UNIVERSITY OF BELGRADE
FACULTY OF MEDICINE

Simulation center

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Overview

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- First AID
- BLS
- ACLS
    - Airway management
    - Haemodynamic management
    - ACLS DRUGS
    - ACLS ECG
    - Important algorithms
- General Cases
- ERC vs AHA

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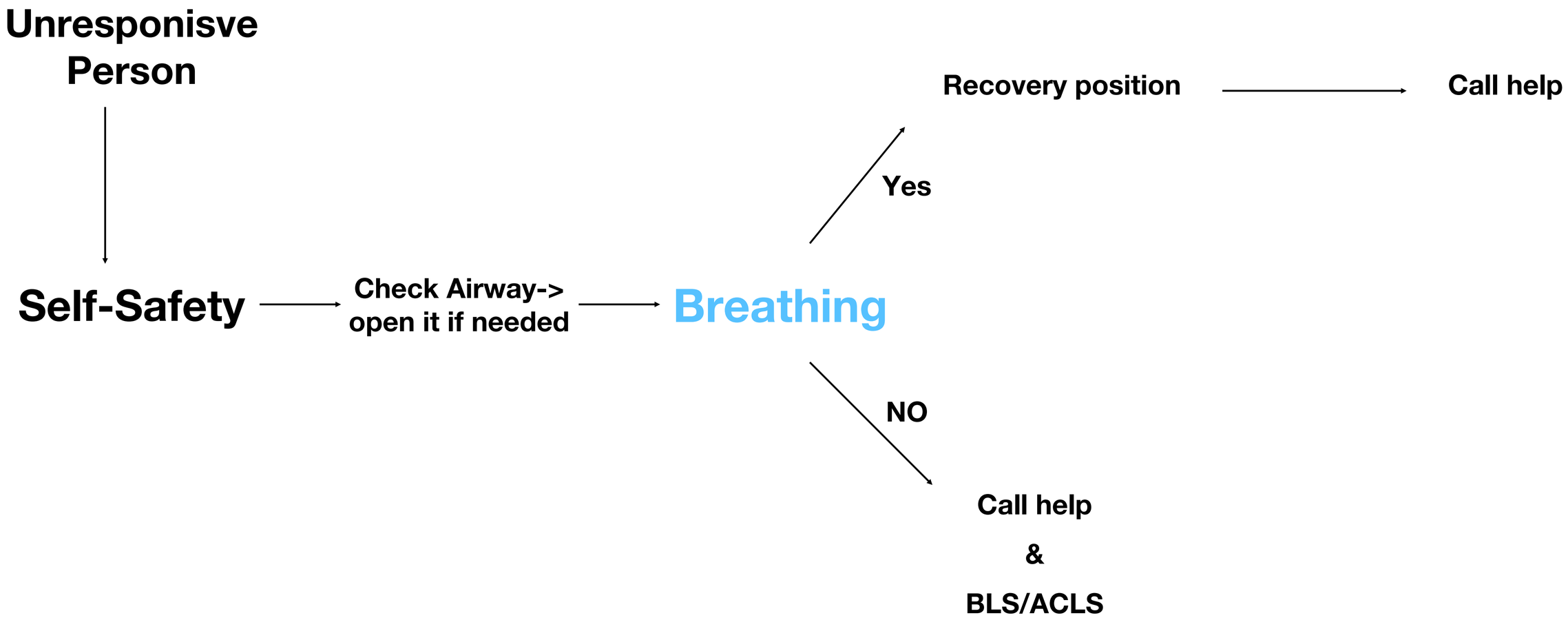
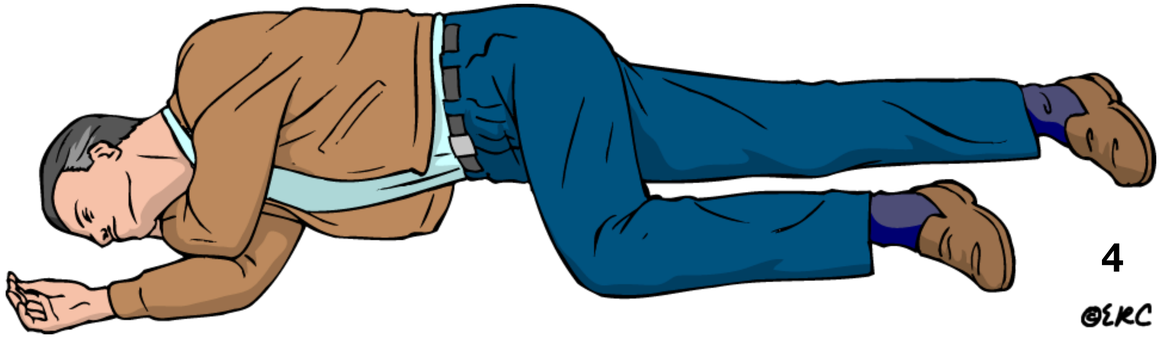
First Aid

First Aid


Unresponisve Person
Self-Safety
Check Airway-> open it if needed
Breathing
Yes
Recovery position
Call help
NO
Call help
&
BLS/ACLS

First Aid- Recovery position



Important Acronyms/Schemes

A	Airway
B	Breathing
C	Circulation
D	Disability(neurologic assessment)
E	Exposure

S	Symptoms
A	Allergies
M	Medications
P	Patient History
L	Last meal/drink/hospital visit/stool/voiding/attack etc
E	Event/Environment
R	Risk factors

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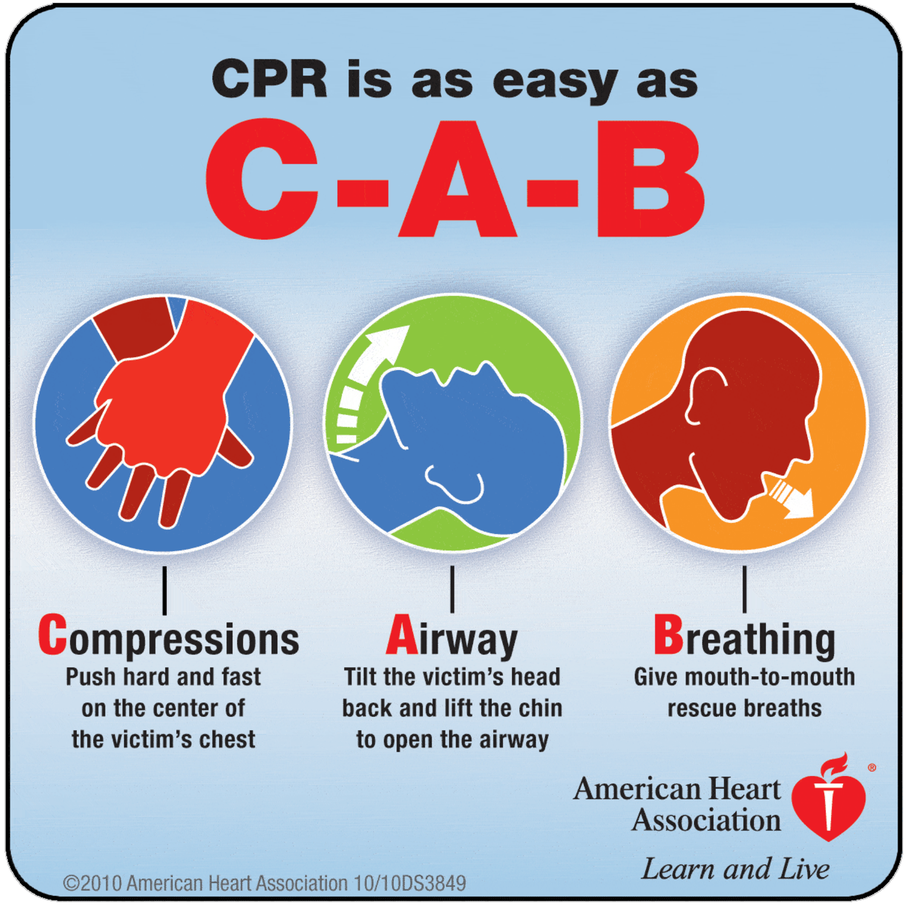
Basic Life Support

