Introductory Course Fourth Year

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- Introduction.
- Basic Life Support (BLS).
- Advanced Cardiac Life Support (ACLS).

- Cardiovascular diseases (CVDs) are the number one cause of death globally: more people die annually from CVDs than from any other cause.

- An estimated 17.3 million people died from CVDs in 2008, representing ***30% of all global deaths***.

- Of these deaths, an estimated 7.3 million were due to coronary heart disease and 6.2 million were due to stroke.

- Low- and middle-income countries are disproportionally affected: over 80% of CVD deaths take place in low- and middle-income countries and occur almost equally in men and women.

- The number of people who die from CVDs, mainly from heart disease and stroke, will increase to reach 23.3 million by 2030.

- ***CVDs are projected to remain the single leading cause of death.***

Sudden Cardiac Death

- Sudden cardiac death (SCD) accounts for up to 50% of cardiovascular-related deaths in the United States and other developed countries.
- By definition, *SCD refers to* the acute and natural death from cardiac causes within a short period (often within an hour of onset of symptoms).

- The time and mode of death are unexpected, and often death occurs in patients without any prior potentially fatal conditions.
- Most cases of SCD are associated with underlying cardiac arrhythmias; however, other causes have been identified.

- Epidemiology:
- SCD causes an estimated 300,000 to 400,000 deaths annually.
- Structural coronary arterial abnormalities and their consequences cause 80% of the fatal arrhythmias associated with SCD.

- Recordings during episodes of SCD have shown an underlying rhythm of ventricular tachycardia (VT), ventricular fibrillation (VF), or VT degenerating into VF in 85% of cases.
- In other studies, bradyarrhythmia was the underlying rhythm in 16% of patients who died suddenly.

- The incidence of SCD is higher among men than women. The incidence also increases with age.
- In older patients, SCD occurs most often with reduced left ventricular function and symptomatic heart failure.
- Only 5% to 15% of cardiac arrest patients are successfully resuscitated and discharged from the hospital without any associated neurologic deficits.

- Survival from SCD often depends on immediate cardiopulmonary resuscitation and the availability and use of automated external defibrillators (AEDs).
- The American Heart Association recommends the placement of AEDs in public locations, where an average of one cardiac arrest occurs every 5 years.

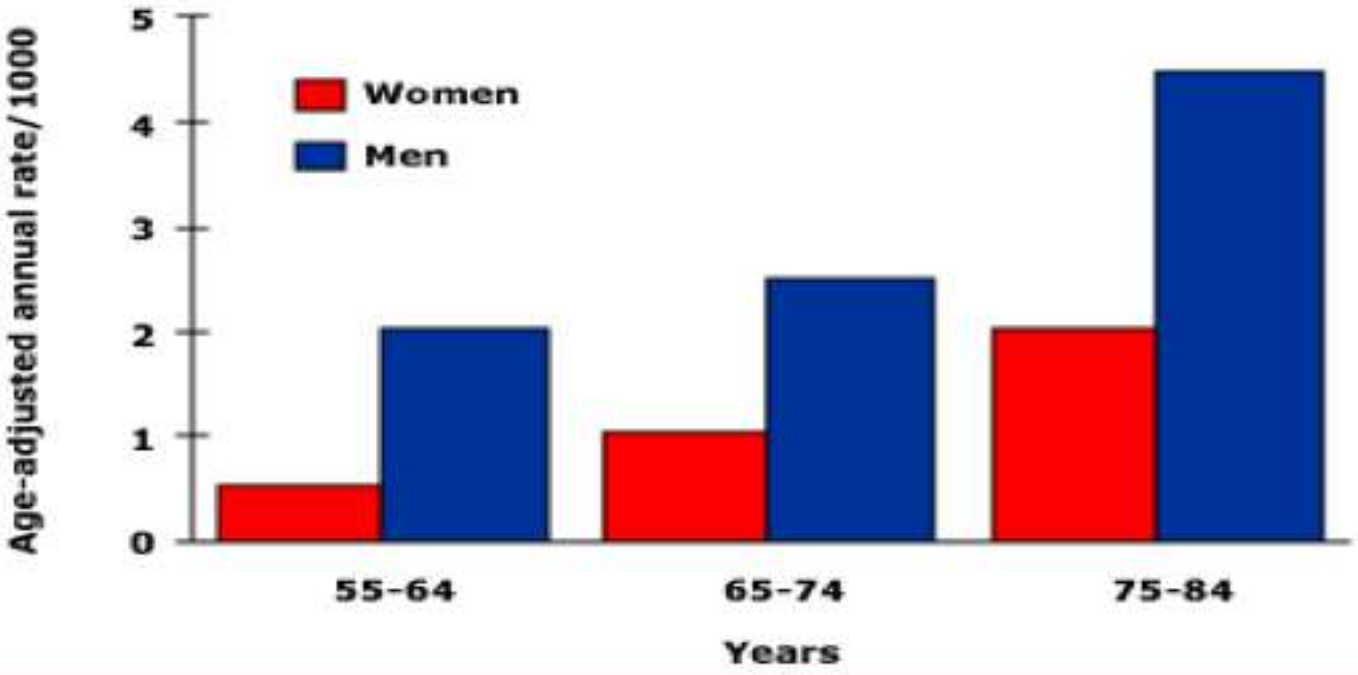

PULL
PULL
HEARTSTART
PHILIPS
PHILIPS

Major causes of sudden cardiac death

Ischemic heart disease
Coronary artery disease with myocardial infarction or angina
Coronary artery embolism
Nonatherogenic coronary artery disease (arteritis, dissection, congenital coronary artery anomalies)
Coronary artery spasm
Nonischemic heart disease
Hypertrophic cardiomyopathy
Dilated cardiomyopathy
Valvular heart disease
Congenital heart disease
Arrhythmogenic right ventricular dysplasia
Myocarditis
Acute pericardial tamponade
Acute myocardial rupture
Aortic dissection
No structural heart disease
Primary electrical disease (idiopathic ventricular fibrillation)
Brugada syndrome (right bundle branch block and ST segment elevation in leads V1 to V3)
Long QT syndrome
Preexcitation syndrome
Complete heart block
Familial sudden cardiac death
Chest wall trauma (commotio cordis)
Noncardiac disease
Pulmonary embolism
Intracranial hemorrhage
Drowning
Pickwickian syndrome
Drug-induced
Central airway obstruction
Sudden infant death syndrome

- ***Atherosclerotic coronary artery disease is the leading cause of SCD.***
- Studies have shown that 40% to 86% of patients who survived SCD, depending on the age and sex of the population, had coronary vessels with more than 75% cross-sectional stenosis.

Incidence of sudden death in men and women increases with age



During a 38 years follow-up of subjects in the Framingham Heart Study, the annual incidence of sudden death increased with age in both men and women. However, at each age, the incidence of sudden death is higher in men than women.

Data from Kannel, WB, Wilson, PWF, D'Agostino, RB, et al, Am Heart J 1998; 136:205.

Advanced Cardiac Life Support

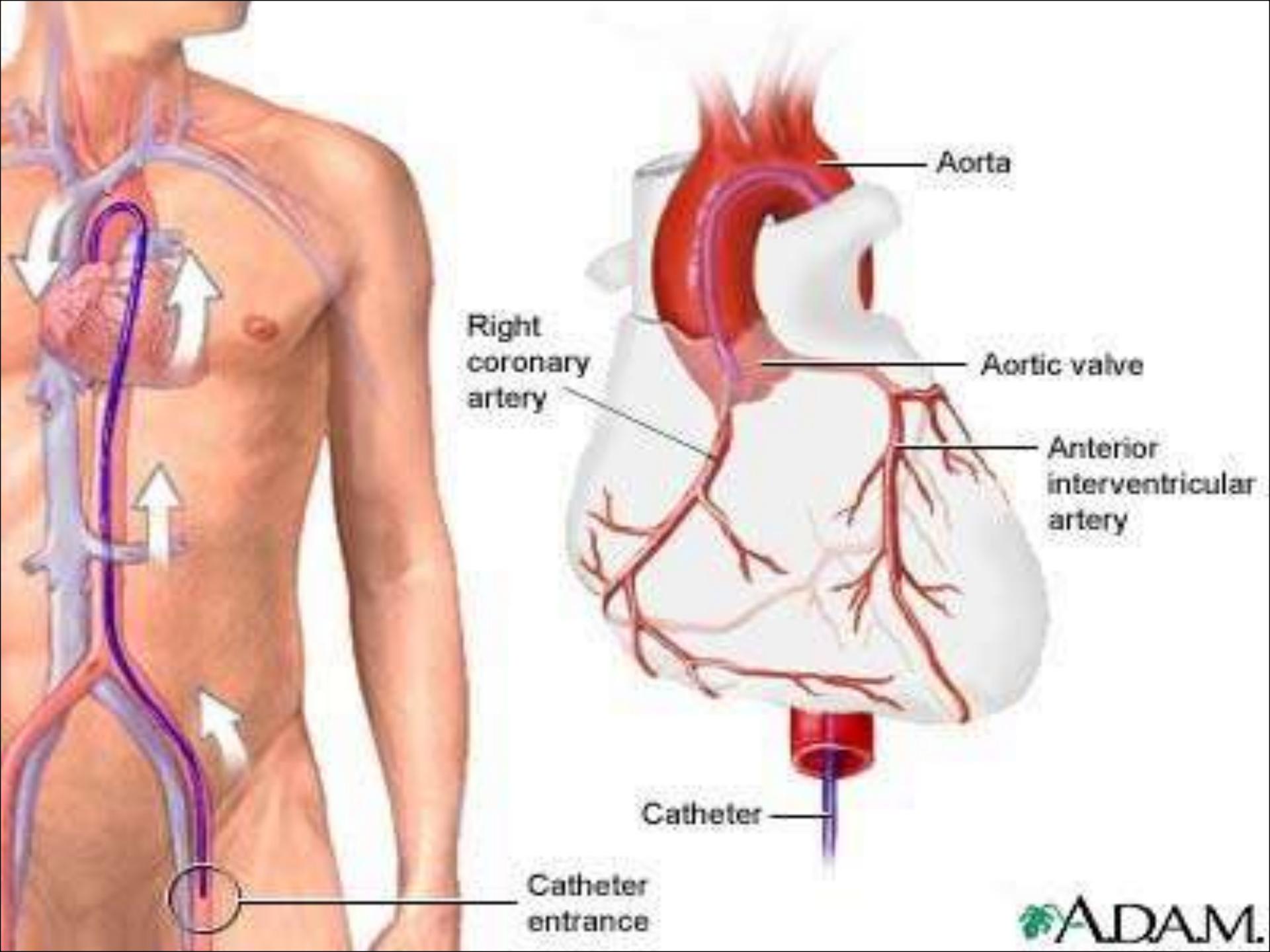
- Acute Coronary Syndromes and Stroke.
- Cardiac Arrest, Arrhythmias, and Their Treatment.

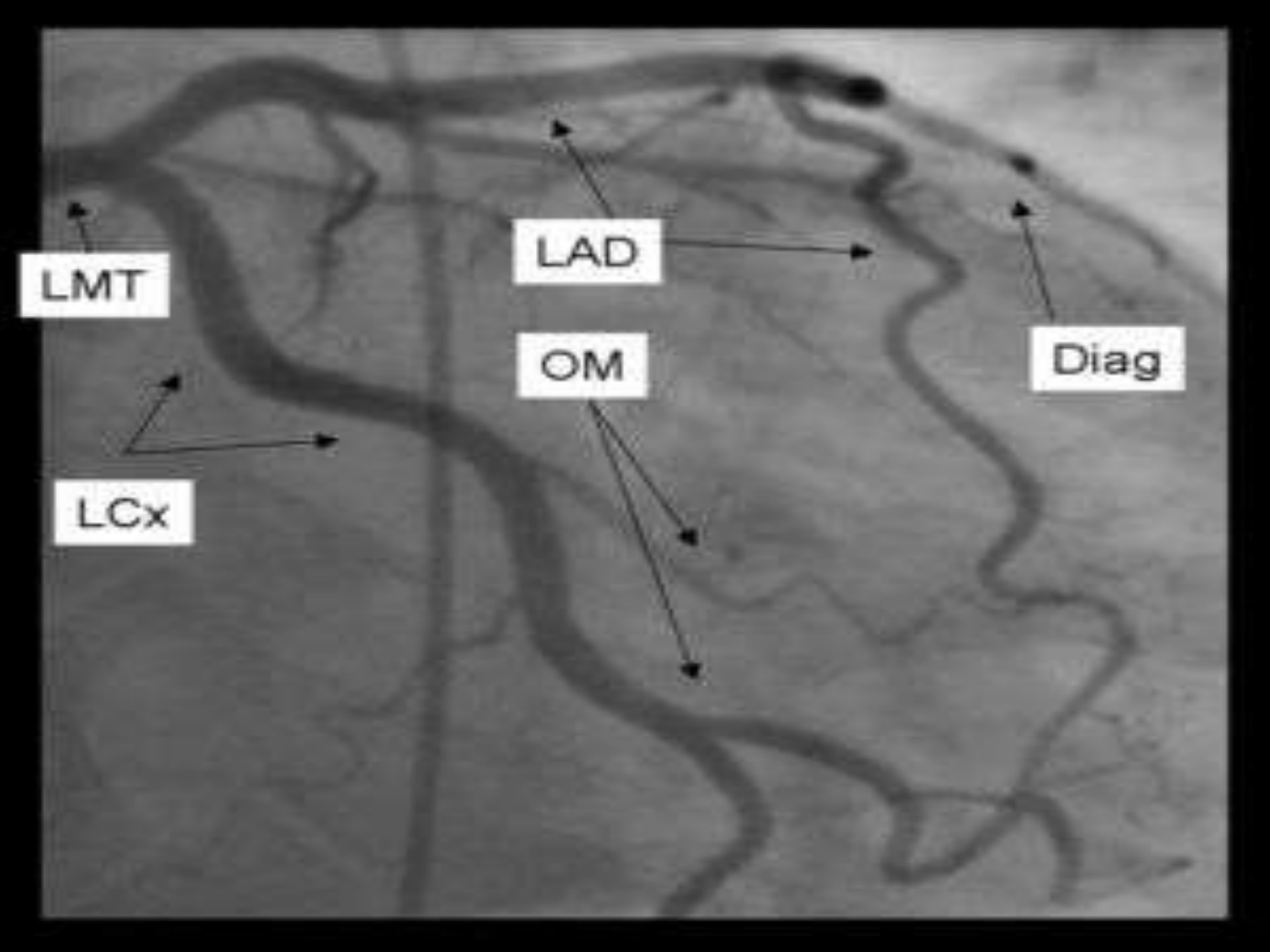
- Acute Coronary Syndromes (ACS):

