WVU Critical Care & Trauma Institute

Didactic Presentation

Intended Audience:

Residents

Medical Students

Definition and Work up of Cardiac Arrest

Created by: Paul McCarthy, MD

Objectives

- Define cardiac arrest
- Discuss etiologies and epidemiology of cardiac arrest
- Discuss “shockable” heart rhythms
- Discuss advanced cardiac life support

Cardiac Arrest

- Abrupt and complete cessation of effective circulation
- Encompasses many underlying diseases and conditions

Causes of Cardiac Arrest

- Coronary ischemia
- Cardiomyopathies
- Structural heart lesions
- Electrical conduction abnormalities
- Metabolic disturbances
- Toxic ingestions
- Other non cardiac conditions

Reversible Causes

- **H**'s
  - **H**ypovolemia
  - **H**ypoxia
  - **H**ydrogen ions (Acidosis)
  - **H**yperkalemia or Hypokalemia
  - **H**ypothermia
  - **H**ypoglycemia or **H**yperglycemia

Reversible Causes

- **T**'s
  - **T**ablets or **T**oxins
  - Cardiac **T**amponade
  - **T**ension pneumothorax
  - **T**hrombosis (myocardial infarction)
  - **T**hromboembolism
  - **T**rauma

Epidemiology of Cardiac Arrest

- > 500,000 adult arrests/year in USA
- 325,000 out-of-hospital
  - 10% survival
  - 30% survival with bystander CPR
- 200,000 in-hospital
  - 20% survival
- Risk increases with age
- 57% men

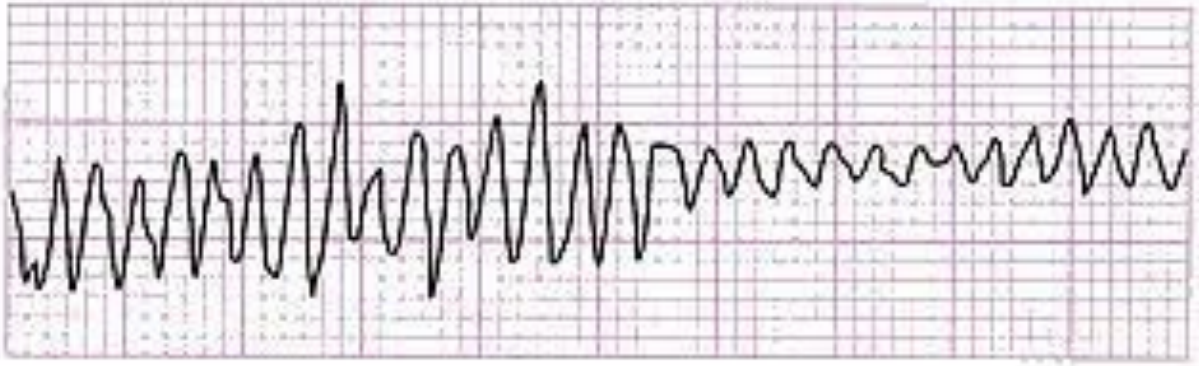
Risk Factors for Cardiac Arrest

- Age
- Smoking and substance abuse
- Hypertension
- Hyperlipidemia
- Obesity
- Diabetes
- Family history

Initial Cardiac Rhythm

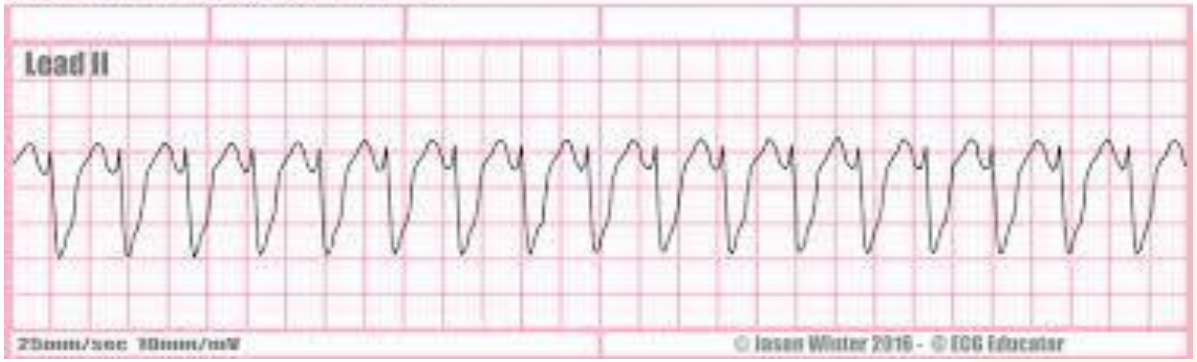
- Ventricular fibrillation (17%) or Ventricular tachycardia (7%)
  - > 30% survival
  - “Shockable rhythm”
- PEA (37%)
  - 10% survival
- Asystole (39%)
  - 10% survival
- 75% of survivors of cardiac arrest have shockable rhythm

