

# Care for the Critically Ill COVID-19 Patient

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**Mount  
Sinai**

# Outline

- COVID-19 basics
- PPE donning / doffing
- COVID-19 unit workflow
- Recognizing / managing respiratory failure
- Shock / sedation management
- Cardiac arrest

# COVID-19 Basics

## ❑ Level of Care:

- Patients with confirmed COVID-19 with rapidly increasing O<sub>2</sub> requirements, non-rebreather, or NIV should be carefully monitored

## ❑ PPE (PUI & COVID-19 patients):

- In patient room: surgical facemask, face shield / goggles, isolation gown, gloves
- N95 (instead of surgical facemask) is used for aerosol-generating procedures (e.g., intubations, cardiac arrest, chest physiotherapy) and also in rooms with PUI/COVID+ patients on HFNC/BiPAP/mechanical ventilator
- Isolation gown: offers full protection against droplets; **same** gown can be worn when interacting with COVID-19 patients in isolation cohort (discard if visibly ripped or soiled)

## ❑ Patient Room:

- Isolation designation: special droplet + contact precautions
- If requiring frequent aerosolized procedures (e.g., HFNC, BiPAP), transfer to negative pressure room if available
- Cohorting is allowed for COVID-19 positive patients; NOT allowed for PUI (must be single room)

## ❑ Patient Visitors:

- No visitors
- Patients can video chat with family and friends using hospital smart tablets
- Daily phone calls to families by critical care team to provide medical updates

## ❑ Patient Transport:

- Necessity should be confirmed by MD prior to transport
- Non-intubated patients should wear a facemask, nasal cannula under facemask, or nonrebreather during transport
- Intubated patients should be transported with viral filter
- Staff transporting patient should wear a mask

## ❑ Personal clothing & equipment:

- Use ONLY disposable stethoscopes
- Clean personal devices, phone, pager frequently with rubbing alcohol

# COVID-19 Basics

## LABORATORY TESTING

- ❑ Obtain procalcitonin, LDH, CRP, ferritin in addition to routine testing
- ❑ In critically ill patients, consider arterial line to aid ABGs, blood draws, BP monitoring, minimize staff exposure

## IMAGING

- ❑ Consider utility of bedside and other imaging/diagnostic studies in context of personnel exposure and potential for equipment contamination
- ❑ Batch indications for CXR together (i.e., intubation, central line, NGT)
- ❑ Consider use of bedside ultrasound for evaluation of lung pathology and assessment for cardiomyopathy
- ❑ Limit use of CT scans when possible

## RESPIRATORY SUPPORT

- ❑ Limit use of aerosol-generating modalities whenever possible (e.g., nebulized medications)
- ❑ Use MDI instead of nebulized medications
- ❑ Supplemental oxygen if SpO<sub>2</sub> <92%
  - Nasal cannula and non-rebreather masks may be used as usual
  - A monitored trial of Non-Invasive Ventilation (HFNC & BiPAP with filter on exhalation port). Patient ideally would be in an airborne isolation room and HCP would use N95 instead of surgical mask for PPE
  - BiPAP should have a HEPA filter on exhalation port

# COVID-19 Basics

## **INTUBATION:**

- ❑ N95 instead of surgical mask, face shield, double gloves, gown, and hat
- ❑ Plan for rapid sequence intubation by experienced physician
- ❑ Minimize people in room during intubation to limit exposure

## **VENTILATOR MANAGEMENT**

- ❑ Initiate all patients on low tidal volume ventilation immediately (4-6cc/kg IBW)
- ❑ Goal SpO<sub>2</sub> no higher than 94%
- ❑ Consider moderate to high PEEP (minimize plateau) strategy
- ❑ If ventilator dyssynchrony or persistent high plateau pressures
  - ❑ Increase sedation to goal RASS -4/-5, then consider neuromuscular blockade
- ❑ If P/F <100: consider early prone position ventilation; Consider inhaled epoprostenol if persistently hypoxemic despite neuromuscular blockade
- ❑ ECMO team should be consulted when proning is being considered so team can be mobilized quickly if the patient declines