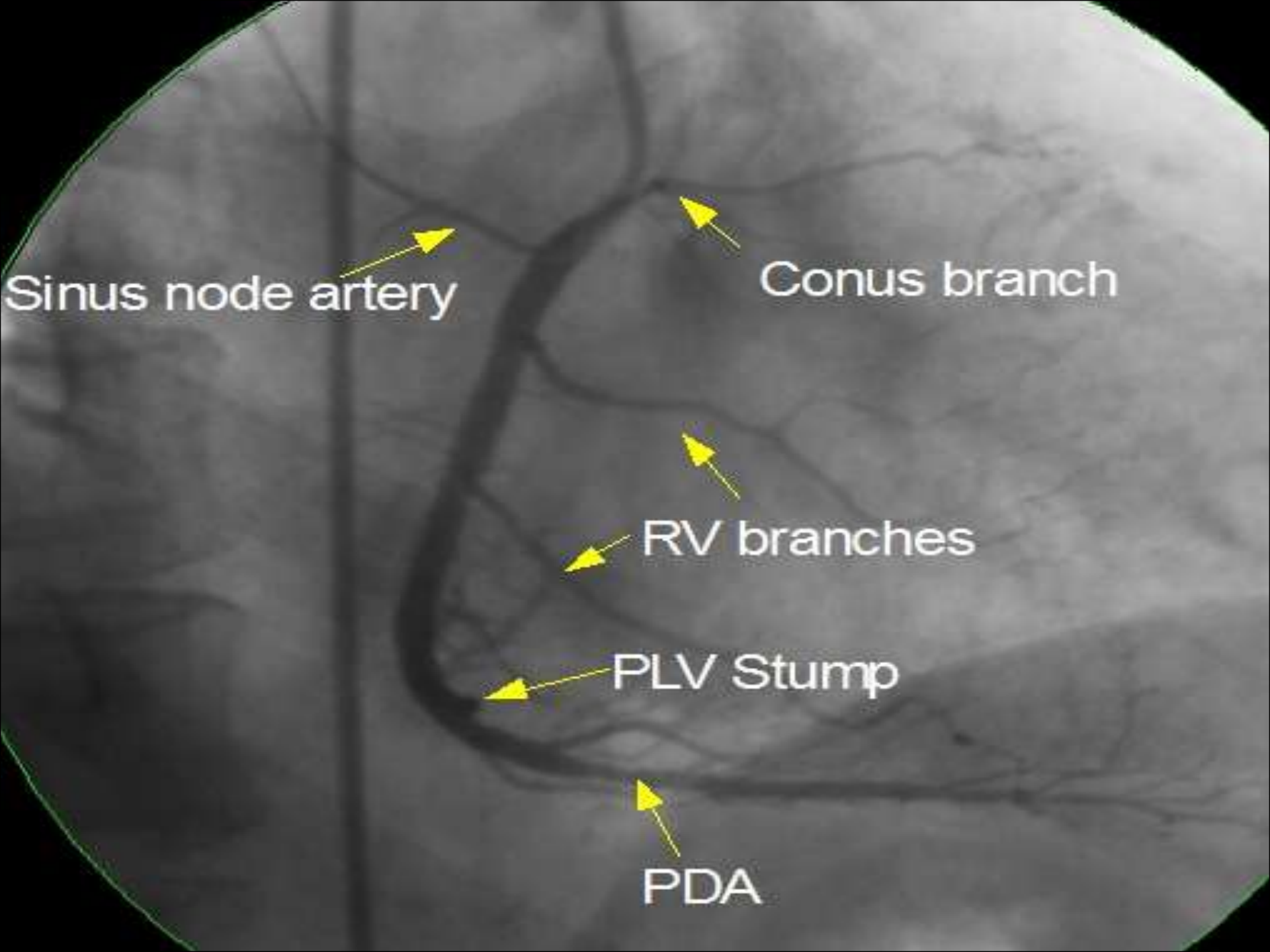
1- Unstable angina.

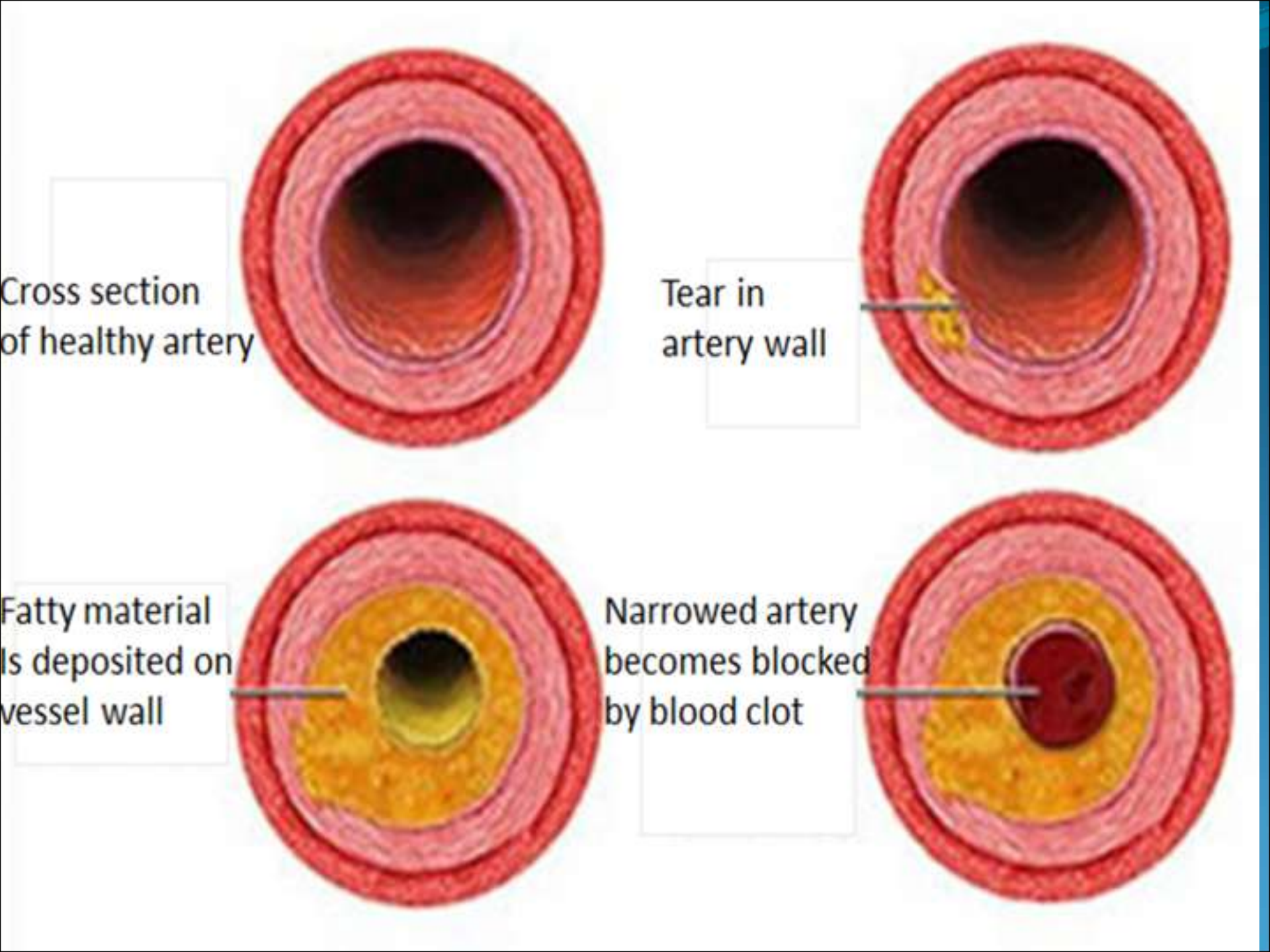
2- Non-ST elevation myocardial infarction (NSTEMI).

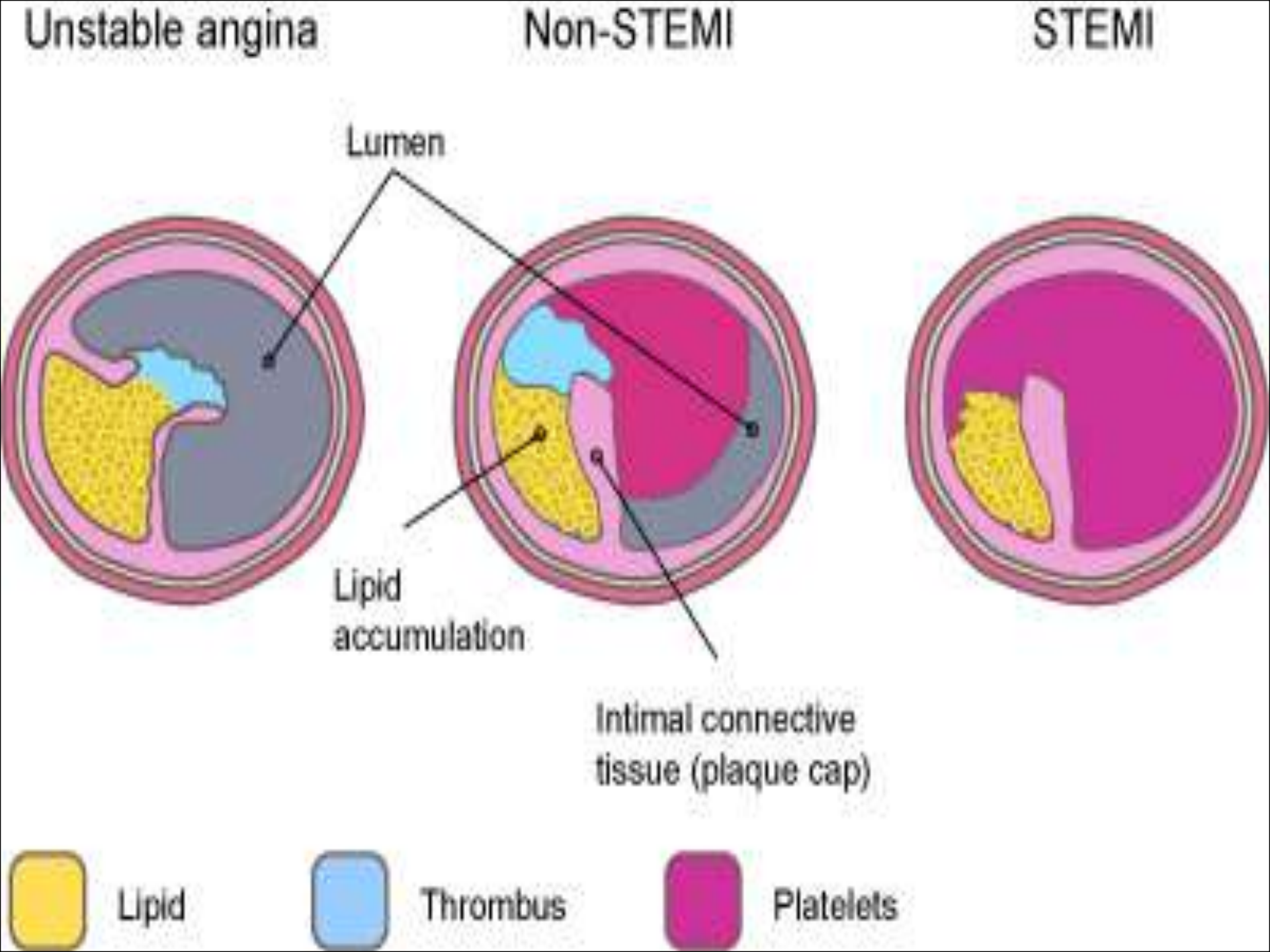
3- ST elevation myocardial infarction (STEMI).


Aorta
Right coronary artery
Aortic valve
Anterior interventricular artery
Catheter
Catheter entrance
A.D.A.M.


LMT
LAD
OM
Diag
LCx

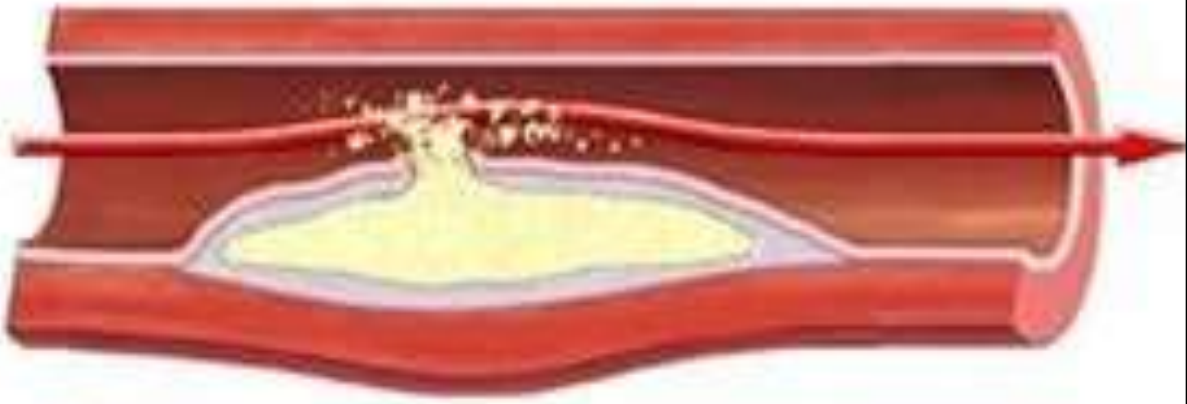

Sinus node artery
Conus branch
RV branches
PLV Stump
PDA


Cross section
of healthy artery
Tear in
artery wall
Fatty material
Is deposited on
vessel wall
Narrowed artery
becomes blocked
by blood clot

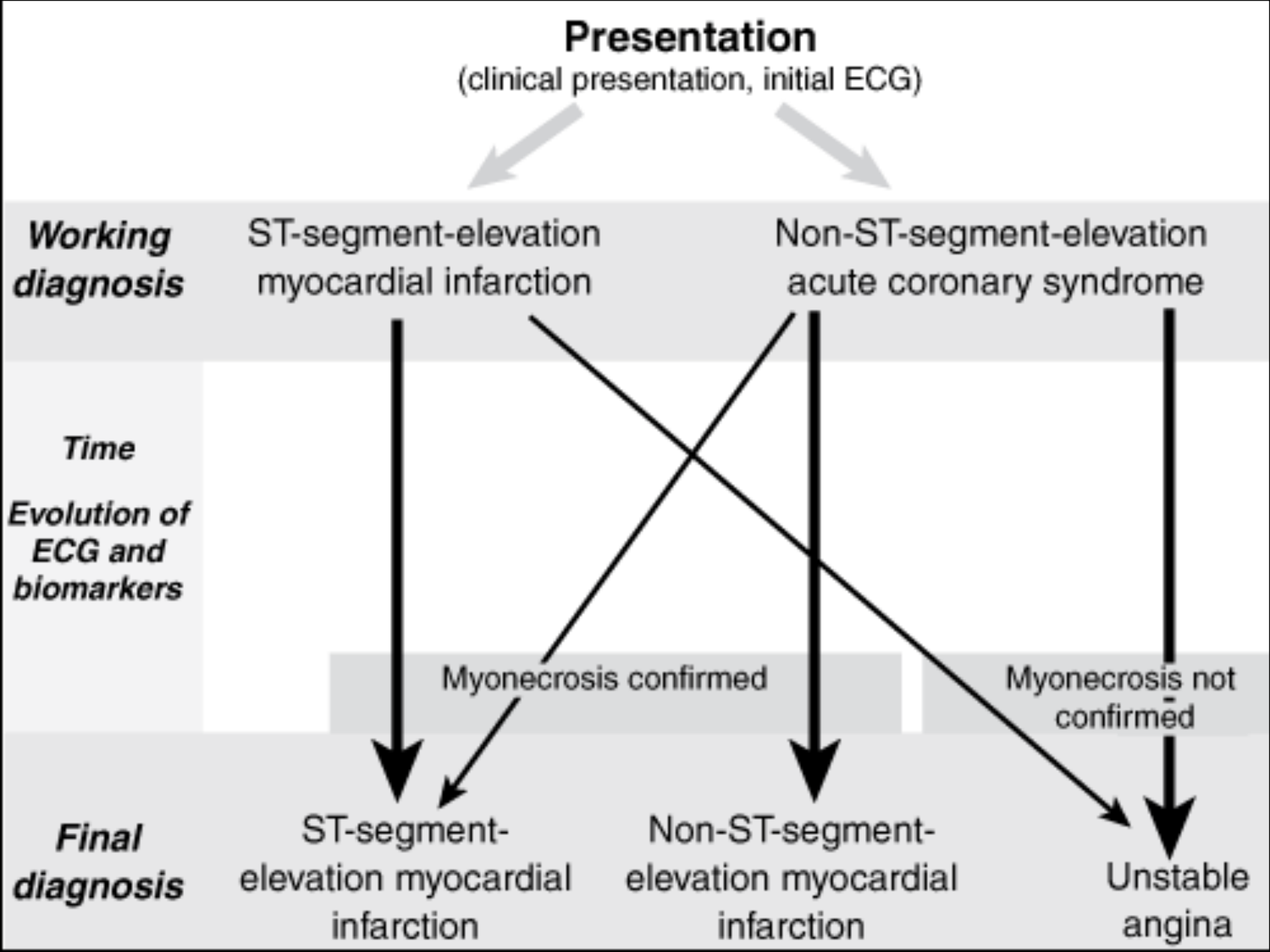

Unstable angina
Non-STEMI
STEMI
Lumen
Lipid accumulation
Intimal connective tissue (plaque cap)
Lipid
Thrombus
Platelets