Chugh Prog Cardiovas Dis 2008

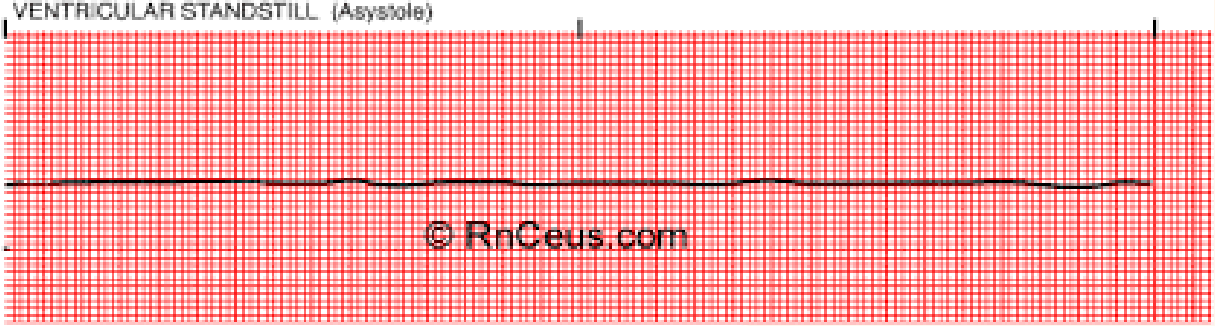


Ventricular Fibrillation

Ventricular Tachycardia (VT)



VENTRICULAR STANDSTILL (Asystole)



Presentation

- Unresponsive
- Pulseless
- Apneic or agonal breathing

Assessment

- Is there a pulse?
  - 10 seconds (carotid)
  - If no pulse start CPR
- CAB (chest compression, airway, breathing)
- Airway/breathing second

Advanced Cardiac Life Support

- American Heart Association and International Liaison Committee on Resuscitation
- Updated guidelines early five years
- Algorithms
- CPR
- Defibrillation
- Medications
- Targeted temperature management

ACLS: Principles and Practice. Dallas: American Heart Association. 2015

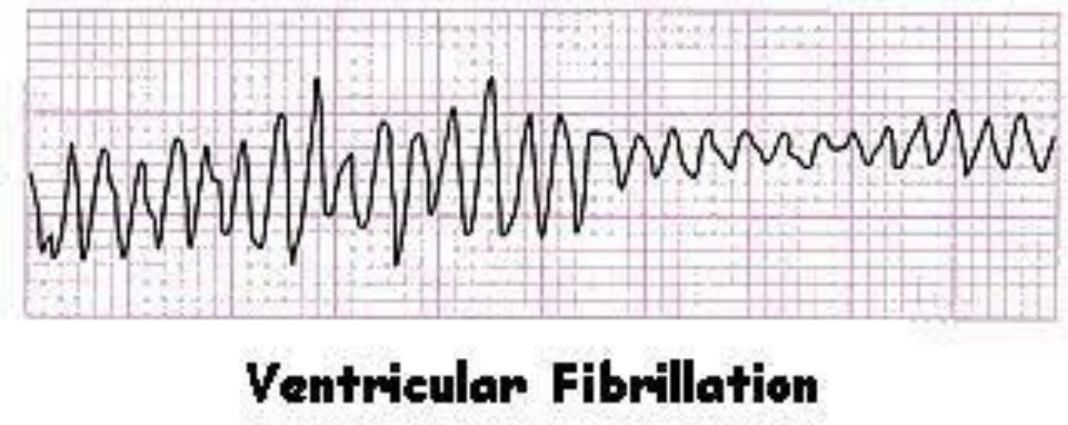
Optimizing Survival High-Quality CPR

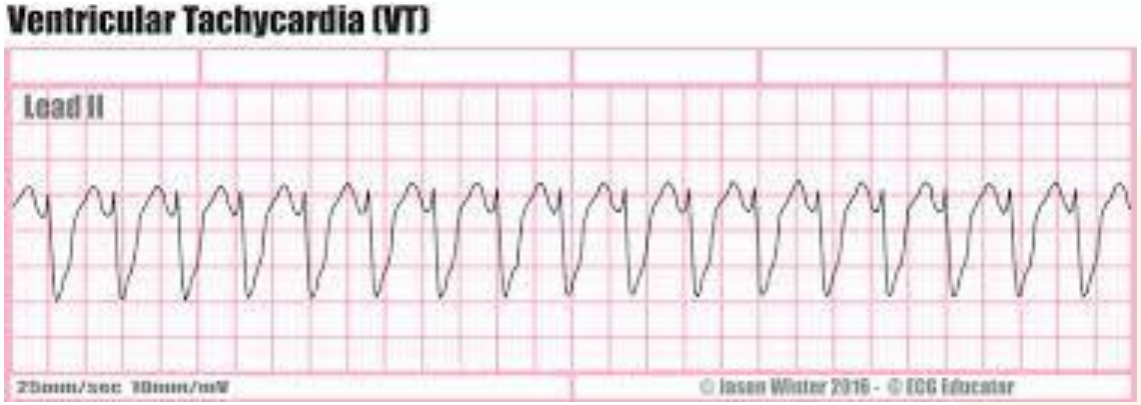
- Rate: 100– 120 compressions/minute
- Depth: 4 – 5 cm
- Continuity: CPR at least 60% of resuscitation time
- Recoil: Allow full chest recoil
- Avoid hyperventilation