BLS

BLS

- Basic Life Support BLS- just AED, no drugs and medical equipment
- ONLY:
  - Chest Compressions
  - Airway – evtl with mask and AMBU bag if available
  - AED

- YOUTUBE:
  - https://www.youtube.com/watch?v=iXcsHoQMGqc



BLS

Approach safely

Check response

Shout for help

Open Airway

Check breathing

Call rescue

START CPR (30 Compressions)

2 rescue breaths

Use AED

Continue with CPR until rescue arrives

BLS

- Approach **SAFELY!**
  - **Check:**
    - Scene
    - Victim
    - Bystanders
- **CHECK** response:
  - Shake shoulders gently -> ask (loud, clearly): “Are you all right?”
  - If he responds ->Leave as you find him, find out what is wrong, reassess regularly
  - If he does not respond-> Shout for help

Approach safely
Check response
Shout for help
Open Airway
Check breathing
Call rescue
START CPR (30 Compressions)
2 rescue breaths
Use AED
Continue with CPR until rescue arrives

BLS- Airway

Approach safely

Check response

Shout for help

Open Airway

Check breathing

Call rescue

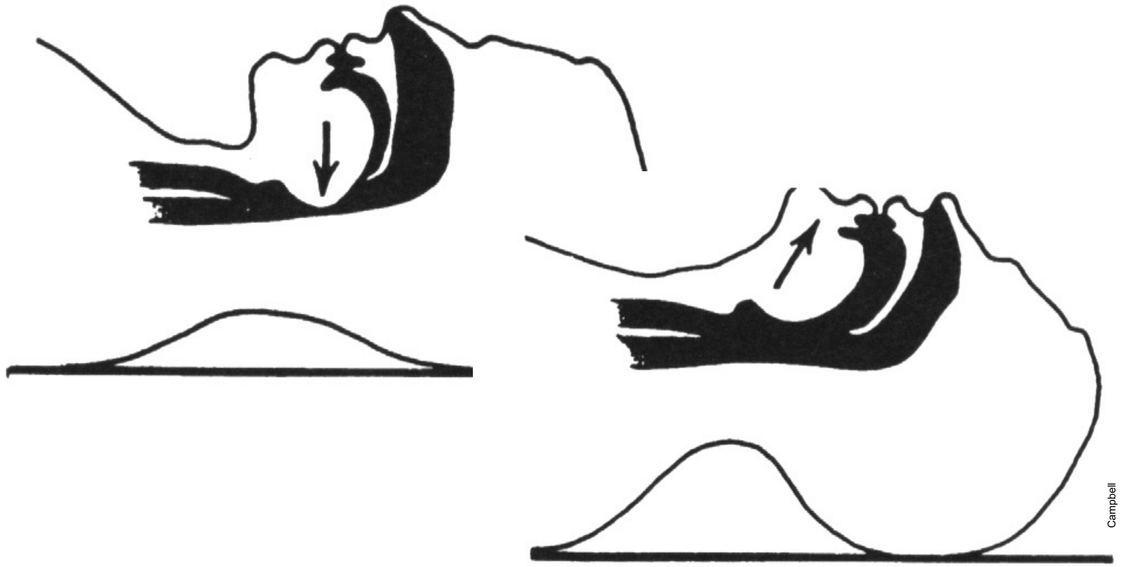
START CPR (30 Compressions)

2 rescue breaths

Use AED

Continue with CPR until rescue arrives

BLS- Ways to open an airway



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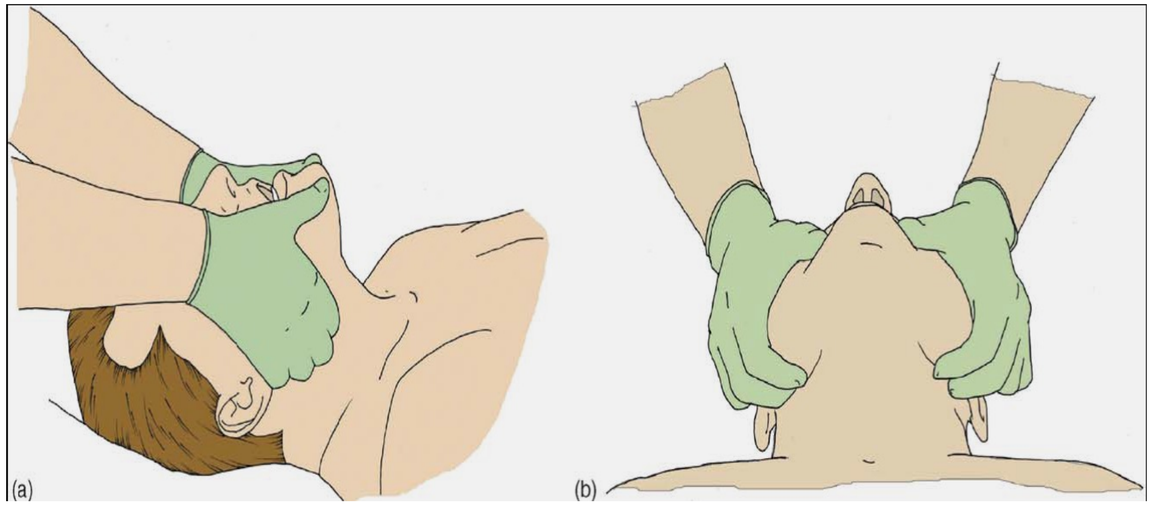


Open the airway by neck extension

Head tilt, chin lift + jaw thrust (Esmarch Grip)

- Look and listen for and feel if normal breathing is present
- Do **not** mistake agonal breathing for normal breathing

BLS- Emergency numbers

Emergency numbers:

Serbia 194

Europe 112

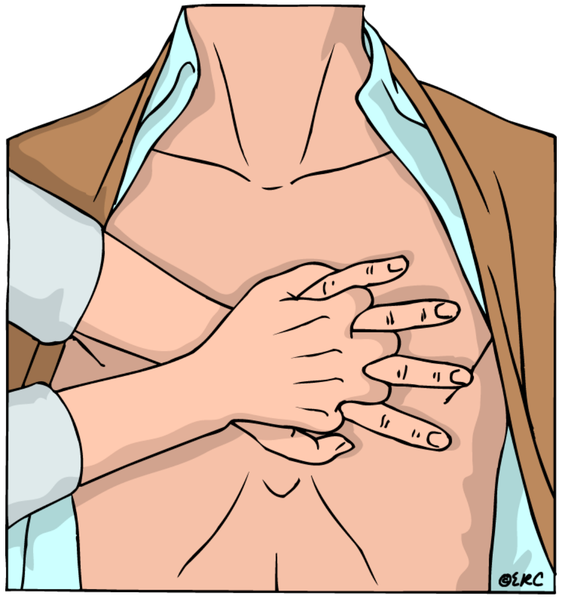
USA 911

UK 999

Australia 0000

Approach safely
Check response
Shout for help
Open Airway
Check breathing
Call rescue
START CPR (30 Compressions)
2 rescue breaths
Use AED
Continue with CPR until rescue arrives

BLS- CPR



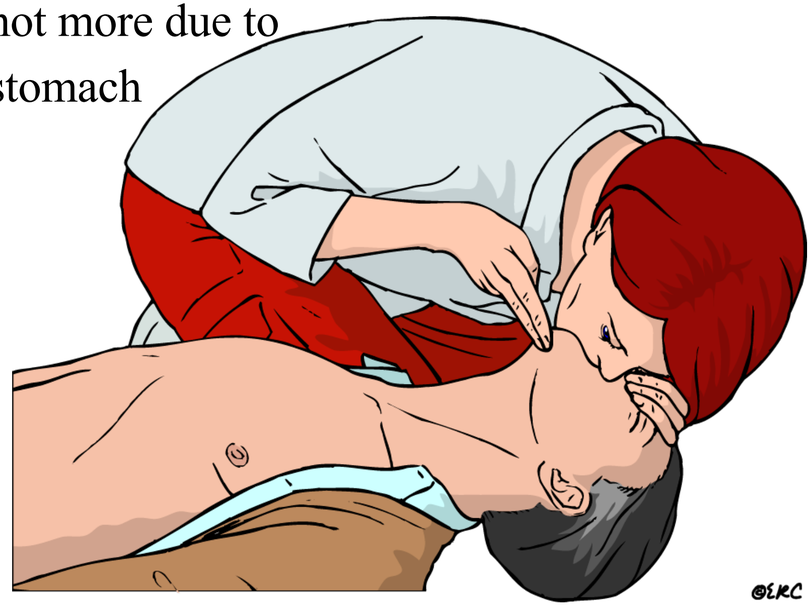
- Place one hand on the centre of the chest and the other hand on top and interlock your fingers (lower 2/3 of the sternum)
- Start chest compressions
  - Rate **100 - 120 /min**
  - Depth **5-6 cm**
  - **Equal** compression : relaxation
- If possible change CPR operator every 2-5 min or after each shock

Approach safely
Check response
Shout for help
Open Airway
Check breathing
Call rescue
START CPR (30 Compressions)
2 rescue breaths
Use AED
Continue with CPR until rescue arrives

!!!HIGH-QUALITY COMPRESSIONS ARE CRUCIAL!!!

BLS- rescue breaths

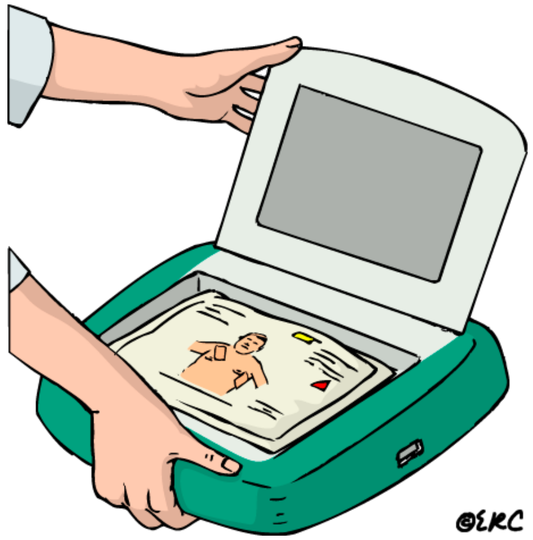
- Pinch the nose
- Take a normal breath
- Place your lips over mouth
- Blow until the chest rises-not more due to additional inflation of the stomach
- Take about 1 second
- Allow chest to fall
- Repeat twice and continue with chest compressions



Approach safely
Check response
Shout for help
Open Airway
Check breathing
Call rescue
START CPR (30 Compressions)
2 rescue breaths
Use AED
Continue with CPR until rescue arrives

BLS with AED

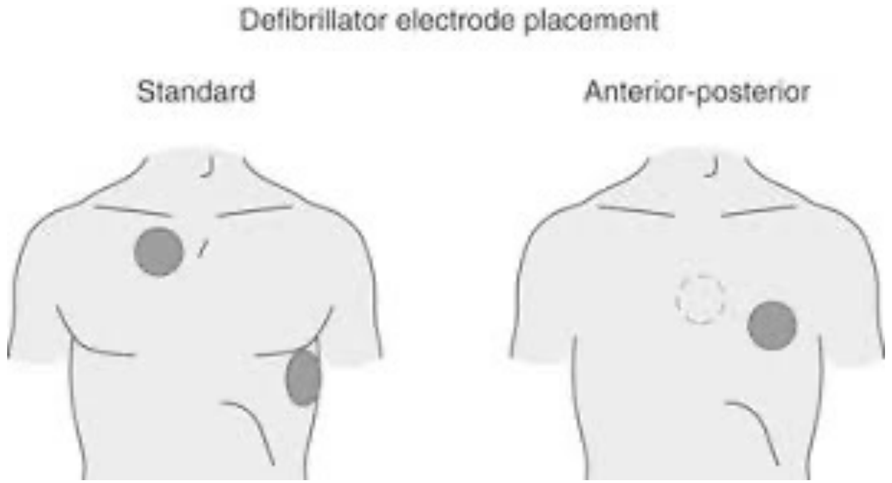
- Continue CPR until an Automatic External Defibrillator (AED) is available
- Use AED and follow the instructions from it
- Some AEDs turn on automatically when their lid is opened