Plaque with fibrous cap

Cap ruptures

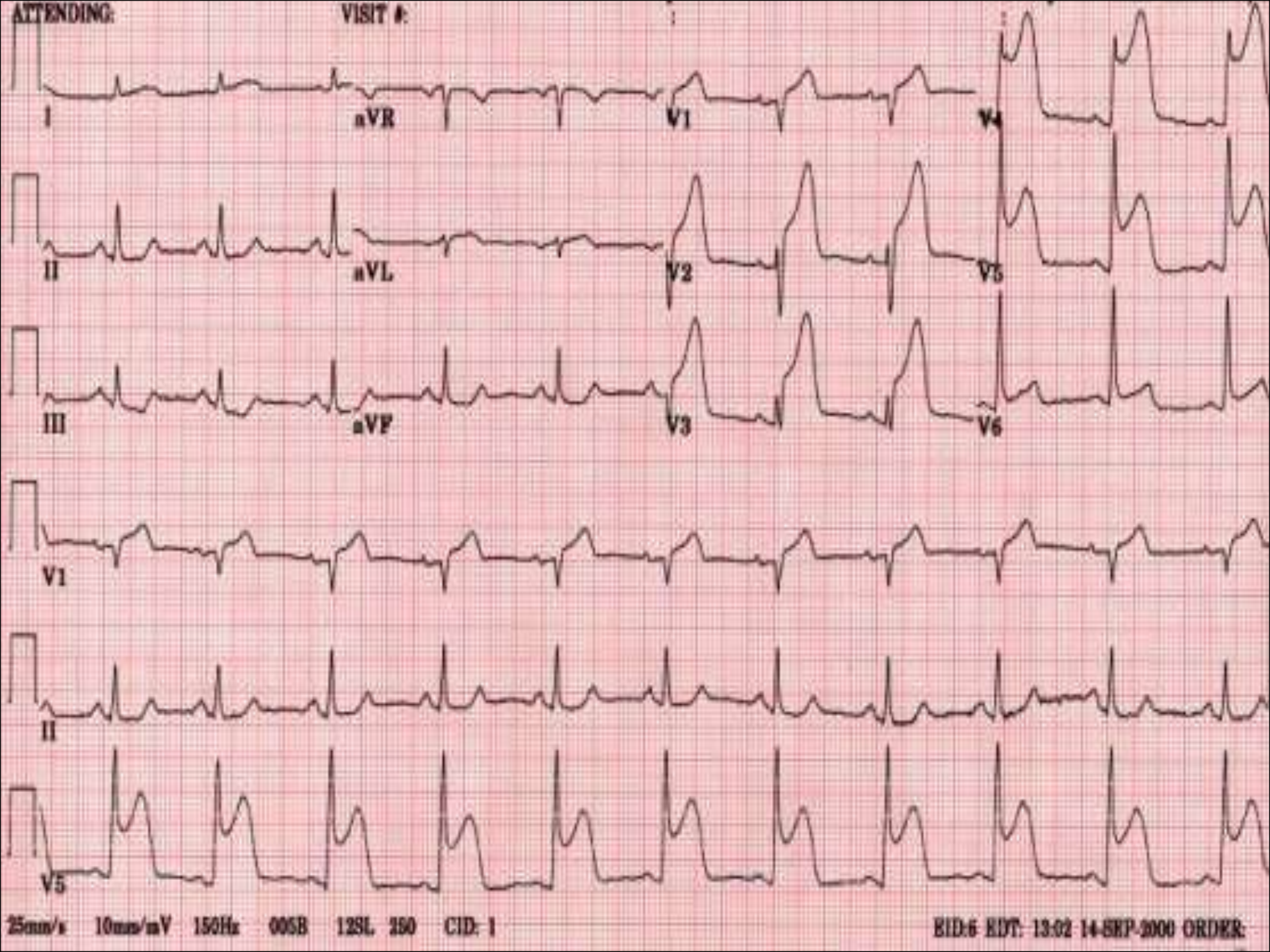


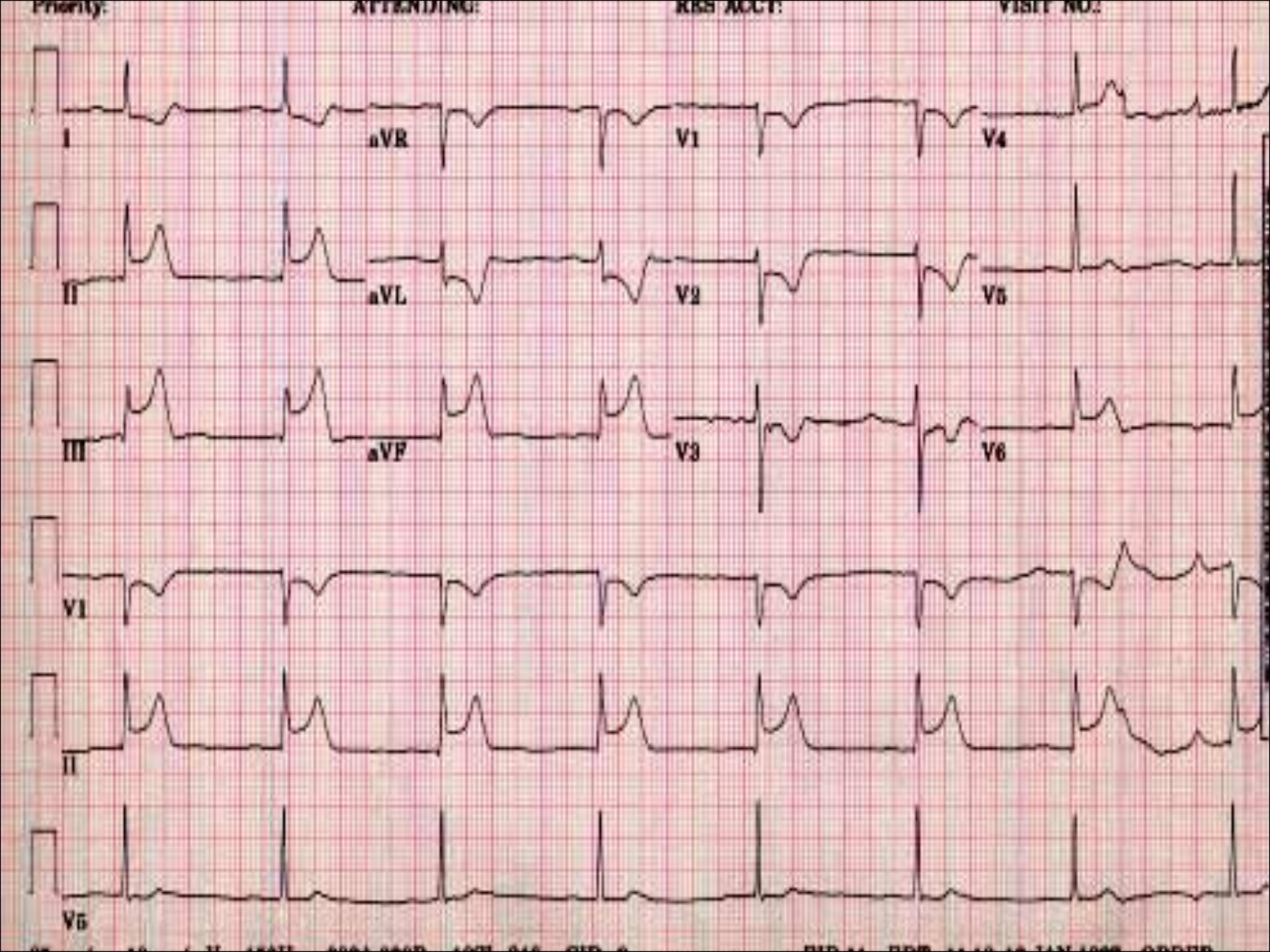
Blood clot forms around the rupture, blocking the artery

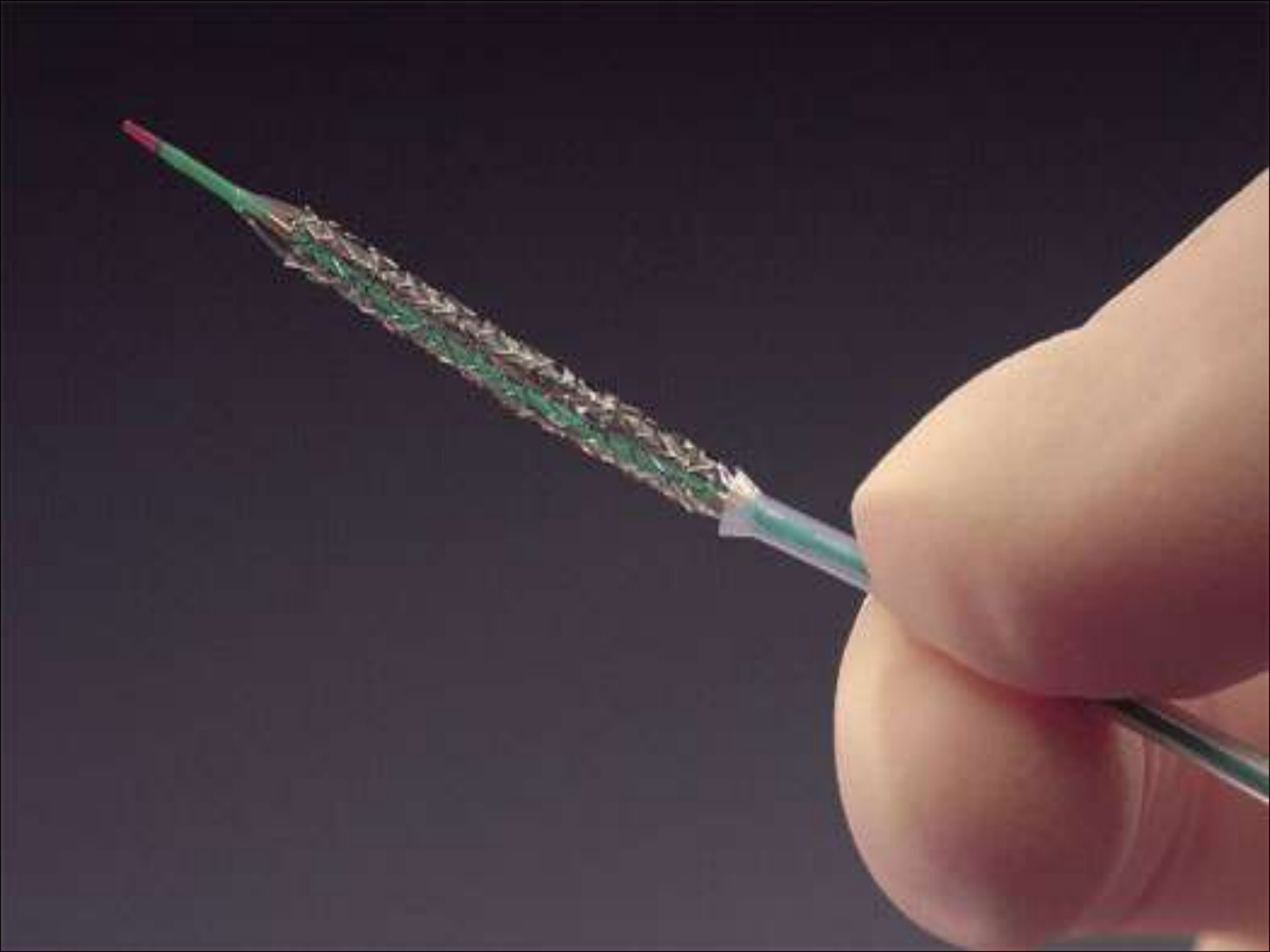

Presentation
(clinical presentation, initial ECG)
Working diagnosis
ST-segment-elevation myocardial infarction
Non-ST-segment-elevation acute coronary syndrome
Time
Evolution of ECG and biomarkers
Myonecrosis confirmed
Myonecrosis not confirmed
Final diagnosis
ST-segment-elevation myocardial infarction
Non-ST-segment-elevation myocardial infarction
Unstable angina

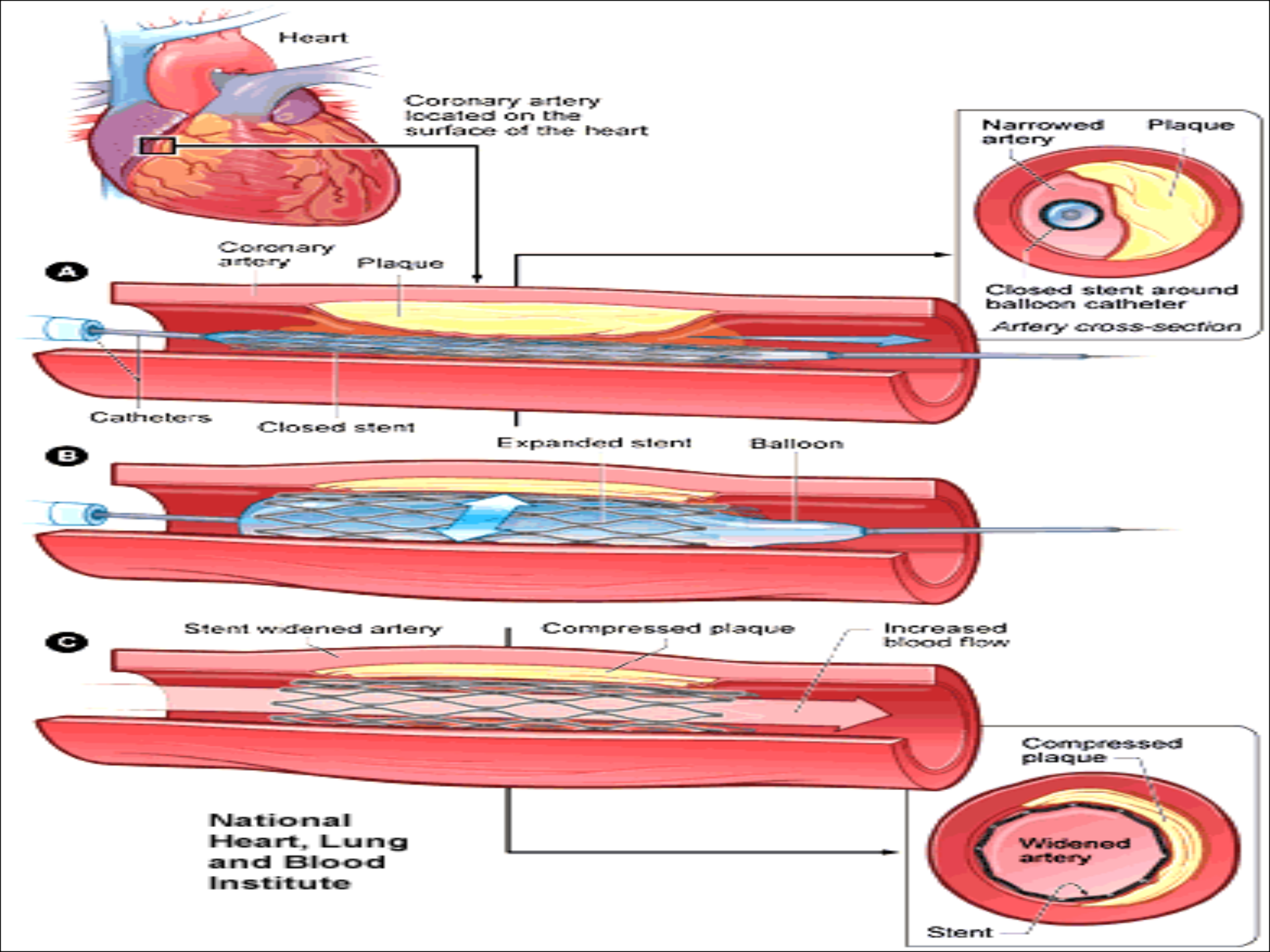
- **Symptoms of MI:**
- Retrosternal (central) chest pain (tightness, pressure) radiation to left shoulder, arm, neck or jaw.
- Dyspnea.
- Nausea or vomiting.
- Diaphoresis (sweating).
- Syncope

- **Complications of MI:**
- Free wall rupture.
- Ventricular septal defect (VSD).
- Papillary muscle rupture causing mitral regurgitation.
- Cardiogenic shock (Left ventricular failure).
- Arrhythmias (VF, VT, AF).
- Ventricular aneurysm.
- Pericarditis.