## **SEDATION:**

- ❑ May require more sedation (slower response because of donning PPE)
- ❑ Daily Spontaneous Awakening Trials with HCP in room

## OTHER PROCEDURES

- ❑ Consider
  - NGT at time of intubation to assess placement using same CXR
  - Arterial line to facilitate blood draws and reduce contact time
  - Central line if requiring pressors / difficult veins
- ❑ Procedures should be performed by an experienced physician (to minimize exposure)
- ❑ 2 providers (2 MDs or MD + RN) should be in the patient's room for the duration of the procedure
- ❑ If increased risk of aerosolization, use N95
- ❑ Non-disposable equipment (e.g. ultrasound) should be wiped down with hydrogen peroxide wipes in the room (>2min contact time). Repeat after exiting room.
- ❑ Avoid bronchoscopy unless absolutely necessary (high risk of aerosolization)

## HEMODYNAMIC MANAGEMENT

- ❑ Use multimodal assessment strategy (skin temp, capillary refill, lactate) to guide fluid resuscitation
- ❑ Conservative fluid strategy, keep net negative, avoid maintenance fluids
- ❑ Prefer buffered crystalloids over colloids/unbalanced crystalloids
- ❑ Target MAP 60-65 using levophed as first-line agent, and vasopressin if 2nd agent needed
- ❑ If shock with cardiac dysfunction despite IVF and levophed, add dobutamine or epinephrine
- ❑ If refractory shock or chronic steroid use, consider stress dose steroids (hydrocortisone 50mg q6h)
- ❑ Be mindful of the potential for development of cardiomyopathy in COVID-19 patients

# COVID-19 Basics

## PHARMACOLOGIC TREATMENT

- ❑ Acetaminophen for **fever** (no clear evidence that ibuprofen can make COVID-19 worse, can avoid if concerned)
- ❑ **Bacterial co-infection may occur**, treatment of bacterial pneumonia should be based on clinical suspicion (CAP or HCAP as appropriate). Consider stopping antibiotics after 48-72 hours if no evidence of infection
- ❑ **Viral co-infection is rare**, but may occur.
- ❑ **Nebulized medications** should be **avoided** whenever possible; **use MDI instead**
- ❑ Multiple clinical trials for experimental COVID-19 treatments, discuss with ID team

## CARDIAC ARREST

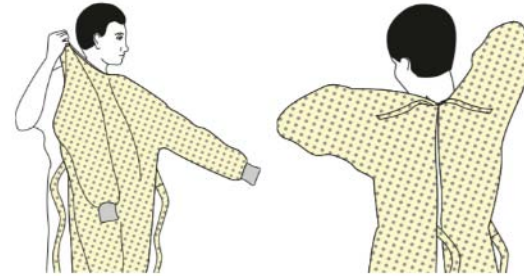
- ❑ Don PPE **before** entering room, **N95**, eye protection, **hat**, gown, **double** gloves; room door remains closed
- ❑ If patient is already intubated, perform CPR on VC mode with FiO<sub>2</sub> 100%
- ❑ Use automated external compression device (LUCAS) if available
- ❑ **Hold compressions during intubation** to minimize aerosolization

**PPE**



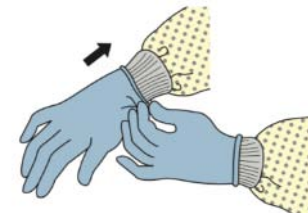
# Donning PPE

- Perform **hand hygiene**
- Don **yellow gown**
- Tie straps on the side of your body
- Put on **mask**
- Pinch nose to ensure tight fit



*If aerosolizing procedures or patient is intubated or on HFNC or BiPAP, use N95 instead of surgical mask*