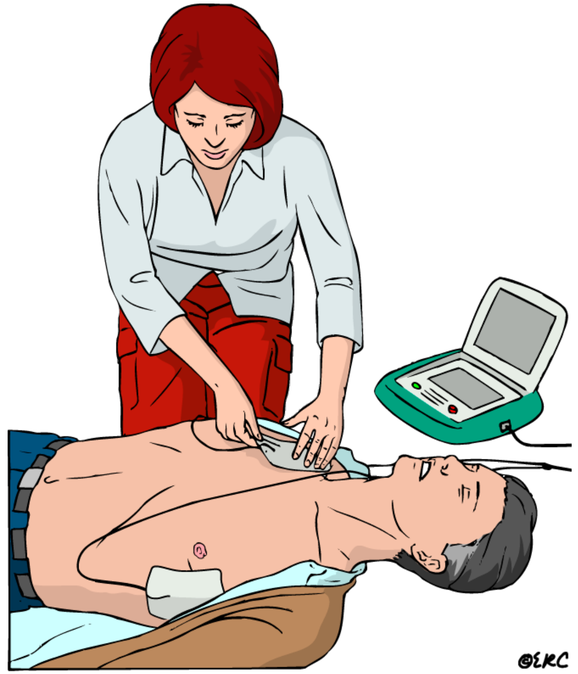
Types of AEDs;Reference: https://ezcardiohelp.us/aeds/

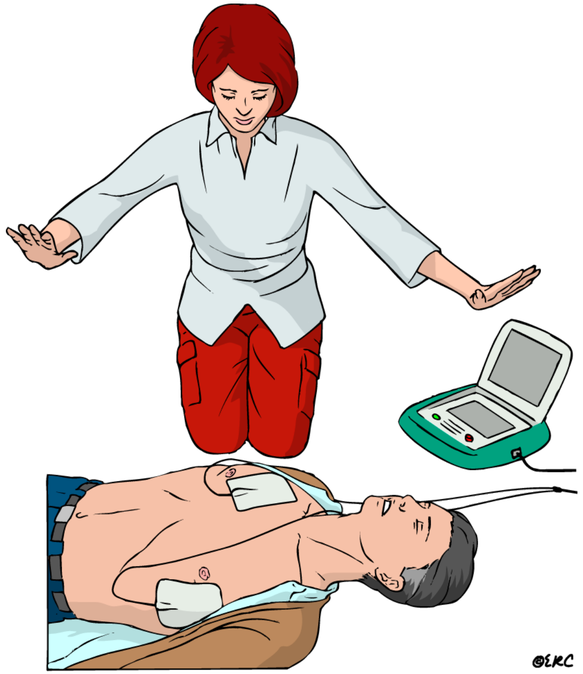
BLS with AED

- Attach the patches to the bare chest of the patient
- AED starts analysis of the heart rhythm automatically
- During the analysis DO NOT touch the patient



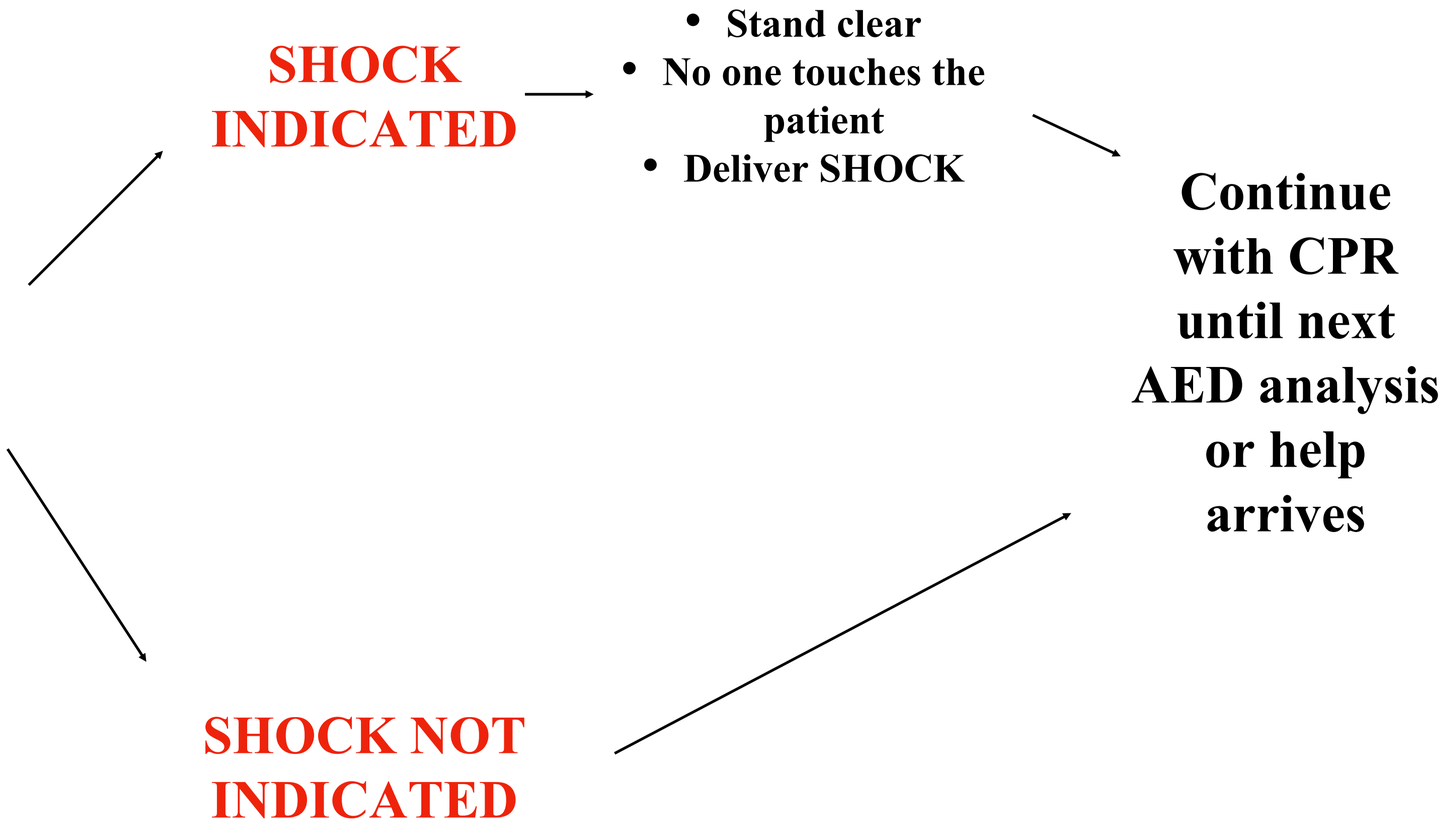
Electrode Placement;Reference: https://nursekey.com/31-cardiovascular-emergencies/





BLS with AED

2 possible results of the AED analysis



Continue with BLS until

- Qualified help arrives and takes over
- The patient starts breathing normally
- Rescuer becomes exhausted

Approach safely
Check response
Shout for help
Open Airway
Check breathing
Call rescue
START CPR (30 Compressions)
2 rescue breaths
Use AED
Continue with CPR until rescue arrives

STOP CPR if

- Return of breathing or pulse or consciousness—> Place the patient into the recovery position
- Professional help arrives
- Rescuer too exhausted to continue
- Unsafe scene
- Physician directed (do not resuscitate orders)
- Cardiac arrest longer than 30 minutes (controversial)

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Quiz

Question 1

Where on the chest is the correct hand position to apply compressions to?