ATTENDING:
VISIT #:
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5
25mm/s 10mm/mV 150Hz 005B 12SL 250 CID: 1
EID:6 EDT: 13:02 14-SEP-2000 ORDER:


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5




Heart
Coronary artery located on the surface of the heart
Narrowed artery
Plaque
Closed stent around balloon catheter
Artery cross-section
Coronary artery
Plaque
A
Catheters
Closed stent
Expanded stent
Balloon
B
Stent widened artery
Compressed plaque
Increased blood flow
C
Compressed plaque
Widened artery
Stent
National Heart, Lung and Blood Institute


Srs:1
Acq:2
Img:2
2002-01-16
RAO 27
CAUD 14
200 F1
L:128
W:256


Srs:1
Acq:14
Img:14
2002-01-16
RAO 27
CAUD 11
200 F1
L:128
W:256

- Cerebrovascular accident (Stroke):

1- Ischemic.

2- Hemorrhagic.

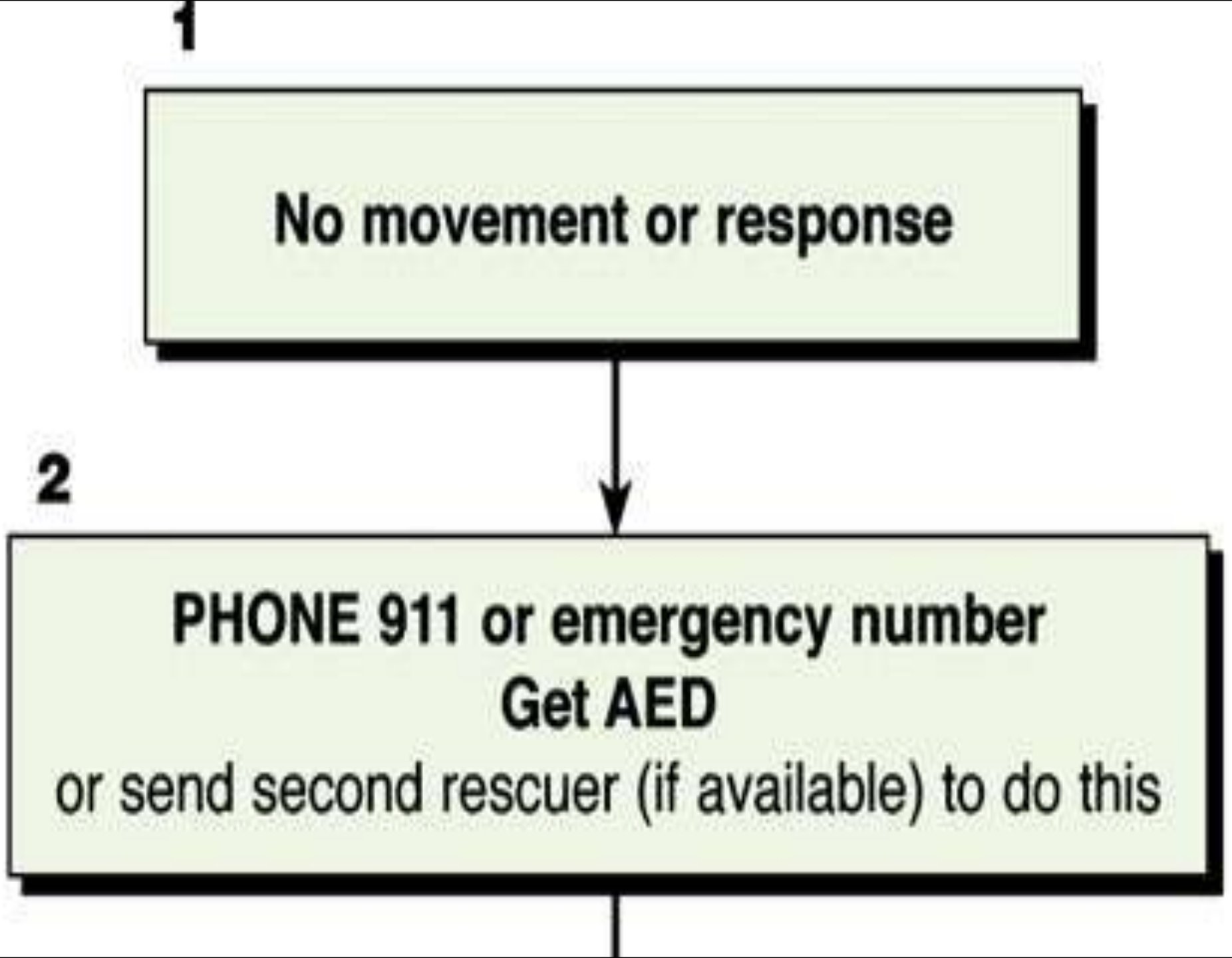
- The ***most common symptom of a stroke*** is sudden weakness or numbness of the face, arm or leg, most often on one side of the body.

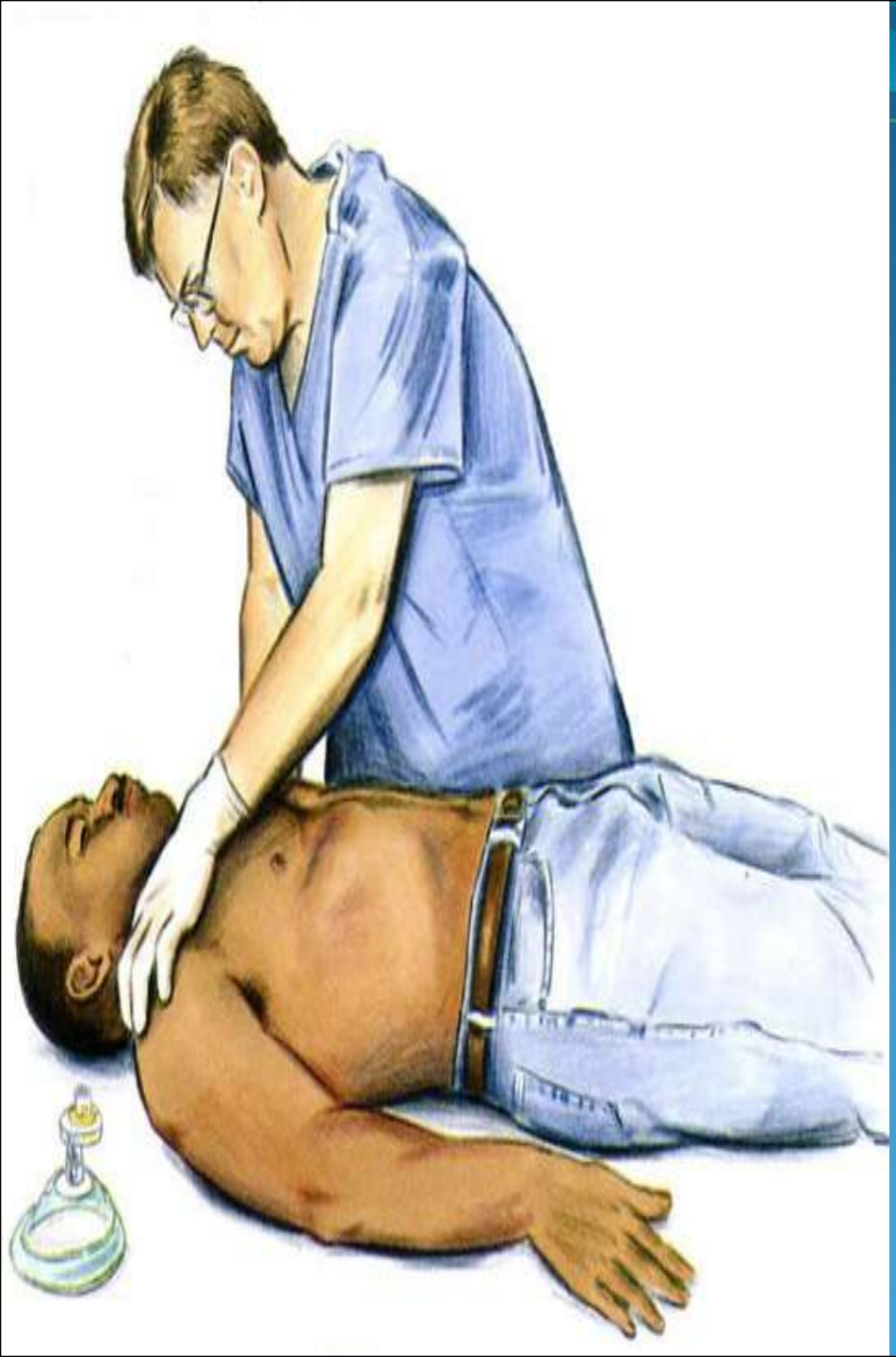
- Other symptoms include:
- confusion.
- difficulty speaking or understanding speech.
- difficulty seeing with one or both eyes.
- difficulty walking, dizziness, loss of balance or coordination.
- severe headache with no known cause.
- fainting or unconsciousness.

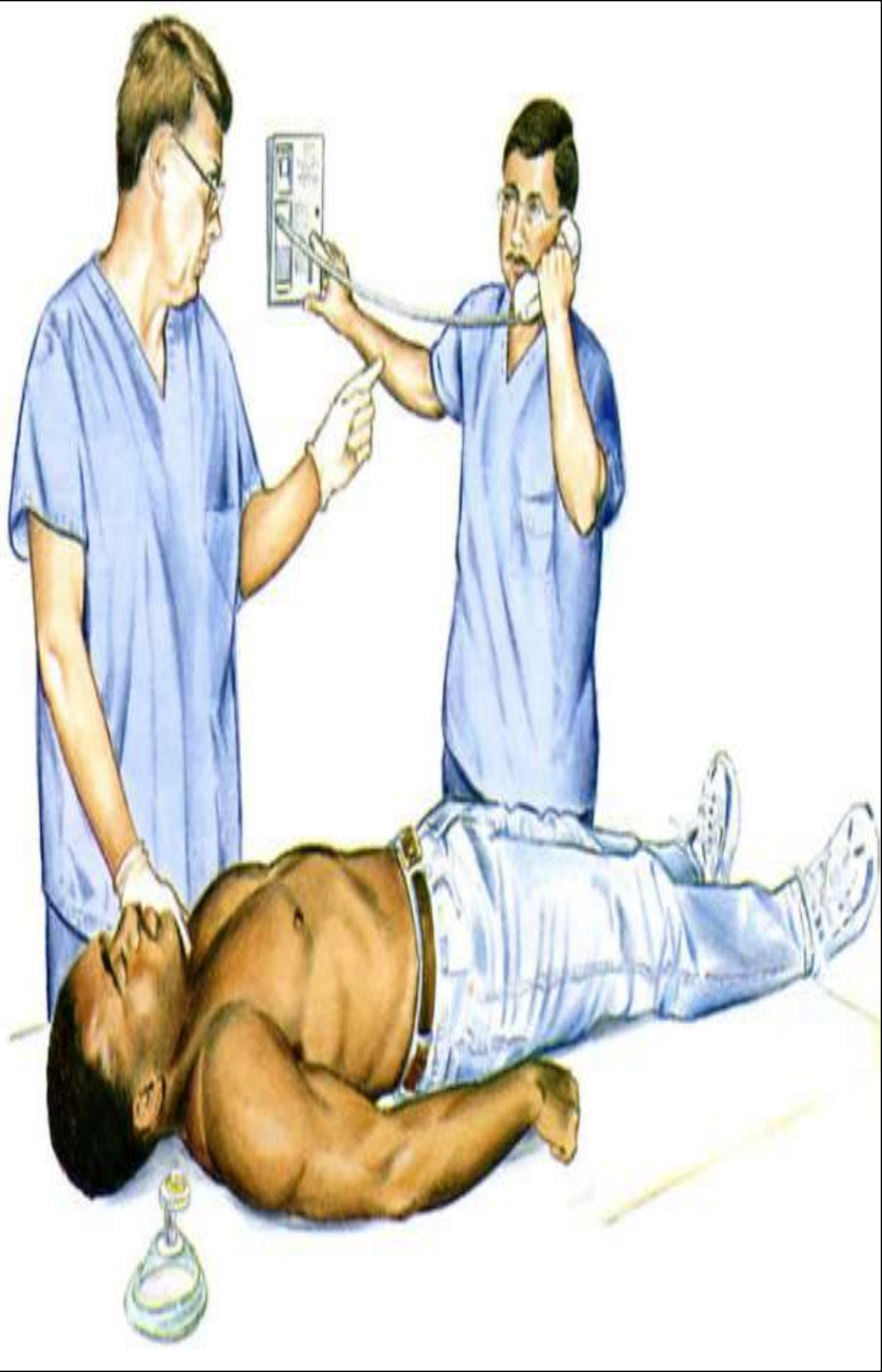
Basic Life Support

- Cardiopulmonary resuscitation (CPR) as we recognize it today was developed in the late 1950s and 1960s.
- Elam and Safar described the technique and benefits of mouth-to-mouth ventilation in 1958.
- Kouwenhoven, Knickerbocker, and Jude subsequently described the benefits of external chest compressions, which in combination with mouth-to-mouth ventilation form the basis of modern CPR.

- External defibrillation, first described in 1957 by Kouwenhoven, has since been incorporated into resuscitation guidelines.
- Basic life support consists of cardiopulmonary resuscitation and, when available, defibrillation using automated external defibrillators (AED).
- The keys to survival from sudden cardiac arrest (SCA) are early recognition and treatment, specifically, immediate initiation of excellent CPR and early defibrillation.


1
No movement or response
2
PHONE 911 or emergency number
Get AED
or send second rescuer (if available) to do this





- In the 2006 AHA guidelines ***A-B-C.***
- In the 2010 AHA guidelines ***C-A-B.***

- Chest compressions:
- Chest compressions are the most important element of CPR.
- Coronary perfusion pressure and return of spontaneous circulation (ROSC) are maximized when excellent chest compressions are performed.
- The mantra of the AHA 2010 BLS Guidelines is: *"push hard and push fast on the center of the chest" .*

- The following goals are essential for performing excellent chest compressions:
- Maintain a rate of at least 100 compressions per minute.
- Compress the chest at least 5 cm (2 inches) with each down-stroke.

- Allow the chest to recoil completely after each down-stroke (eg, it should be easy to pull a piece of paper from between the rescuer's hand and the patient's chest just before the next down-stroke).
- Minimize the frequency and duration of any interruptions.

Chest Compressions

Importance (vital organ perfusion)

Before:

At the victim's side.