Circulation 2000

Early Defibrillation

- Defibrillation
- Shockable rhythms
- Time sensitive





Google Images

Medications

- "Standard"
  - Epinephrine
  - Lidocaine
  - Amiodarone
- "Non-standard"
  - Sodium bicarbonate
  - Calcium
  - Vasopressin
  - Methylprednisolone
  - Thrombolytics
  - Naloxone
  - Atropine
- Individualized approach

Medscape 2018

Targeted Temperature Management (TTM)

- Neuroprotective mechanisms of hypothermia
  - Preserves cell metabolism
  - Suppresses inflammation
  - Increases growth factor expression
- Fever associated with worse outcomes
- Evolution on who, when, how to manage temperature
- Current AHA guidelines for comatose patients after return of spontaneous circulation (ROSC)
  - Maintain 32 – 36 degrees C for at least 24 hours

Nature Reviews 2012
AHA Guideline 2015

Chain of Survival

- Early recognition
- Early CPR
- Early defibrillation
- Early advanced care
- Early post-resuscitation care

Improving Outcomes

- Community education and access to defibrillators
  - < 1 in 5 Americans trained in CPR
  - Community defibrillation saves 40,000 lives a year
- Code and rapid response teams
- Advanced directives
- Access to definitive care
  - Revascularization
  - Critical care
  - Electrophysiology

Do Not Resuscitate (DNR)

- In USA and most countries recognized
- Poor prognosis
  - Advanced age
  - Longer duration of CPR
  - “Non-shockable” rhythm
  - Co-morbidities
  - Unwitnessed out-of-hospital arrest

Case 1

A 60 year old male with diabetes is admitted to the hospital for chest pain. After several hours on the floor he suddenly becomes unresponsive and falls to the floor.

- What are some possible causes for this event?
- What should be done to manage this patient?
- Give examples of reversible causes if cardiac arrest?

Case 2

A 19 year old male was found unresponsive at a party at his university.

- What should be done at this point?

He is examined by a nurse who reports he is in cardiac arrest.

- What should be done at this point?

Case 3

A 86 year old male with diabetes, coronary artery disease, dementia, and a new abdominal mass suspicious for cancer has recently had his code status changed to DNR by his daughter who is his power of attorney. He lives in a nursing home and is found unresponsive in his room by a new caregiver.

- Should CPR be performed?
- What if his granddaughter is present and insists on CPR?
- What factors would contribute to his prognosis if CPR was performed?

Case 4

A code is called for a patient in your ICU. The rhythm below is seen on the monitor. Should defibrillation be performed?

- What can be done to revive this patient?
- What is the patient's overall prognosis?

Question 1

A patient has an in-hospital cardiac arrest and after 25 minutes of high-quality CPR there is a return of spontaneous circulation (ROSC). The patient is comatose but maintaining hemodynamic stability. Which of the following is true regarding Targeted Temperature Management (TTM)?

A. Current guidelines discourage this practice

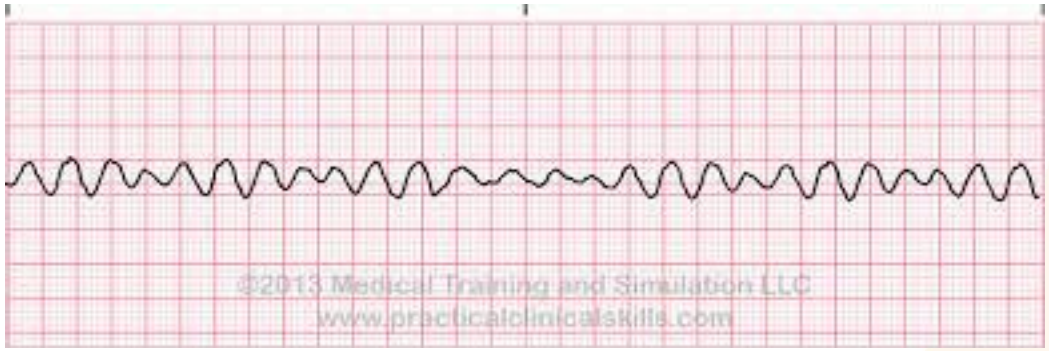
B. Current guidelines suggest maintaining a temperature of less than 32 degrees C for at least 48 hours

C. TTM should only be used after an asystole arrest

D. Current guidelines suggest maintaining a temperature of 32 – 36 degrees C for at least 24 hours

Question 2

A 66 year old male with diabetes, chronic kidney disease and hypertension is admitted to the hospital with atypical chest pain and pneumonia. He becomes unresponsive with no pulse. CPR is begun and the following heart rhythm is seen on his monitor:



What should be done early in the treatment algorithm?

A. Begin Targeted Temperature Management (TTM) with a goal of 32 degrees C immediately
B. Continue CPR with no additions to treatment
C. Start a sodium bicarbonate infusion
D. Defibrillate

Definition and Work up of Cardiac Arrest

- Questions?

- Thank you for your time.