- Put on **eye protection** (face shield or goggles)
- Put on **gloves**
- Make sure thumbs are in gown thumb hole
- Gloves over yellow gown so no skin exposed

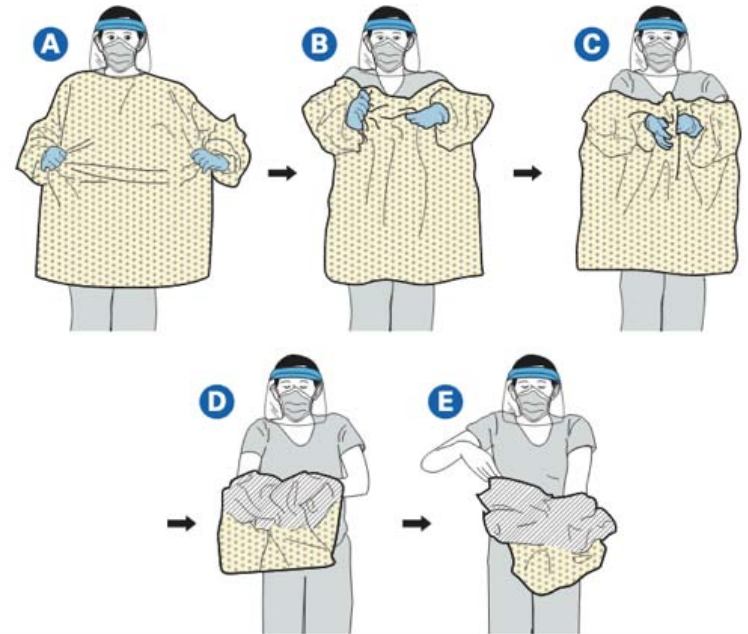


**Remember that your safety is paramount**  
**Even in a crash scenario, you should NEVER enter a room without appropriate PPE**



# Doffing PPE

1. Untie gown
2. Roll off gown **inside-out** into a bundle, peeling off **gloves** at the same time. (bare hands touch only the inside of gown)
3. Discard
4. Perform hand hygiene



# COVID-19 Unit Workflow

# COVID-19 Unit Admission

- Medication reconciliation of home meds
  - collateral from family/nursing homes/outpatient pharmacies/prior discharge meds
- Identify the health-care proxy and/or surrogates
  - confirm accurate phone numbers
  - obtain advance directives (if patient is incapacitated)
  - Document in an Advanced Care Planning note in the **Advanced Care Planning Tab**

# Pre-Rounding / Rounding in the COVID-19 unit

- ❑ Step 1:
  - Get **signout** from the overnight team on new admissions and major overnight events
  
- ❑ Step 2:
  - EPIC **pre-rounding** for vitals, labs, drips, blood gas, vent support required, new microbiology data, in's/out's
  - Make note of **trends** (e.g., increasing pressor or FiO2 requirement)
  
- ❑ Step 3
  - **Examine** patients

# Sample Presentation for Rounds

1. Overnight events
2. Vital signs: blood pressure and oxygenation should be reported in context of pressor dose and ventilator settings
3. Drips: vasopressors, sedatives, increasing/decreasing dose
4. Medications: antibiotics (day x of y), COVID-19 directed treatment

## **Example:**

*"Levophed increased to 18 mcg and vasopressin added to maintain MAP 65  
Ventilator settings are unchanged from yesterday (VC FiO2 70%, PEEP 14),  
maintaining similar oxygenation SpO2 92%; ABG 7.35, pCO2 50, PaO2 67  
Propofol increased to 40mcg/hr to achieve RASS -4 for ventilator synchrony"*

# **Recognizing and Managing Acute Hypoxemic Respiratory Failure**

# Recognizing Acute Hypoxemic Respiratory Failure

## Assessing Patient's Respiratory Status

- Vitals: Heart Rate, Respiratory Rate, SpO<sub>2</sub>
- Physical exam: grimacing, abdominal / accessory muscle use, tachypnea
- ABG: pH / pCO<sub>2</sub> / pO<sub>2</sub> / lactate, contextualize with amount of O<sub>2</sub> support