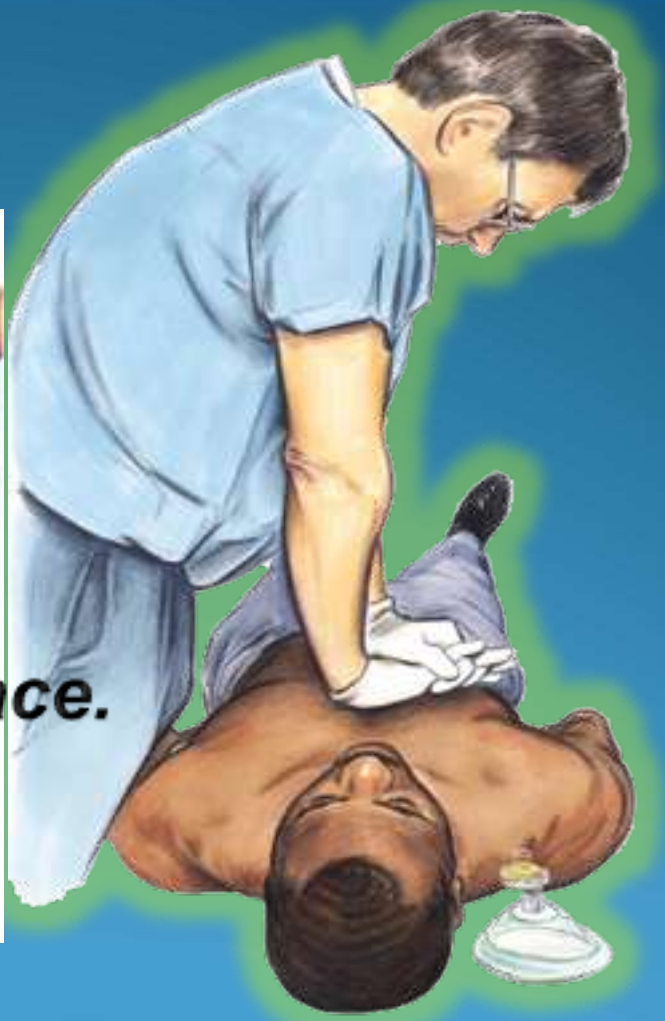
Supine + Firm, Flat Surface.

Exposure

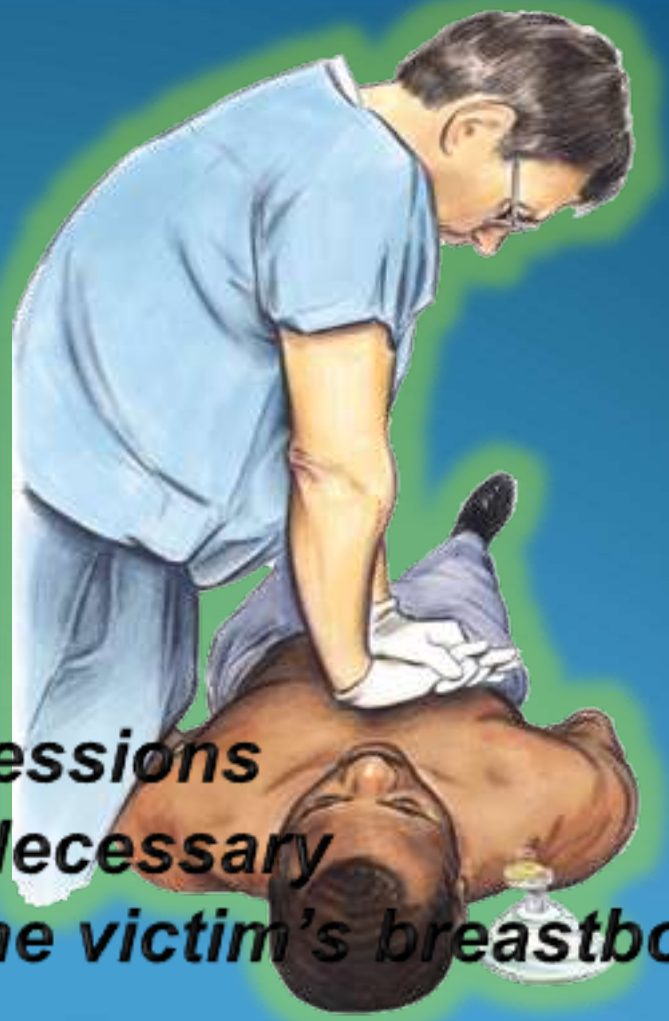
Landmark

Arms (straightened)

Shoulders (directly over hands)



Chest Compressions



During:

- *Push Hard, Deep & Fast*
- *Rate (100 times/min)*
- *Depth (2 inch)*
- *Chest Recoil*
- *Do NOT Interrupt Compressions*
- *Move Victim only when Necessary*
- *Push straight down on the victim's breastbone*

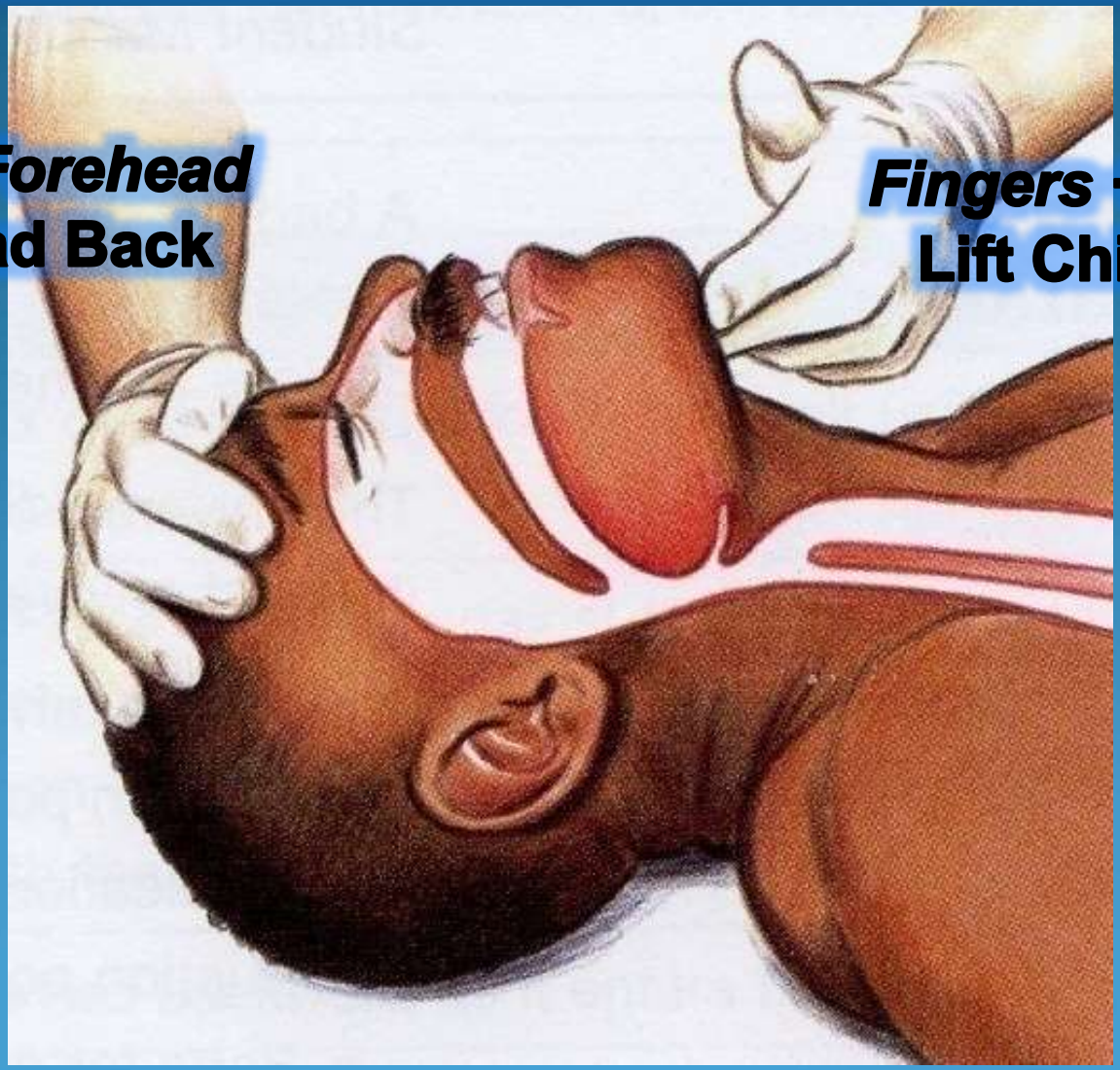
Airway Obstruction

Tongue is the Main Cause of Airway Block In the Unresponsive Pt.

Head-Tilt-Chin Lift

& Spontaneous Breathing

Palm + Forehead
Tilt Head Back



Fingers + Lower Jaw
Lift Chin Forward

- Breathing:
- A bag valve mask (also known as a BVM or Ambu bag) is a hand-held device used to provide positive pressure ventilation to a patient who is not breathing or who is breathing inadequately.

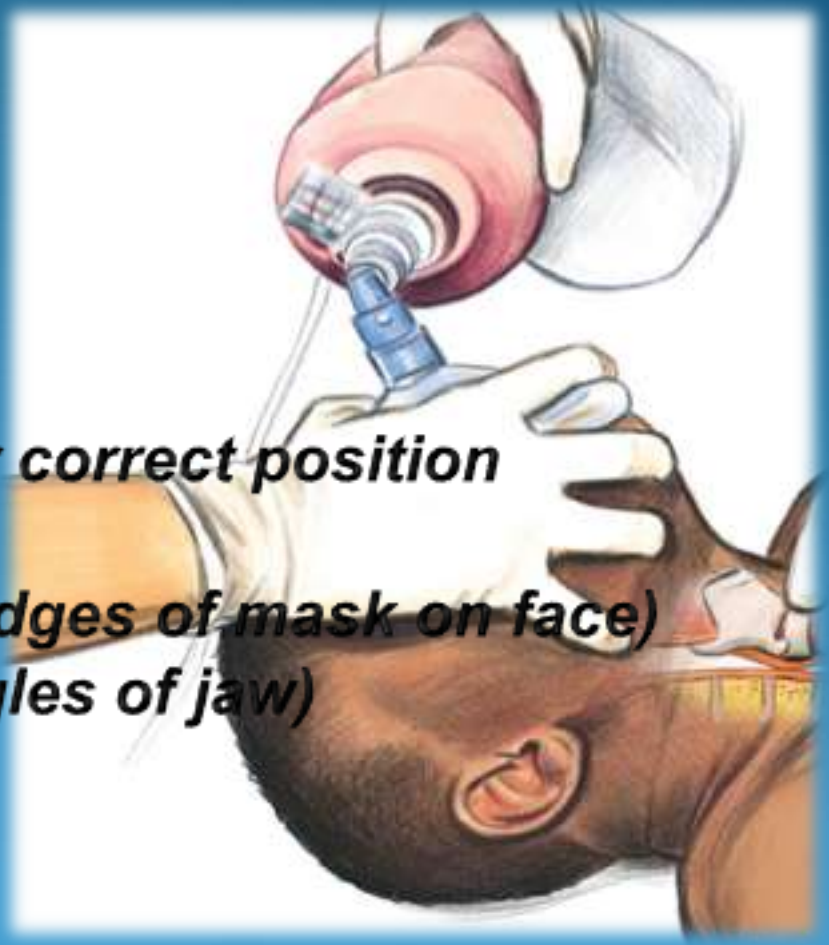
Bag-Mask E-C Technique

Above the Head

Mask on Face

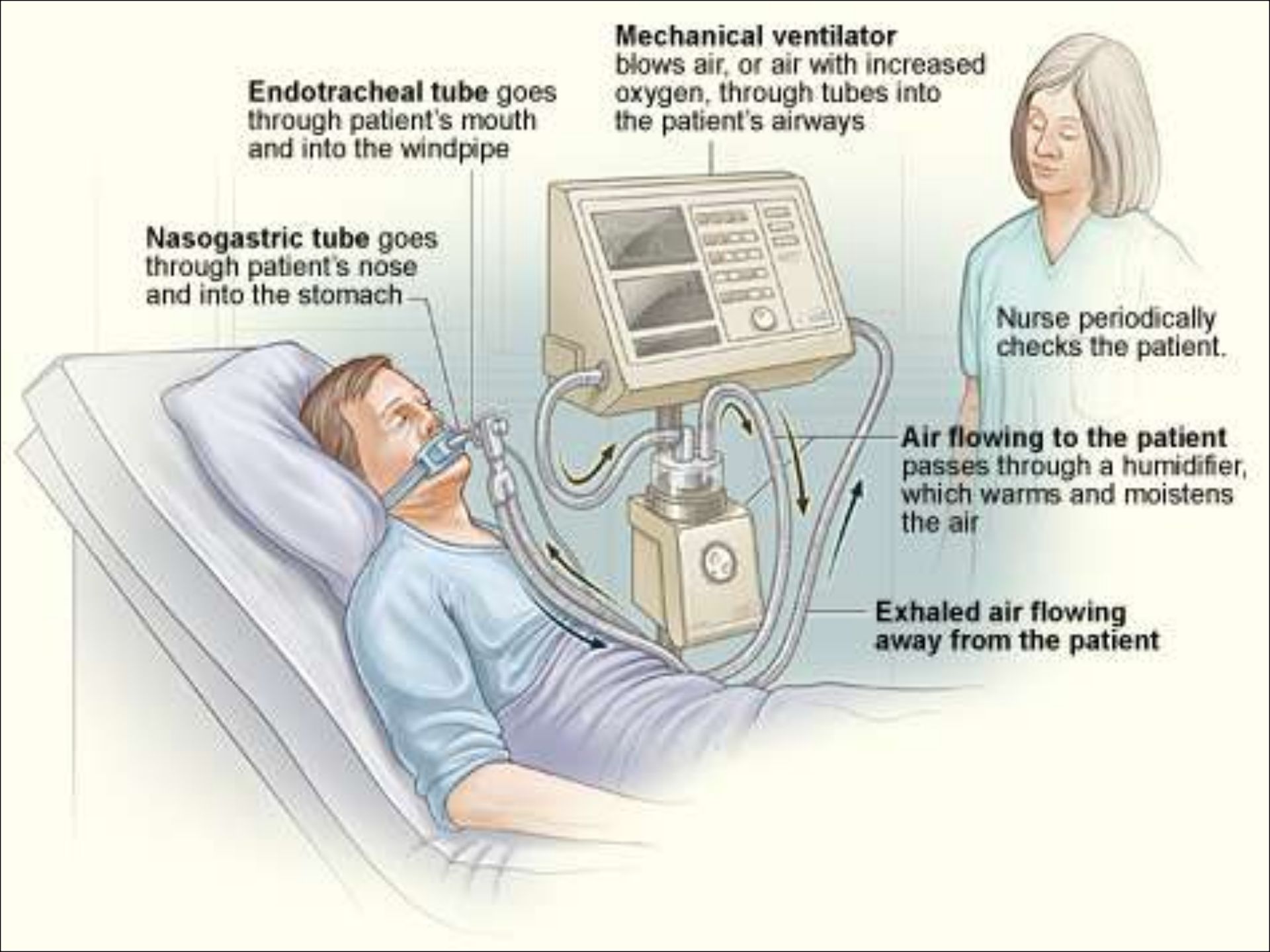
E-C clamp technique

- *Nasal bridge= guide for correct position*
- *Tilt head*
- *Make a "C" (pressing edges of mask on face)*
- *Form an "E" (lifting angles of jaw)*
- *Open airway*



