) 5 micgm/kg/min (70 kg)</td>
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<tr>
<td>Dobutamine (250 mg) 7 micgm/kg/min (70 kg)</td>
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<tr>
<td>Norepinephrine (4mg) 8 micgm/min</td>
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Drugs Given By the Endotracheal Tube (2x the dose) **Note: The IV or Intraosseous route is preferred.**

N  naloxone
A  atropine
V  valium, ventolin, versed (midazolam)
E  epinephrine
L  lidocaine

**Chest Pain Nemonic**

M  morphine
O  oxygen
N  nitrates
A  aspirin
Anaphylaxis Algorithm

(Multisystemic involvement: respiratory distress, hypotension, airway swelling)

ABC

Cardiac Monitor (if available) plus 1 Litre NS bolus

0.3mL (0.3 mg) Epinephrine 1:1,000 IM (or 5-15 mcg/min IV-especially with shock) plus
- Diphenhydramine (Benadryl) 50 mg IV
- Ranitidine 50 mg IV
- Methylprednisolone (Solu-Medrol) 125 mg IV

*Never use SC Epinephrine due to inconsistent absorption. Administer IM, deltoid or thigh.

In patients on Beta-blockers, beware of poor response to epinephrine; use Glucagon 1 mg IV/IM instead.

If NO or INADEQUATE response after 5 minutes

Repeat IM Epinephrine 0.3 mg (.3ml) or continue IV infusion 5-15 mcg/min

If hypotension persists: Repeat 1 Litre NS bolus

If poor response after another 5 minutes,

CALL FOR BACK-UP (snr medical resident/anaesthesia/ or rapid response team)

Continue with IV fluids and epinephrine infusion

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CORE PHARMACOLOGY REFERENCE FOR ACLS

ADENOSINE
6 mg IV RAPID PUSH over 3 seconds.
May repeat at 12 mg IV and then another 12 mg IV if first dose is not effective.
IV rapid push always followed by 20 cc NS bolus. May repeat in 2-3 min.

AMIODARONE
300 mg IV push for cardiac arrest, and may then give 150 mg if initial dose is not effective. 150 mg IV over 8-10 min for VT, PSVT, Atrial Fibrillation/Flutter with either good or impaired LV function. After bolus, infusion should be started immediately at 1 mg/min for 6 hours, then 0.5 mg/min for 18 hours.

ATROPINE 0.5-1.0 mg IV fast push to max of 0.04 mg/kg 2-2.5 times IV dose down ETT in 10 ml NS. Drug should be given quickly to offset paradoxical effect (if given too slowly). Caution should be used in high level blocks.

CALCIUM CHANNEL BLOCKER
Diltiazem: 0.25 mg/kg slow IV push over 2 minutes, repeat dose of 0.35 mg/kg in 15-30 min
Verapamil: 2.5 -5mg IV push
Caution: Common calcium channel blocker side effects: Hypotension.
Do not use in WPW with AFib or where a delta wave or short PR is apparent, sick sinus syndrome, AV block, CHF or bundle branch block.

EPINEPHRINE 1 mg IV Q 3-5 min (no maximum ) 2-2.5 mg in 10 ml NS ET followed by hyperventilation when IV not available (Intermediate and high dose IV epinephrine treatment is not recommended.) Continuous infusion may be appropriate for symptomatic bradyarrhythmias.

LIDOCAINE 1-1.5 mg/kg and repeat at 0.5 - 0.75 mg/kg Q 5-10 min to max dose 3 mg/kg.
1.0 mg/kg for stable Ventricular Tachycardia. Maintenance infusion may be used after rhythm is successfully converted.

MAGNESIUM 1-2 g IV push diluted in 10 ml NS Give for known or suspected magnesium deficiency or for torsade des pointes. May cause rapid drop in BP. Caution in renal failure.

PROCAINAMIDE 20-30 mg/min IV dose to max of 17mg/kg then 1-4 mg/min as maintenance infusion (Can mix 100 mg at a time in a syringe to give over 5 min.). Class I antiarrhythmic that can be given as rapidly as 50 mg/min in urgent situations. Administer until: dysrhythmia is suppressed, QRS widens >50%, max dose reached, hypotension occurs--watch QT Interval. Has pro-arrhythmic effects as well! Maintenance infusion may be used after rhythm is successfully converted.

SODIUM BICARBONATE
1 mEq/kg IV and may repeat (half dose) in 10 min. Give for known metabolic acidosis, TCA or Barbiturate OD, long code endpoint.

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