## Warning Signs of Respiratory Decompensation

- ❑ Rapidly escalating O<sub>2</sub> needs (e.g., room air --> 6L NC--> NRM over a few hours)
- ❑ Hypoxemia despite escalating O<sub>2</sub> therapy
- ❑ Respiratory distress: tachypnea, accessory muscle use, short sentences

## Non-invasive ventilation support

- ❑ A trial of Non-Invasive Ventilation (HFNC and BiPAP) can be given with close monitoring for lack of clinical improvement
- ❑ Patients with increased work of breathing or persistent hypoxia despite high level of non-invasive support should be intubated

Note that these patients have very little reserve and can decompensate QUICKLY  
BE VIGILANT AND ESCALATE YOUR CONCERNS EARLY



# General Intubation Principles

- ▶ Minimize exposure / aerosolization
  - Rapid Sequence Intubation by the most experienced provider
  - Minimal number of providers in the room (should be 2-3 at most)
  - Avoid: awake intubation, LMA use
- ▶ If possible, optimize patient / room before intubating
  - Pre-oxygenate
  - Ensure patient has reliable IV access, suction
  - RT sets up ventilator in room *before* intubation
  - Prepare medications and intubation equipment outside of room. Only bring in what is necessary

## Intubation Check List:

- Working IV, ideally two
- BVM ( $\pm$  PEEP Valve) on oxygen
- Waveform Capnograph on BVM
- Video Laryngoscope
- Backup Laryngoscope
- ET tube the size your plan to use and one size smaller
- ET tube stylet
- Oral airway
- Bougie
- LMA sized for the patient
- Suction
- NRB for pre-oxygenation
- Nasal Cannula for Apneic Oxygenation
- Paralytic (succinylcholine 1-1.5 mg/kg or rocuronium 1.2 mg /kg)
- Induction Agent (suggest ketamine 1-2mg/kg or etomidate)
- Flushes
- Post intubation sedation (hydromorphone or midazolam) (setup on PCA or pump)
- Orogastric tube
- Norepinephrine on pump only if needed
- Bolus dose of phenylephrine

# Ventilator Basics / Lung protective ventilation

## Ventilator Basics

- ❑ Goal: Support oxygenation and ventilation by improving O<sub>2</sub> & removing CO<sub>2</sub>
- ❑ Most patients will be on Volume Control (i.e., VC mode)
  - Oxygenation controlled by setting the FiO<sub>2</sub>, PEEP
  - Ventilation controlled by Tidal Volume (V<sub>t</sub>), Flow, Respiratory Rate

## Lung-Protective Ventilation Settings

- ❑ GOAL: SpO<sub>2</sub> > 90%, pH > 7.3, while minimizing ventilator induced lung injury
- ❑ **Low Tidal Volume.** Ideal Body Weight (IBW) x 6cc/kg  
e.g., 60kg IBW → tidal volume of 360cc
- ❑ **Respiratory Rate:** titrate based on pH / PCO<sub>2</sub>.  
e.g., if acidemic → increase RR to blow off CO<sub>2</sub>
- ❑ **FiO<sub>2</sub>:** Start with 100% and slowly wean down
- ❑ **PEEP:** Start with highest PEEP tolerated for plateau pressure ~30
- ❑ **Most patients will need to start at high vent settings**  
**e.g., 100% FIO<sub>2</sub> and PEEP >10**

Lower PEEP/higher FiO<sub>2</sub>

FiO <sub>2</sub>	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7
PEEP	5	5	8	8	10	10	10	12

FiO <sub>2</sub>	0.7	0.8	0.9	0.9	0.9	1.0
PEEP	14	14	14	16	18	18-24

A close-up look...