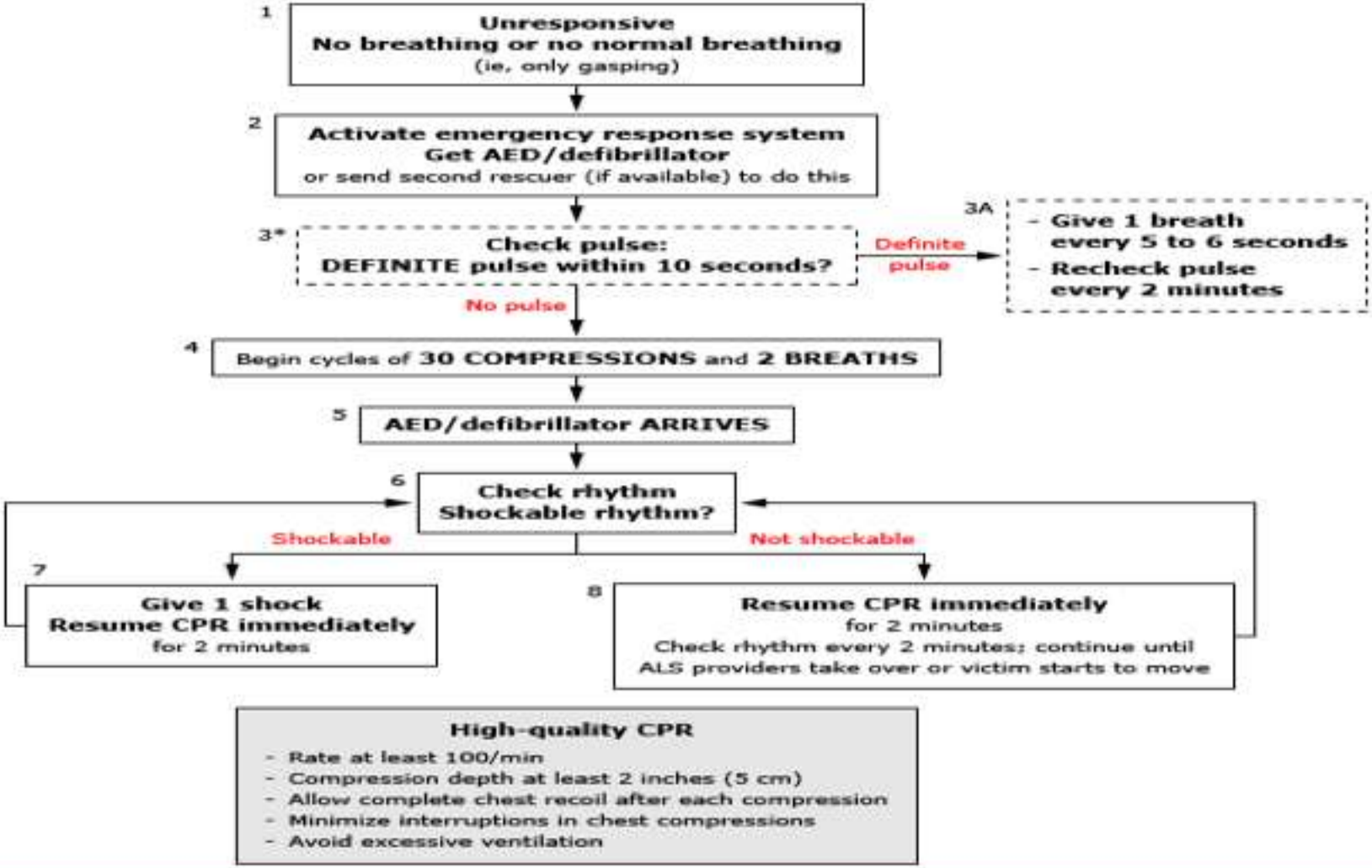
Squeeze the bag

- The vast majority of tracheal intubations involve the use of a viewing instrument of one type or another.
- Since its introduction by Kirstein in 1895, the conventional laryngoscope has been the most popular device used for this purpose.
- Today, the conventional laryngoscope consists of a handle containing batteries with a light source, and a set of interchangeable blades.


Mechanical ventilator blows air, or air with increased oxygen, through tubes into the patient's airways
Endotracheal tube goes through patient's mouth and into the windpipe
Nasogastric tube goes through patient's nose and into the stomach
Nurse periodically checks the patient.
Air flowing to the patient passes through a humidifier, which warms and moistens the air
Exhaled air flowing away from the patient

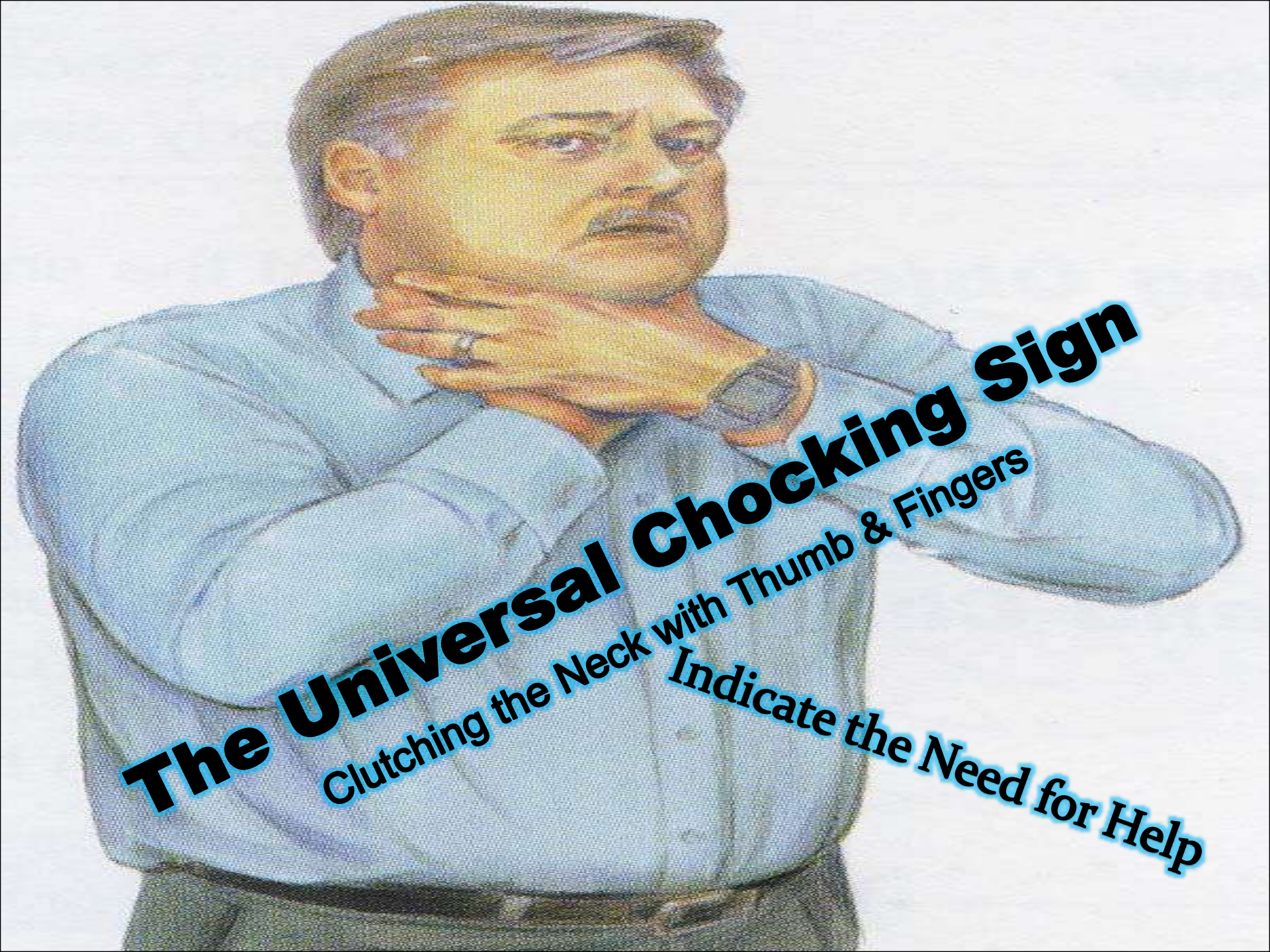
- Proper ventilation for adults includes the following:
- Give 2 ventilations after every 30 compressions for patients without an advanced airway.
- Give each ventilation over no more than one second.
- Provide enough tidal volume to see the chest rise.
- Avoid excessive ventilation.
- Give 1 asynchronous ventilation every 8 to 10 seconds (8 to 10 per minute) to patients with an advanced airway (eg, supraglottic device, endotracheal tube) in place.

Adult BLS algorithm for healthcare providers: 2010 guidelines



AED: automated external defibrillator; ALS: advanced life support; BLS: basic life support.
* The boxes bordered with dashed lines are performed by healthcare providers and not by lay rescuers.

- Sequence:
- Before beginning basic life support (BLS), rescuers must ensure that the scene is safe for them and the victim (such as by removing the victim from a burning building).
- The next steps in BLS are activating emergency medical services (EMS), getting an automated external defibrillator (AED), and starting CPR.


The Universal Chocking Sign
Clutching the Neck with Thumb & Fingers
Indicate the Need for Help

Relieving Chocking in Responsive Adults & Children

Abdominal Thrusts (Heimlich Maneuver)

With Victim Standing or Sitting

Steps:

Behind + Stand/ Kneel

+ Wrap arms around waist

Fist + Thumb against abdomen

(between navel & breastbone)

Gasp fist + Quick upward thrust

Repeat until object expelled

OR victim unresponsive

Examine for Complications

(damage to internal organs)

NOT for Infants

Relieving Chocking in Responsive Adults & Children

Abdominal Thrusts (Heimlich Maneuver)

With Victim Lying Down

Examine for Complications

(damage to internal organs)

NOT for Infants

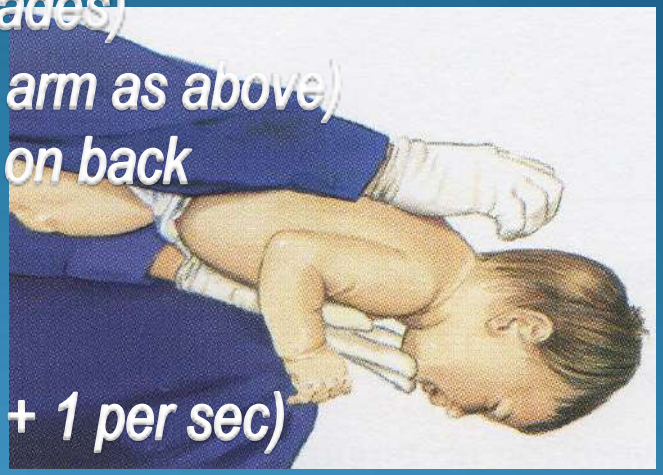
Relieving Chocking in Responsive Pregnant & Obese Victims

Chest Thrusts

Relieving Chocking in Responsive Infants

Up to 5 Back Slaps

(heel + middle back between shoulder blades)
Free hand on back + Palm on head (first arm as above)
Turn infant as a unit with Support + Hold on back



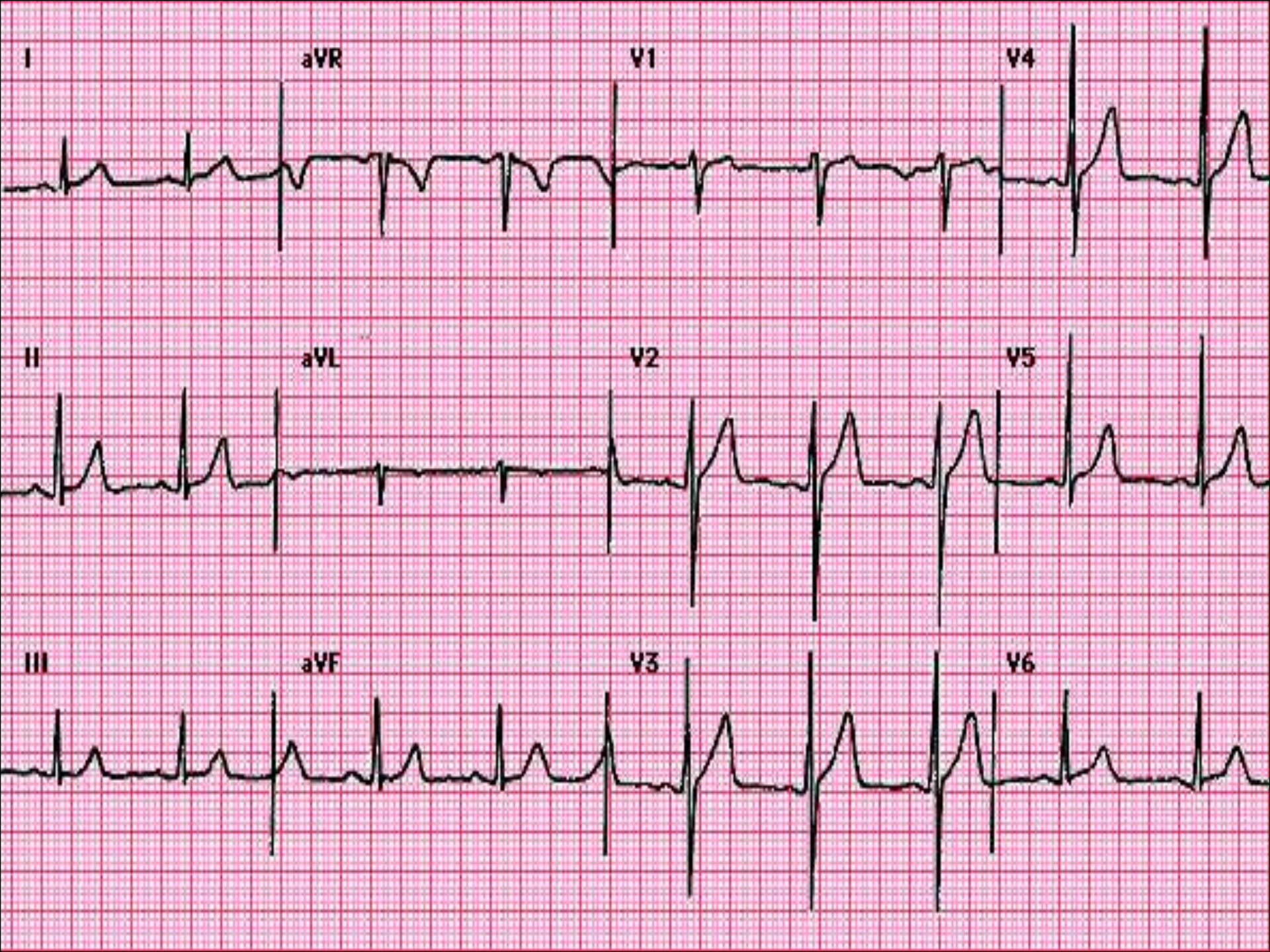
Up to 5 Chest Thrusts

(quick downward + just below nipple line + 1 per sec)