A. Upper sternum

B. Left side of the chest

C. Lower 2/3 of the sternum

D. Left medial-clavicular line

C

Question 2

What is important in providing adequate chest compressions?

A. Relaxation and compression have to be equal

B. Compression rate has to be 80-90/min

C. Compression depth 3-4cm

D. Compressions can be done with one hand only

A

Question 3

What is a possible contraindication to CPR?

A. Many people watching

B. Unsafe scene

C. Rain

D. Alcohol intake by the rescuer

B

Question 4

What is the correct compression rate and depth?

A. 100-120/min and 5-6 cm depth

B. 100-120/min and 3-4cm depth

C. 90-100/min and 5-6 cm depth

D. 60-100/min and 6-10cm depth

A

Question 5

When you approach an unconscious person, which is breathing and the scene is safe-what are your first steps?

A. Call the rescue, place person into supine position

B. Call rescue and place person into recovery position

C. Start CPR immediately

D. Do not do anything

B

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Advanced Cardiac Life Support

ACLS

ACLS

ACLS includes **BLS** + **additional measures** (professional airway management, drugs, hemodynamic management, rhythm analysis, defibrillation/cardioversion/pacing)

GOOD BLS IS CRUCIAL FOR GOOD ACLS!!!

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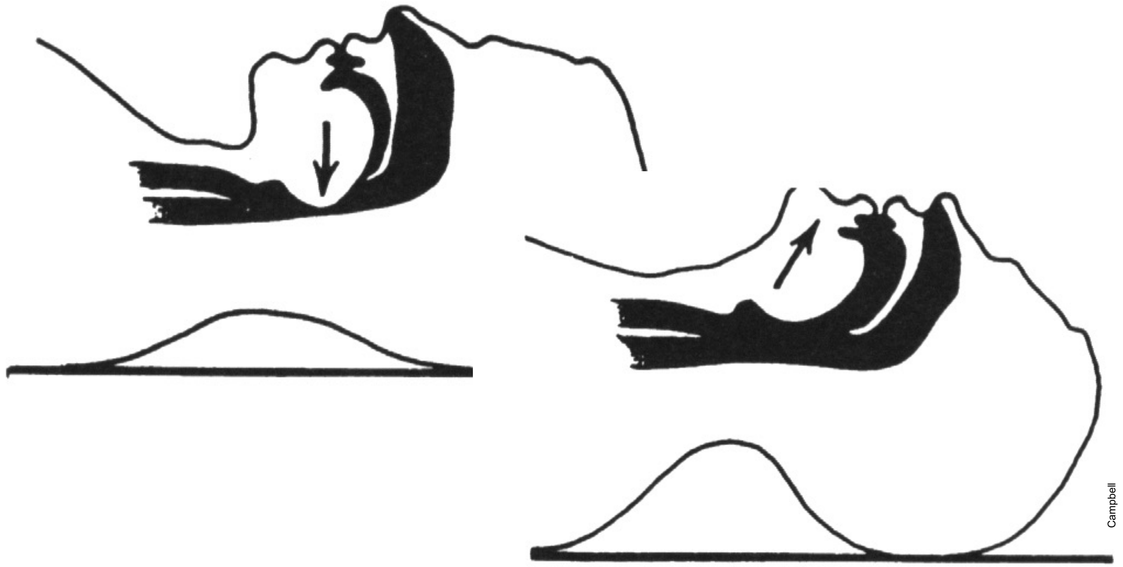
ACLS- Airway management

Airway Management- Neck Extension& Esmarch/Chin-lift



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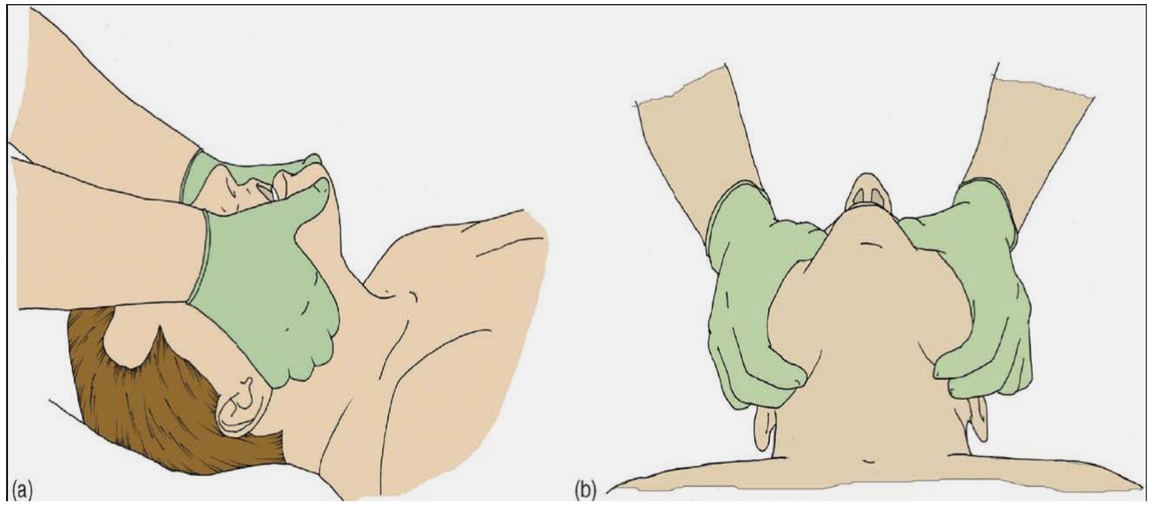


Open the airway by neck extension

Head tilt, chin lift + jaw thrust (Esmarch Grip)

- Look and listen for and feel if normal breathing is present
- Do **not** mistake agonal breathing for normal breathing

Airway Management- Mask-Bag-Ventilation (MBV)

- Successful MBV requires technical competence and depends on:
  - patent airway
  - An adequate mask seal
  - Proper ventilation technique
- Establishing a patent airway MBV:
  - Clear oropharynx (no obstructions:eg, secretions, vomitus, foreign bodies)
  - Proper positioning of the patient and manual manoeuvres
  - Use of airway adjuncts (e.g.:nasopharyngeal/ oropharyngeal tube)
- Goal: Rapid and successful provision of ventilation

- Indications
  - Emergency ventilation
  - Pre-oxygenation during efforts to achieve and maintain definitive artificial airways (eg, endotracheal intubation)