Actual output as measured by the ventilator. This is what the patient is doing.

Pressure-time and flow-time curves

Vent settings:

$f$  = respiratory rate

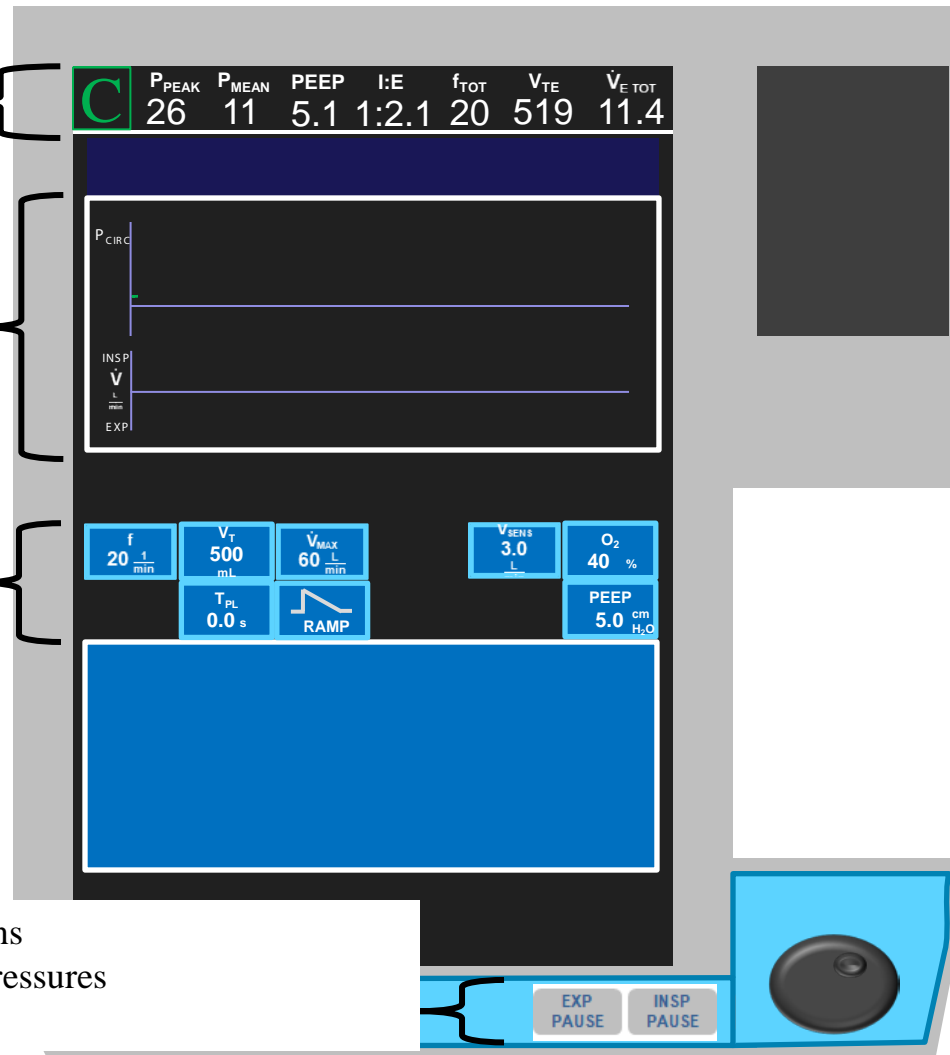
$V_t$  = Tidal volume

$V_{max}$  = Flow in Liters per minute

Inspiratory and expiratory hold buttons

Inspiratory pause measures plateau pressures

Expiratory pause measure autoPEEP



#### Lower PEEP/higher FiO<sub>2</sub>

FiO <sub>2</sub>	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7
PEEP	5	5	8	8	10	10	10	12