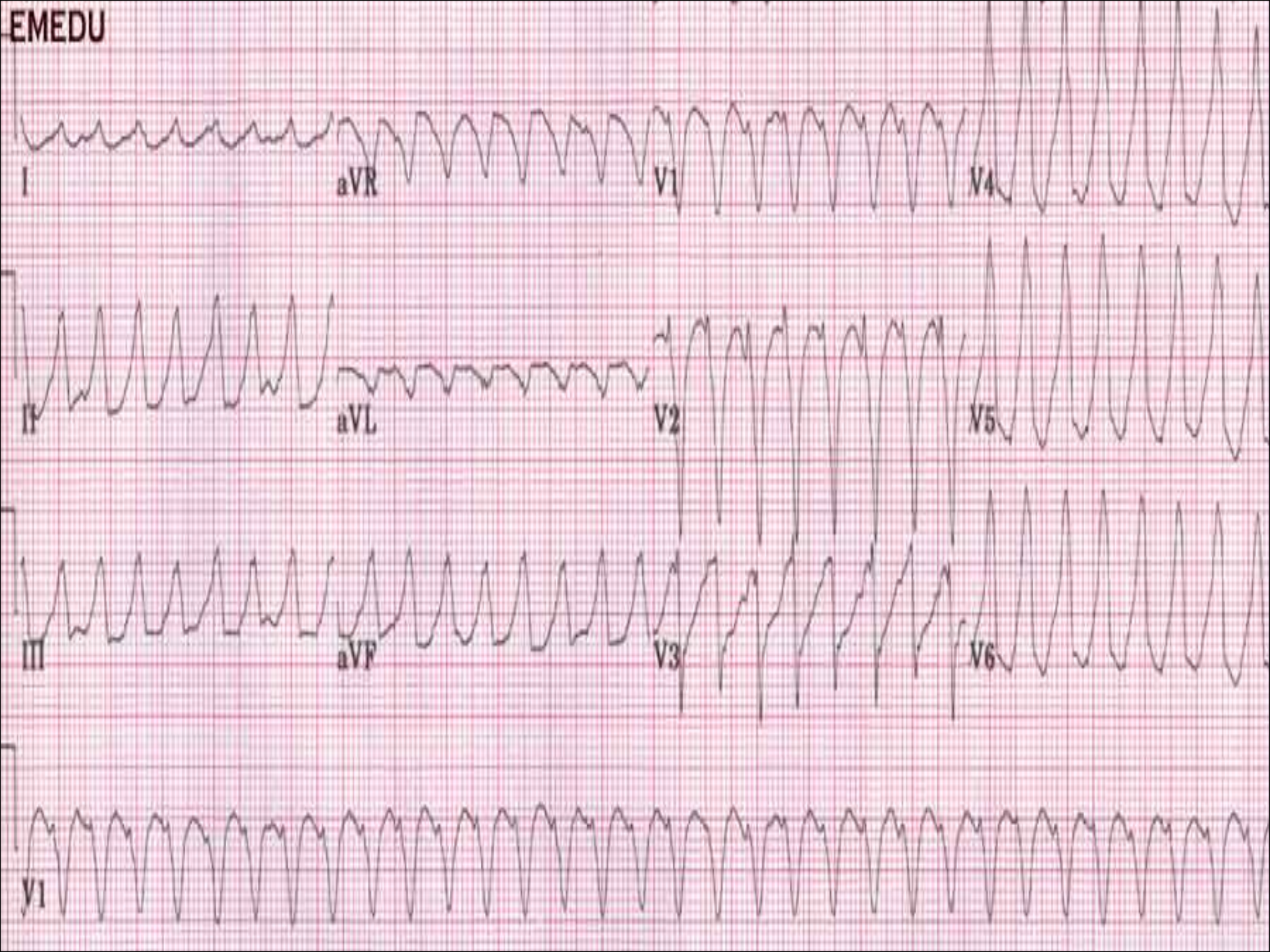
Repeat Cycle

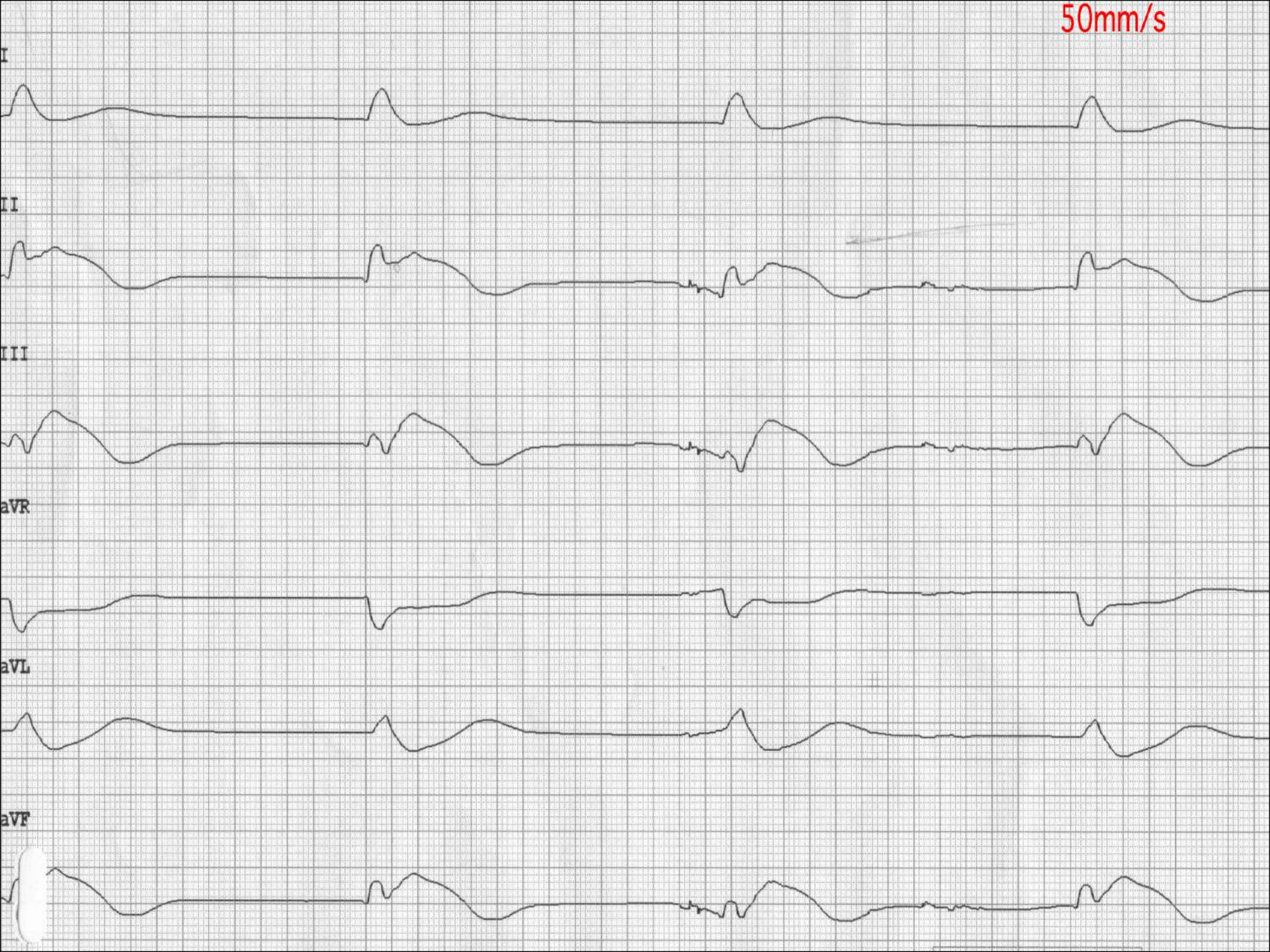
until obstruction removed
OR unresponsive

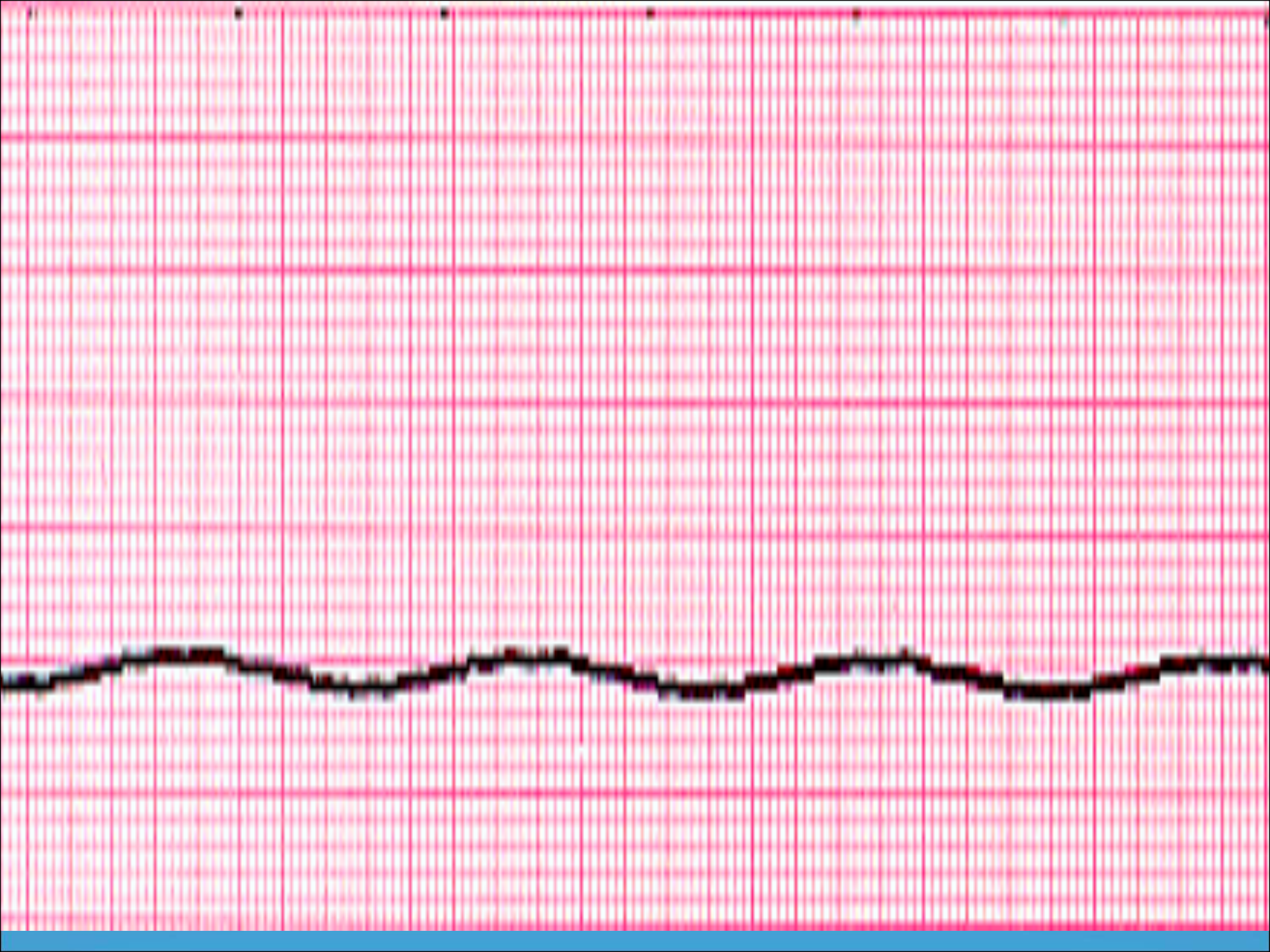
- Adult cardiac arrest management.
- Adult tachycardia management.
- Adult bradycardia management.


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6

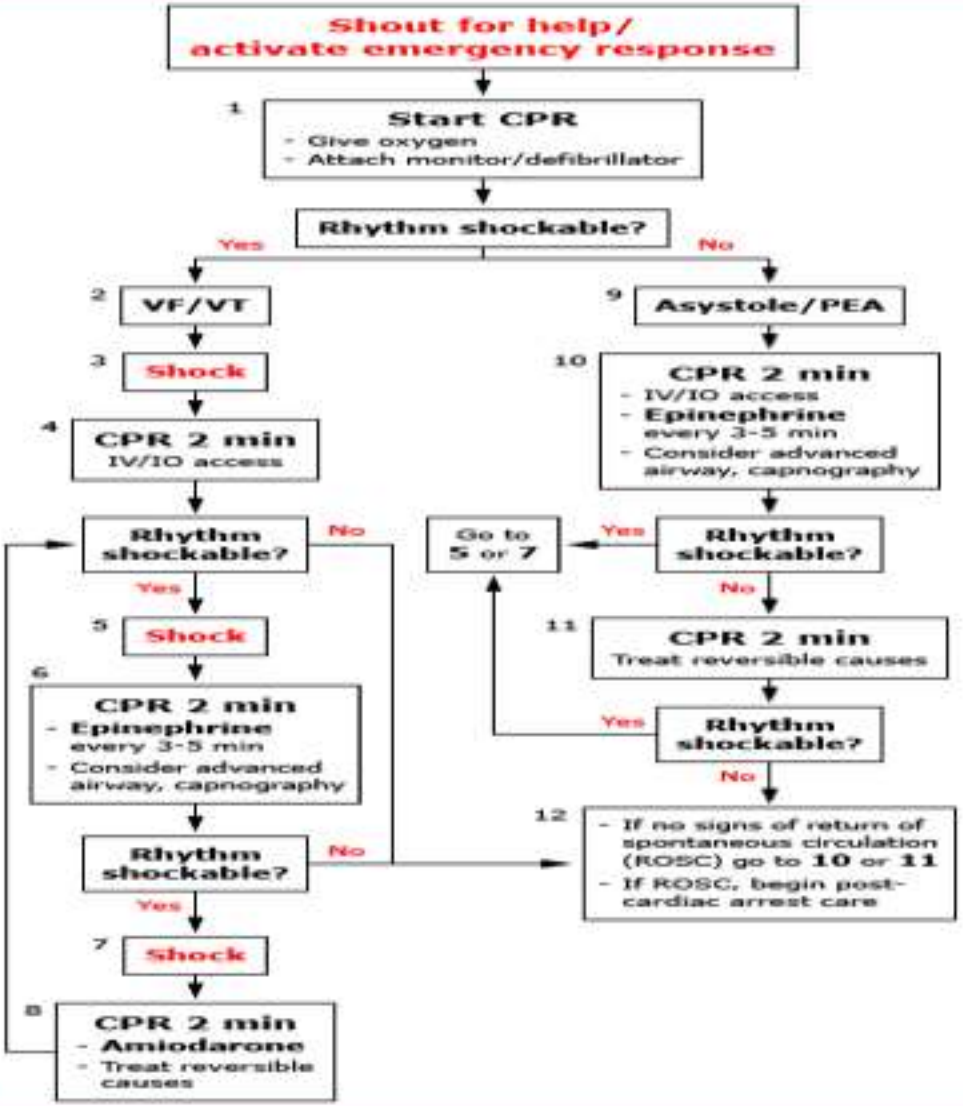

I
aVR
V1
V4
II
V2
V5
III
aVF
V3
V6
RHYTHM STRIP: II
25 mm/sec; 1 cm/mV


EMEDU
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1


50mm/s
I
II
III
aVR
aVL
aVF



Adult cardiac arrest algorithm: 2010 ACLS guidelines



CPR quality
- Push hard (≥2 inches [5 cm]) and fast (≥100/min) and allow complete chest recoil
- Minimize interruptions in compressions
- Avoid excessive ventilation
- Rotate compressor every 2 minutes
- If no advanced airway, 30:2 compression-ventilation ratio
- Quantitative waveform capnography
  - If $PETCO_2$, <10 mm Hg, attempt to improve CPR quality
- Intra-arterial pressure
  - If relaxation phase (diastolic) pressure <20 mm Hg, attempt to improve CPR quality

Return of spontaneous circulation (ROSC)
- Pulse and blood pressure
- Abrupt sustained increase in $PETCO_2$ (typically ≥40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

Shock energy
- *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
- *Vasopressin IV/IO dose:* 40 units can replace first or second dose of epinephrine
- *Amiodarone IV/IO dose:*
  - First dose: 300 mg bolus.
  - Second dose: 150 mg.