- Complications: Ventilation of the stomach-> Gastric distension

- MBV is **ALWAYS** a back-up for ventilation

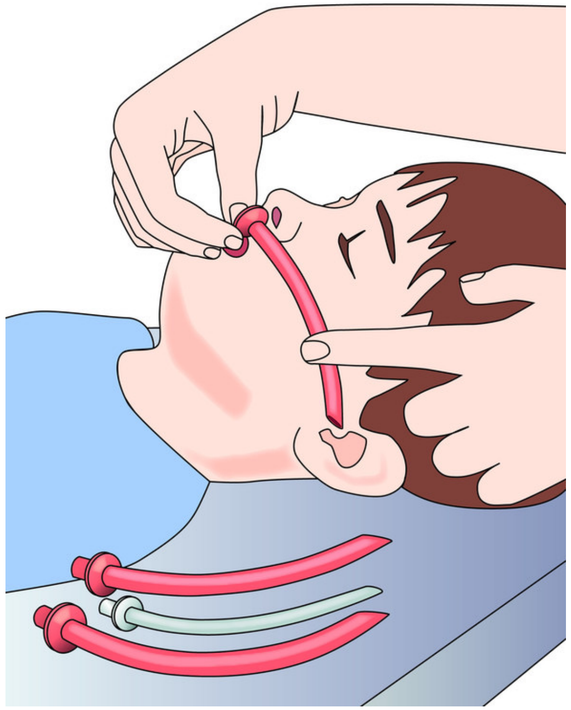
- Youtube: https://www.youtube.com/watch?v=rOZVljYnmxc

Mask attached to a bag;Reference: https://rebelem.com/prevent-bag-mask-ventilation-prior-to-intubation/

C-grip;Reference:https://www.ems1.com/airway-management/articles/how-to-improve-your-bag-valve-mask-technique-Id6to8AxqaXnAs6v/

Double C-grip;Reference: https://www.researchgate.net/figure/The-Two-hand-E-C-technique-of-Bag-Mask-Ventilation_fig1_233001238

Airway Management- Nasopharyngeal tube



Nasopharyngeal tube; Reference:https://eref.thieme.de/cockpits/clAINS0001clRettungsdienst0001/0/coAnae00129/4-18601

- Indications:
  - Spontaneously breathing patient with soft tissue obstruction of the upper airway
  - Secure airway in patient with intact gag reflex
  - settings where oropharyngeal airways cannot be used, eg, oral trauma, trismus
  - May facilitate bag-valve-mask ventilation
- Contraindications:
  - Nasal trauma and cribriform plate fracture
- Youtube: https://www.youtube.com/watch?v=NDx1AwR25PA

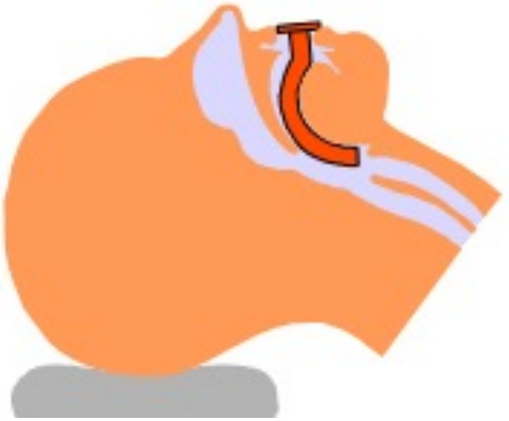
Airway Management- Oropharyngeal tube

- Indications:
  - Aid bag-valve-mask ventilation
  - Spontaneously breathing patient with soft tissue obstruction of the upper airway (unconscious & no gag reflex)

- Contraindications:
  - Consciousness
  - presence of gag reflex
  - oral trauma
  - trismus

- Youtube: https://www.youtube.com/watch?v=Hot2mXhiqSQ

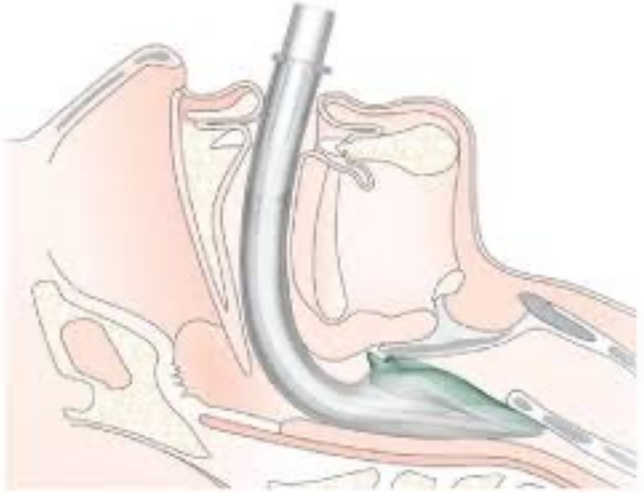
Oropharyngeal tube;Reference:https://www.praxindo.de/guedel-tubus-steril-verschiedene-groessen-50-stueck.html



Oropharyngeal tube; Reference: http://www.san-erlangen.de/VirtuelleSanArena-Erlangen-Html4/html/Topic9a4ff37fe8624474bc4510b51be4bab4.html

Airway Management-Larynx mask

- Indications:
  - Apnea, severe respiratory failure
- Contraindications:
  - Maximum mouth opening between incisors < 2 cm (—> consider: nasotracheal intubation or surgical airway)
  - Impassable upper airway obstruction
  - Consciousness
  - Presence of a gag reflex
  - Increased risk of regurgitation
  - Need for high pressure ventilation (the tighter seal of an endotracheal tube or a special LMA designed to form a tighter seal is needed for patients with excessive airflow resistance in the infraglottic airways or lungs)
- Complications:
  - Vomiting and aspiration
  - Tongue edema
  - Dental or oropharyngeal soft tissue trauma during insertion
- Youtube: https://www.msdmanuals.com/professional/multimedia/video/v27304465



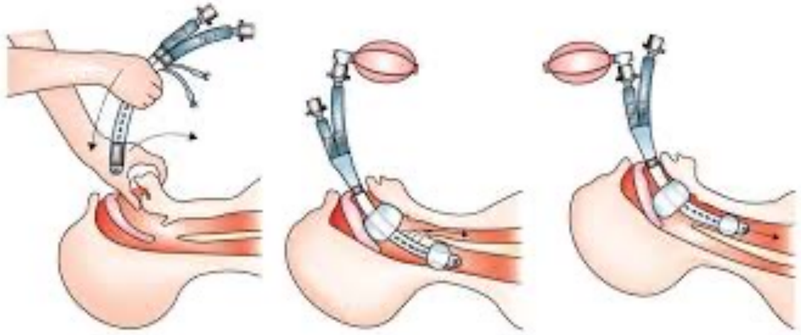
Larynxmask Postion;Reference:https://siga-fsia.ch/files/Ausbildung/Abschlussarbeiten/XUND_Luzern/Abe__Gino_14_15_AN_Diplomarbeit_2016-01-29.pdf