## Oxygenation Goals

- ❑ SpO<sub>2</sub> 88-94%, PaO<sub>2</sub> ≥ 55
- ❑ Preferentially wean FiO<sub>2</sub> before weaning PEEP, per the ARDS Network PEEP ladder
- ❑ **e.g., FiO<sub>2</sub> must decrease to 50% before you can wean PEEP down to 8**

FiO <sub>2</sub>	0.7	0.8	0.9	0.9	0.9	1.0
PEEP	14	14	14	16	18	18-24

## Management of Refractory Hypoxemia

- ❑ Neuromuscular blockade to rest their lungs completely
- ❑ P/F <100: Prone position ventilation
- ❑ P/F < 80: ECMO evaluation
- ❑ Inhaled epoprostenol or inhaled nitric oxide therapy

# Evaluating / managing a desaturating intubated patient

- ❑ Confirm a good SpO<sub>2</sub> waveform
- ❑ Make sure vent is connected
- ❑ Increase FiO<sub>2</sub> to 100%
- ❑ Check peak inspiratory pressure / plateau pressure
- ❑ Lung ultrasound to evaluate for lung sliding and other pathology
- ❑ If decide to bag valve mask:
  - ❑ Endotracheal tube must be connected to a HEPA filter
  - ❑ You must be use N95 respirator

# Shock & Sedation

# Shock

- ❑ Adequate volume resuscitation?
  - ❑ If net negative: assess fluid responsiveness with small bolus (e.g., 250cc)
  
- ❑ If  $MAP < 65$  despite adequate resuscitation → vasopressor
  - First line: Norepinephrine
  - Second line: Vasopressin (e.g., norepinephrine  $> 20$  mcg/min)
  - Avoid dopamine – increase risk of arrhythmias
  
- ❑ If norepinephrine dose  $> 15$  mcg/min, can add stress dose steroids
  - ❑ Hydrocortisone 100mg bolus, then 50mg q6h
  - ❑ +/- Fludrocortisone



# Sedation of Intubated COVID-19 patients

- ❑ If having ventilator dyssynchrony +/- hypoxemic
  - Sedate heavily (goal RASS -4/-5)
- When oxygenation improves and patient is a candidate for spontaneous breathing trials (SBT) → lighten goal RASS to -1 to 0 (alert awake)
- ❑ Sedatives
  - ❑ Propofol
  - ❑ Opiates: Fentanyl/Dilaudid
- ❑ If agitated delirium during SBT --> consider dexmedetomidine (Precedex)
- ❑ Avoid if possible: Benzodiazepines
  - Versed is least preferred due to delirium, however may be needed for adjunctive therapy if propofol / dilaudid is insufficient or having adverse reaction from either

# Aside from Vents, Pressors, Sedation...

The hallmark of good critical care medicine is attention to preventable harms, which include:

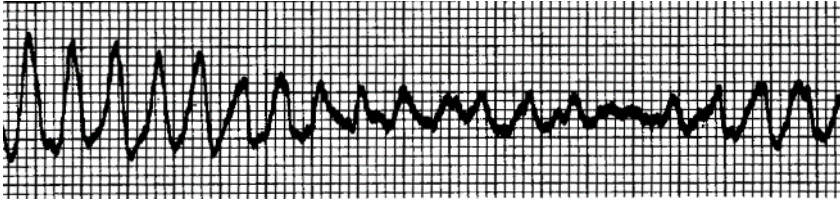
- DVT prophylaxis
  - lovenox or subcutaneous heparin
- GI prophylaxis for patients on mechanical ventilation
  - H2 blocker or PPI
- Antibiotic, lines, catheter de-escalation – consider daily
- Early enteral nutrition with tube feeds
- Glycemic control (goal FSG 120-180)
- Net even or net negative fluid balance once adequately volume resuscitated
- Bowel movements on opioids