Advanced airway
- Supraglottic advanced airway or endotracheal intubation
- Waveform capnography to confirm and monitor ET tube placement
- 8-10 breaths per minute with continuous chest compressions

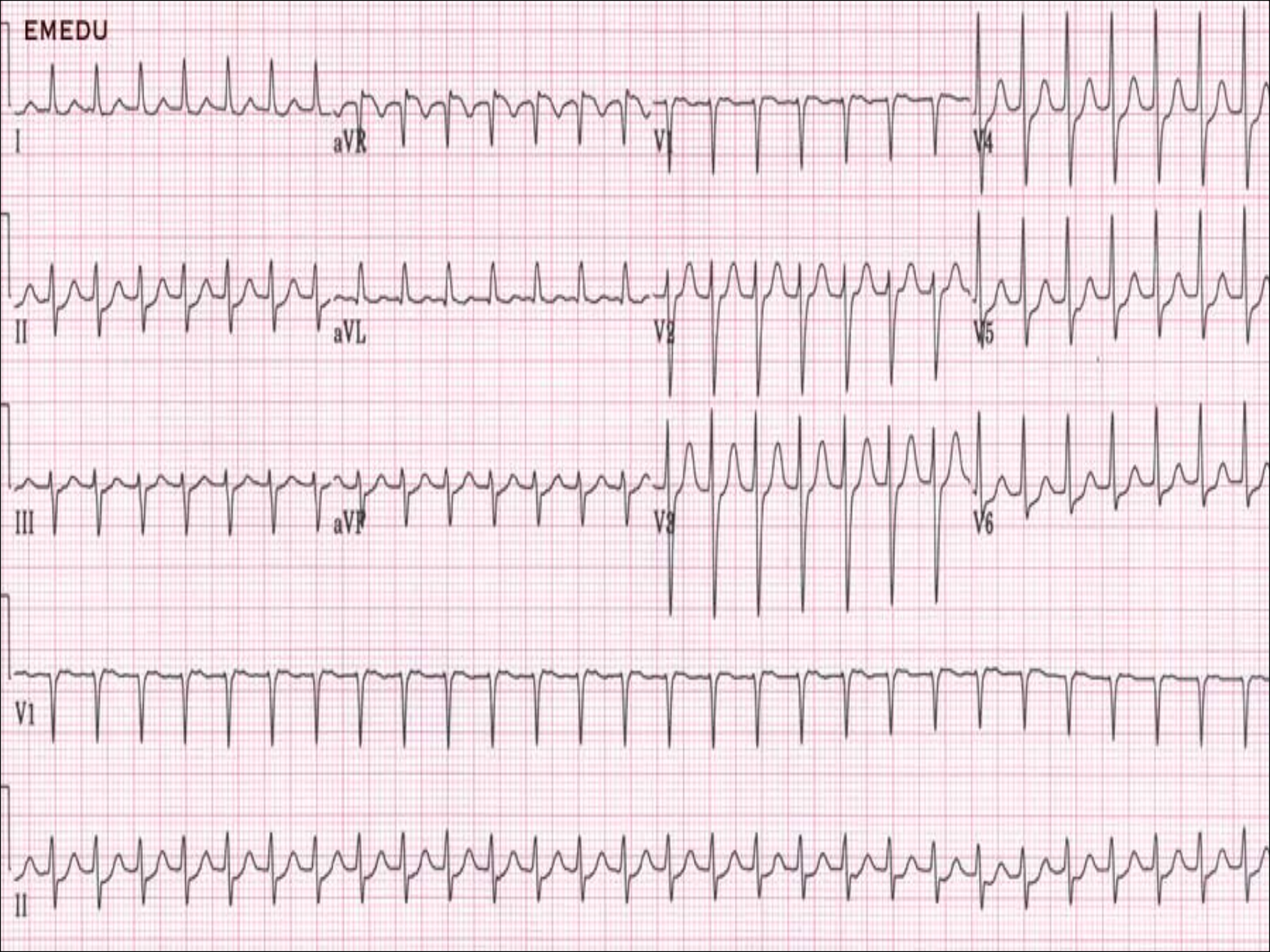
Reversible causes
- Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hypo-/hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary

CPR: cardiopulmonary resuscitation; ET: endotracheal tube; EtCO2: end tidal carbon dioxide; IO: intraosseous; IV: intravenous; PEA: pulseless electrical activity; VF: ventricular fibrillation; VT: ventricular tachycardia.

- Tachycardia:
- Tachycardia is defined as a heart rate above 100 beats per minute, but symptomatic tachycardia generally involves rates over 150 beats per minute, unless underlying ventricular dysfunction exists.
- Management of tachyarrhythmias is governed by the presence of clinical symptoms and signs caused by the rapid heart rate.

- The fundamental approach is as follows: First determine if the patient is unstable (eg, manifests ongoing ischemic chest pain, acute mental status changes, hypotension, signs of shock, or evidence of acute pulmonary edema).

- **If instability is present and appears related to the tachycardia, treat immediately with synchronized cardioversion.**
- **Is the QRS complex wide or narrow?**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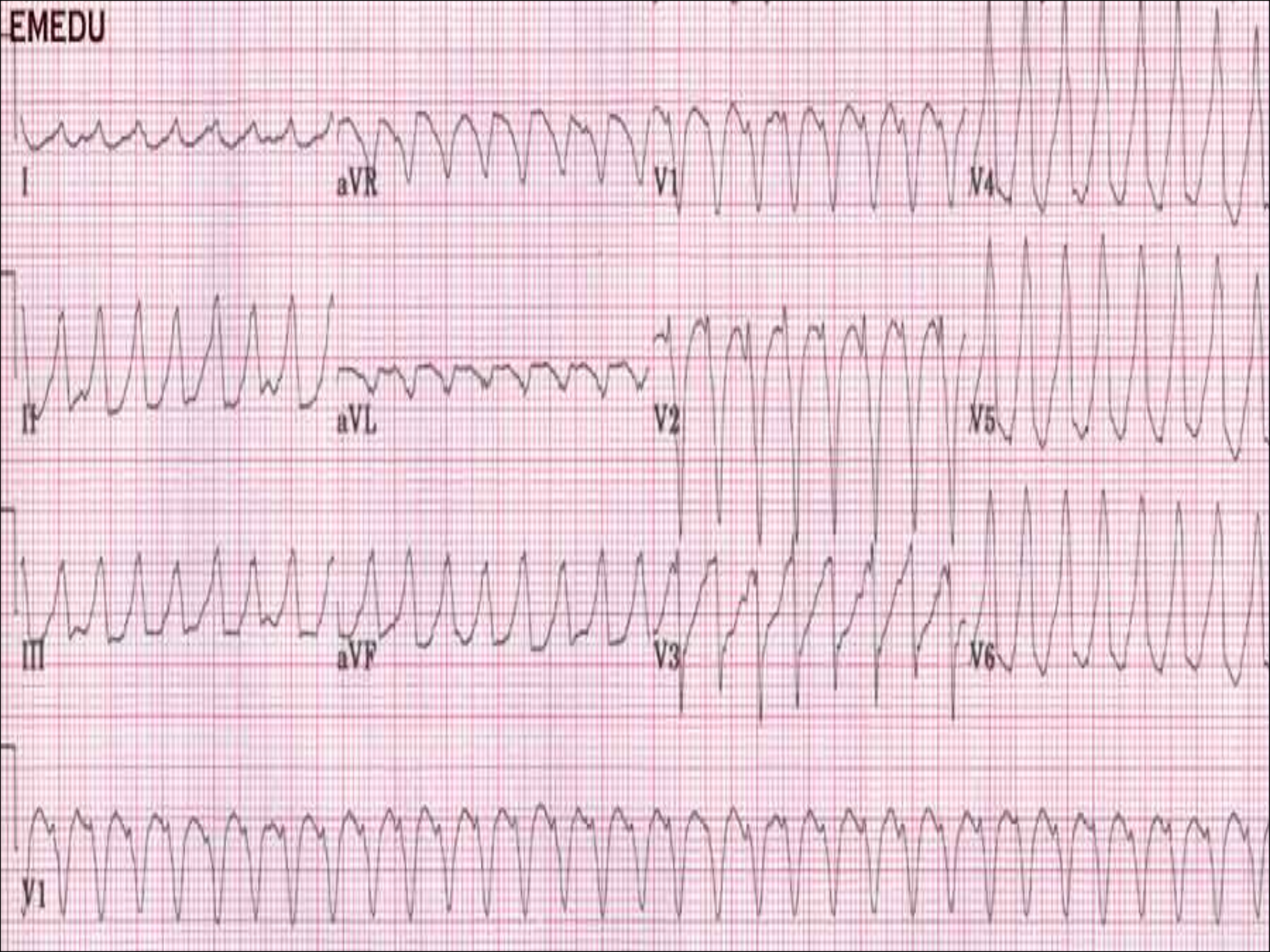
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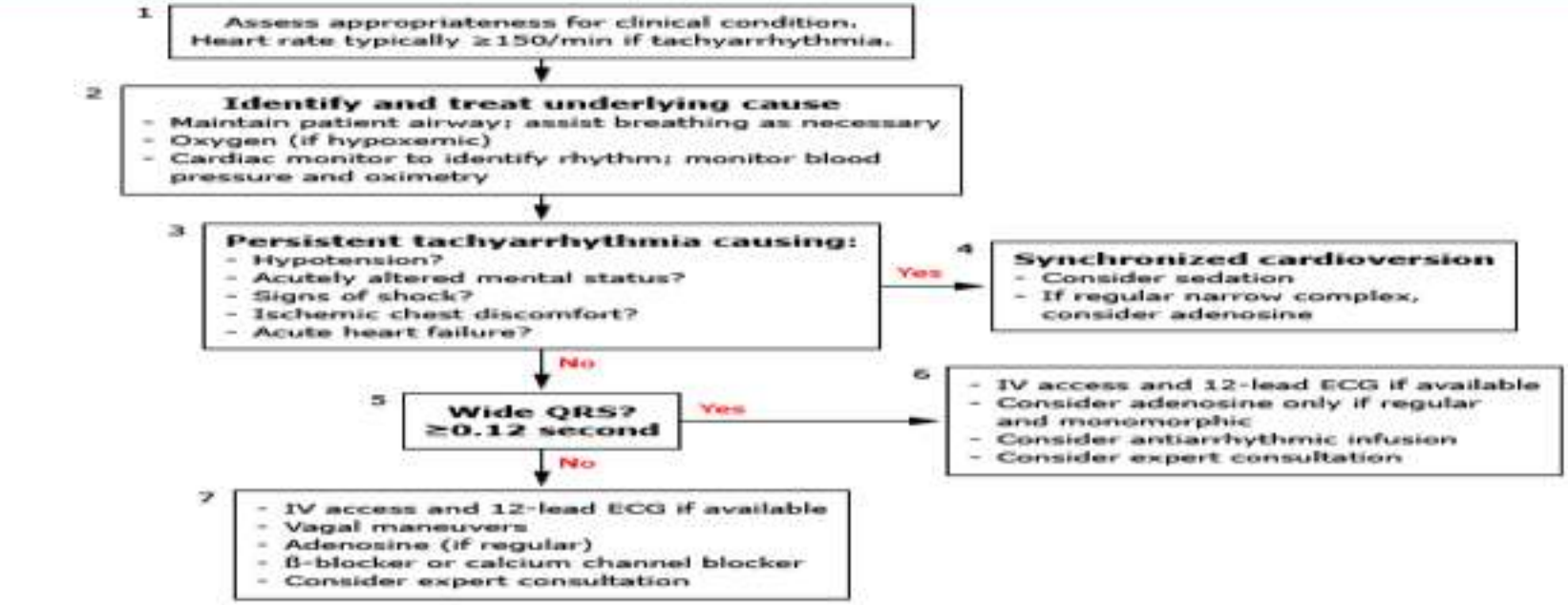
Adult tachycardia algorithm (with pulse): 2010 ACLS guidelines



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 percent, 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.

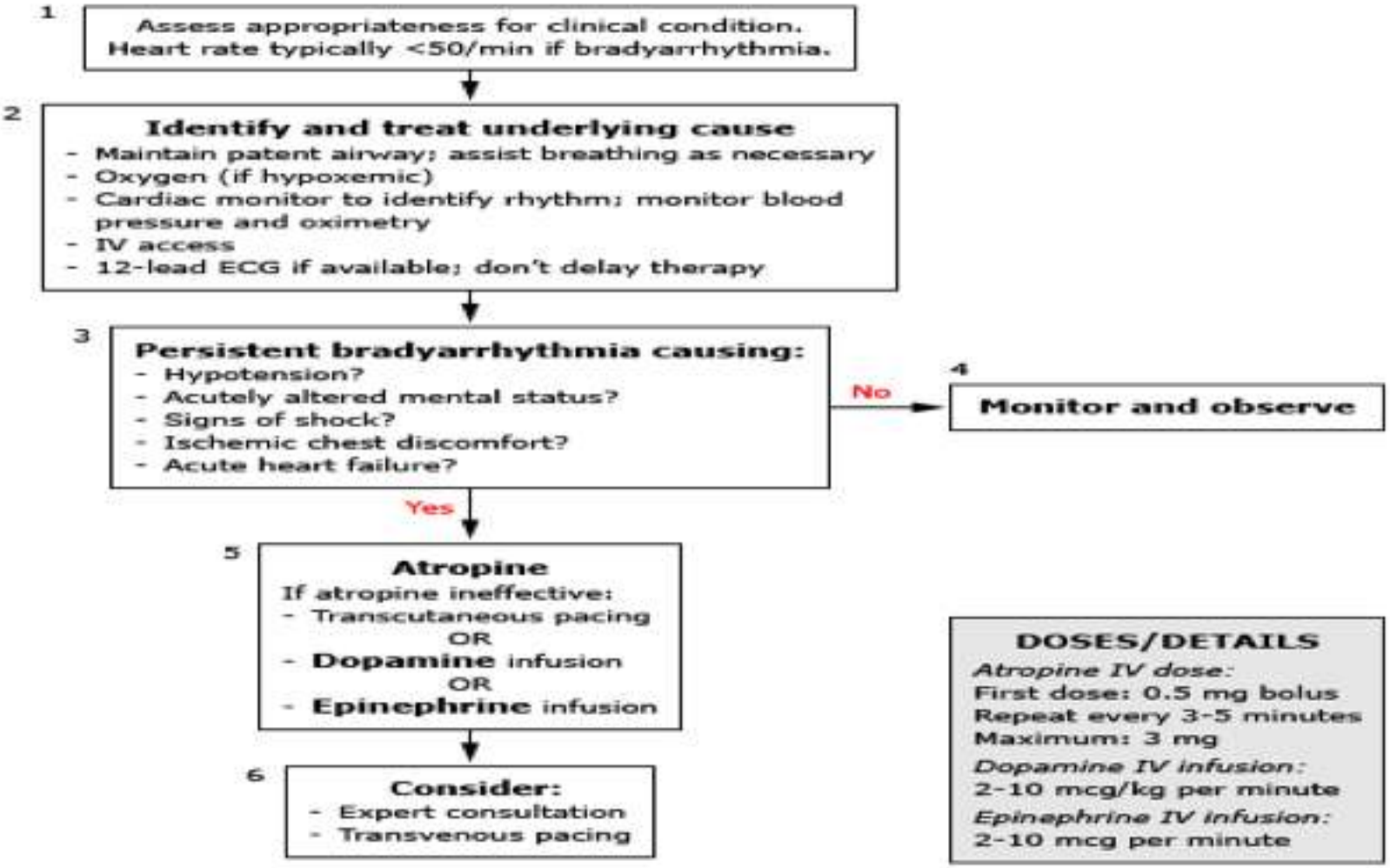
Sotalol IV dose:
100 mg (1.5 mg/kg) over 5 minutes. Avoid if prolonged QT.

CHF: congestive heart failure; ECG: electrocardiogram; IV: intravenous; J: joules; NS: normal (isotonic) saline; VT: ventricular tachycardia.

- Bradycardia:
- Bradycardia is defined conservatively as a heart rate below 60 beats per minute, but symptomatic bradycardia generally entails rates below 50 beats per minute.
- The 2010 ACLS Guidelines recommend that clinicians not intervene unless the patient exhibits evidence of inadequate tissue perfusion thought to result from the slow heart rate.

- Signs and symptoms of inadequate perfusion include hypotension, altered mental status, signs of shock, ongoing ischemic chest pain, and evidence of acute pulmonary edema.

Adult bradycardia algorithm (with pulse): 2010 ACLS guidelines



ECG: electrocardiogram; IV: intravenous; mcg: microgram.