Larynxmask;Reference:https://medprod.de/produkt/larynxmaske-airway/

Airway Management- Combitube

- Indications:
  - Apnea, severe respiratory failure
- Contraindications:
  - Restricted mouth opening that blocks tube insertion (nasotracheal intubation/surgical airway)
  - Impassable upper airway obstruction
  - Consciousness
  - Presence of a gag reflex
  - Hypopharyngeal or esophageal abnormalities or trauma
  - **not** recommended for patients < 120cm tall
- Complications:
  - Vomiting and aspiration during tube insertion or after placement in patients who regain a gag reflex
  - Dental or oropharyngeal soft tissue trauma during tube insertion
  - Tongue edema
- Youtube: https://www.msdmanuals.com/professional/multimedia/video/v28604758

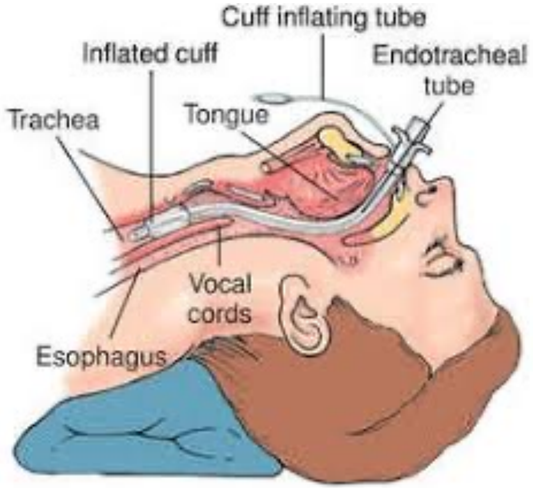
Combitube; Reference: https://www.dufortlavigne.com/en/produit/KEN518437



Location of Combitube; Reference: https://tr.pinterest.com/pin/507217976758286364/

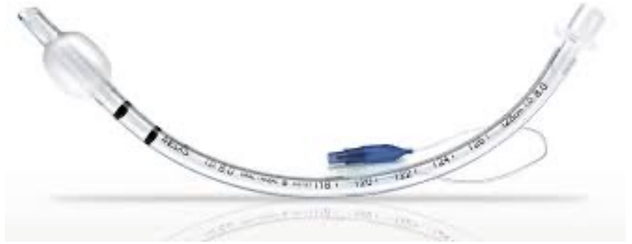
Airway Management-Endotracheal Intubation

- Indications:
  - Apnea, respiratory failure
  - Airway obstruction
  - Inadequate oxygenation or ventilation
  - hemodynamically unstable patient
  - GCS <8 or state in which patient unable to protect airway
  - CPR
  - Flail chest/pulmonary contusion



Position of the et-tube;Reference:https://medical-dictionary.thefreedictionary.com/Endotracheal+tube

- Contraindications (only relative):
  - severe airway trauma
  - obstruction that allows only unsafe placement



et-tube;Reference: https://www.medis-medical.com/products/endo-tube

Laryngoscope;Reference: https://en.wikipedia.org/wiki/Laryngoscopy

- Complications:
  - Direct trauma
  - Esophageal intubation
  - Tracheal erosion or stenosis
  - During Laryngoscopy possible damage of:lips, teeth, tongue, supraglottic& subglottic areas

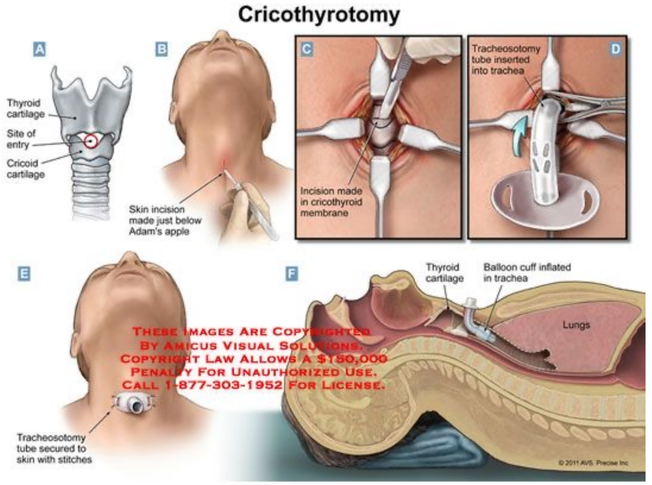
- Youtube: https://www.msdmanuals.com/professional/multimedia/video/v8517417

Airway Management- Cricothyrotomy&Tracheostomy (surgical airway)

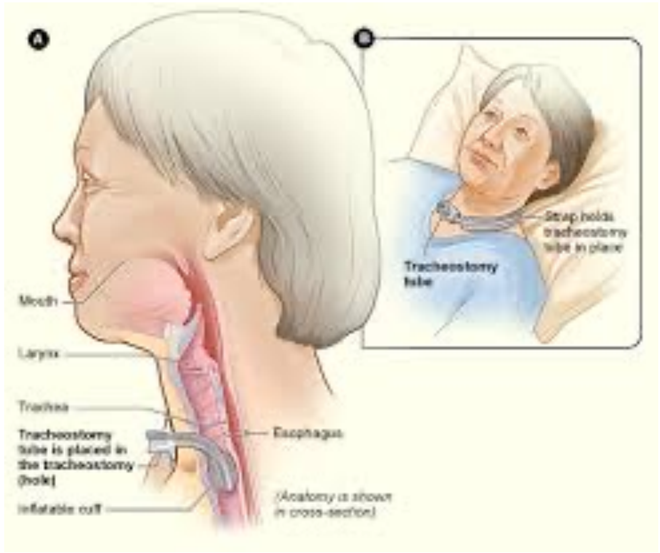
- Indications:
  - Apnea, severe respiratory failure, or impending respiratory arrest requiring endotracheal intubation
  - Failed attempts at endotracheal intubation with inability to oxygenate/ ventilate
  - Contraindications for endotracheal intubation are present (e.g.: massive oral hemorrhage, severe facial trauma, mass effect due to tumor)

- Contraindications:
  - Age < 8 years
  - Inability to identify landmarks due to significant injury to larynx, thyroid cartilage, or cricoid cartilage
  - Partial or complete transection of the distal trachea
- Complications:
  - Bleeding
  - Insertion of tube into neck tissues rather than trachea
  - Injury/perforation of the posterior aspect of the trachea
  - Larynx, vocal cord, or thyroid injury

- Youtube:https://www.msdmanuals.com/professional/multimedia/video/v28604774



Cricothyrotomy Location and Placement; Reference: https://www.pinterest.com/pin/319544536033579160/



Tracheotomy;Reference : https://en.wikipedia.org/wiki/Tracheotomy

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QUIZ

Question 1

What is a crucial step so Mask-Bag-Ventillation is sufficient?

A. Neck extension

B. Endotracheal intubation

C. Tracheotomy

D. Nothing it always works

A

Question 2

What possible complication may Mask-bag ventilation have?

A. Hyperventillation

B. Ventilation of the stomach

C. Hypoventillation

D. Facial fracture

B

Question 3

Which of the following is not a complication of both the larynx mask and the combi tube?

A. Tongue edema

B. Bleeding

C. Vomiting and aspiration

D. Dental and oropharyngeal soft tissue trauma

B

Question 4

Which airway management is a safe prevention for aspiration?