# Cardiac Arrest

# Cardiac Arrest of the COVID-19 patient

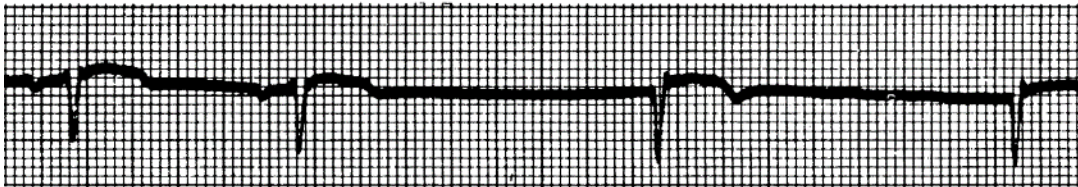
- ❑ Assign code team roles at the beginning of the shift
- ❑ Do not enter room until donned in proper PPE
  - ❑ **N95**, eye protection, gown, hat, gloves
- ❑ Minimize number of staff in room (up to 5 total)
  - ❑ Code leader : MD
  - ❑ Medication administrator / log keeper : RN
  - ❑ If no LUCAS, chest compressions: 2 RN or MD's
  - ❑ If patient requires intubation: RT
- ❑ Outside room
  - ❑ Two staff members to retrieve medications / supplies, observe for PPE breach
- ❑ Airway
  - ❑ If already intubated: put on VC mode, FiO2 100%
  - ❑ If not intubated:
    - ❑ BVM: ensure proper seal, must have HEPA filter
    - ❑ hold compressions during intubation to minimize exposure

# Ventricular Fibrillation



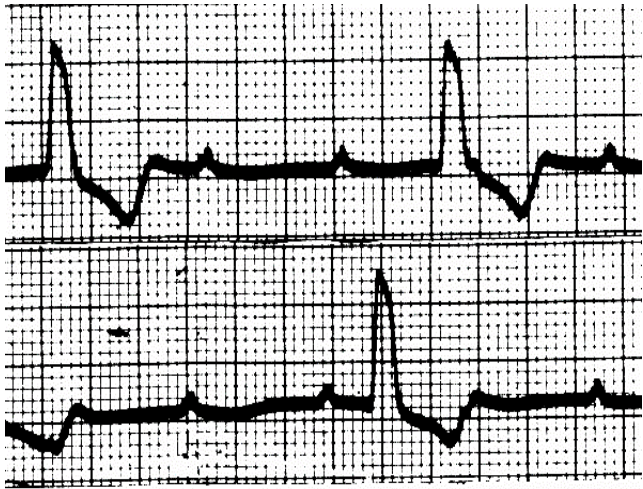
- Start CPR immediately
- Defibrillate as soon as possible
- Epinephrine, 1 mg Q3 min
- Antiarrhythmic agents-Amiodarone 300 mg followed by 150 mg

# Pulseless Electrical Activity and Asystole



- Search for reversible causes H's and T's
- Epinephrine, 1 mg Q3 min

## Bradycardia



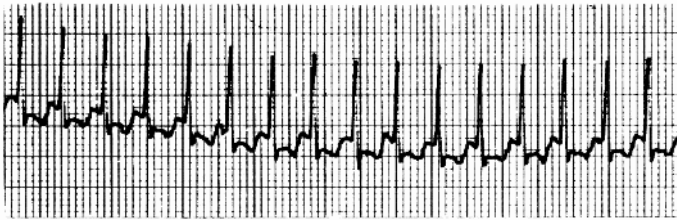
- Transthoracic/Transvenous pacing
- Atropine
- Epinephrine

## Stable Narrow Complex Tachycardia



- Vagal maneuvers
- Adenosine
- Diltiazem
- $\beta$ -Blocker

# Unstable Tachycardia



- Initiate immediate cardioversion if the patient is unstable
- Use synchronized mode
- Premedicate if possible

# Stable Wide Complex Tachycardia



- Amiodarone
- Magnesium (for torsades)
- Cardioversion