A. Larynx mask

B. Oropharyngeal tube

C. Mask-bag ventilation

D. Endotracheal tube

D

Question 5

Which gland may be injured and cause severe bleeding during tracheotomy/cricotomy?

A. Parathyroid gland

B. Thyroid gland

C. Salivary gland

D. Carotid artery

B

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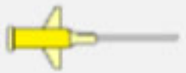
ACLS- hemodynamic Management

Hemodynamic management- peripheral venous access

- Indication:
  - intravenous drug therapy
  - Intravenous fluid administration
  - Repetitive venous blood sampling
- Relative contraindications:
  - Planned use of very concentrated or irritating IV fluids
  - Infection or burned skin at a prospective cannulation site
  - Injured or massively edematous extremity
  - Thrombotic or phlebitic vein
  - Arteriovenous graft or fistula
  - Ipsilateral mastectomy or lymph node dissection
- Complication:
  - Local infection
  - Thrombophlebitis
  - Venous thrombosis
  - Interstitial fluid extravasation
  - Arterial puncture
  - Nerve damage
  - Air or catheter embolism
- The catheter should be removed immediately if signs of inflammation appear or after 72h
- Youtube:https://www.msdmanuals.com/professional/multimedia/video/v28604573

Color	Gauge Size	External Diameter (mm)*	Length (mm)*	Water Flow Rate (mL/min)*	Recommended Uses
 Orange	14G	2.1 mm	45mm	~240 mL/min	Trauma, Rapid blood transfusion, Surgery[1]
 Gray	16G	1.8 mm	45mm	~180 mL/min	Rapid fluid replacement, Trauma, Rapid blood transfusion[1]
 Green	18G	1.3 mm	32mm	~90 mL/min	Rapid fluid replacement, Trauma, Rapid blood transfusion[1]
 Pink	20G	1.1 mm	32mm	~60 mL/min	Most infusions, Rapid fluid replacement, Trauma, Routine blood transfusion[1]
 Blue	22G	0.9 mm	25mm	~36 mL/min	Most infusions Neonate, pediatric, older adults Routine blood transfusion[1]
 Yellow	24G	0.7mm	19mm	~20 mL/min	Most infusions Neonate, pediatric, older adults, Routine blood transfusion, Neonate or Pediatric blood transfusion[1]
 Purple	26G	0.6 mm	19mm	~13 mL/min	Pediatrics, Neonate[1]

Venous cannulas; Reference: https://unese.campusquotient.org/cannula-size-chart/

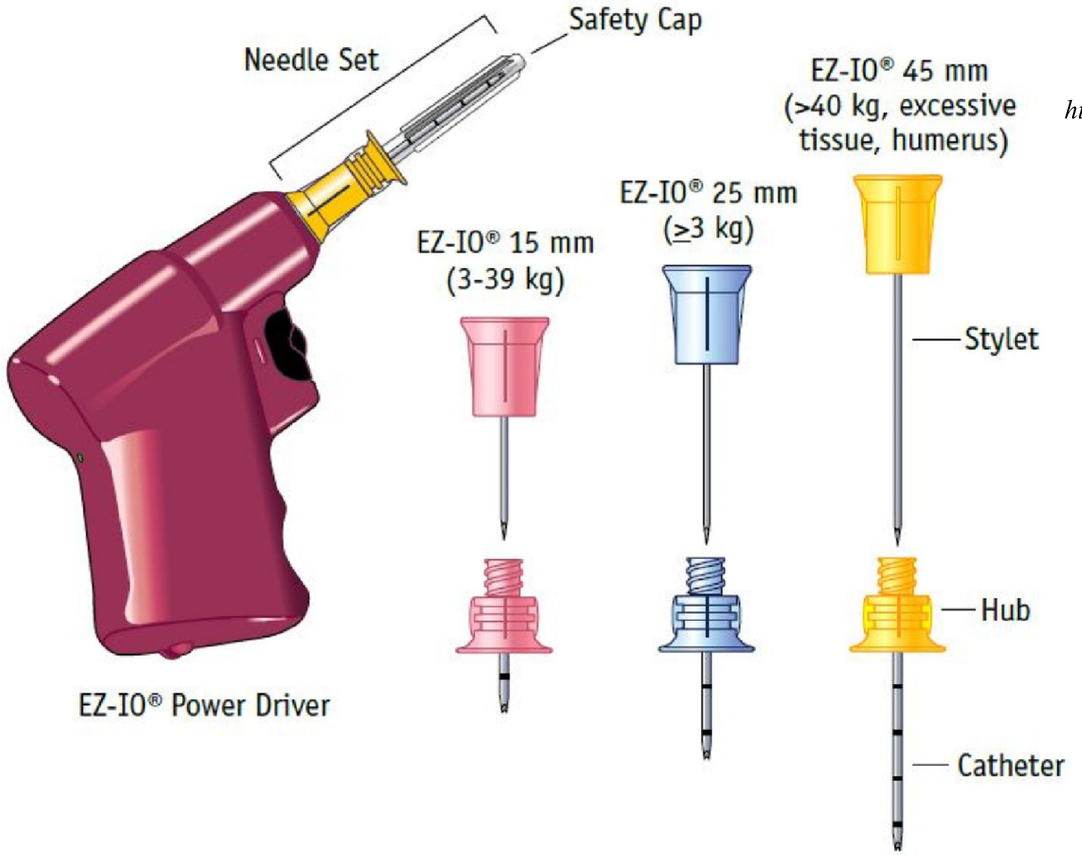
Hemodynamic management- central venous access

- Indications:
  - Secure access
  - Long-term access
  - Poor peripheral venous status
  - Therapy with infusions&solutions too concentrated or irritating for peripheral venous access
- Locations: jugular, subclavian, femoral—> each site has their own complications
- Common complications:
  infection, arteriovenous-fistula, bleeding, pneumothorax, thrombosis, air embolism, arrhythmias, brachial plexus injury
- **OBLIGATORY** X-RAY after upper central venous access!
- Youtube:
  - US-guided femoral vein catheterisation: https://www.msdmanuals.com/professional/multimedia/video/v26443891
  - Femoral vein catheterisation: https://www.msdmanuals.com/professional/multimedia/video/v8517410
  - Internal jugular vein catheterisation: https://www.msdmanuals.com/professional/multimedia/video/v8517412
  - Internal jugular vein catheterisation with US: https://www.msdmanuals.com/professional/multimedia/video/v28573724

Central venous catheter set; Reference: https://healthmanagement.org/products/view/central-venous-venous-catheter-set-medi-syst

Hemodynamic management -intraosseous access

- Indication:
  - Temporary alternative to peripheral/ central venous access
  - Infants & children
- Contraindications:
  - Bone fracture or recent cannulation attempt
  - Injured inferior vena cava
  - Infection or burn at needle-insertion site
  - Osteoporosis and osteogenesis imperfecta
- Complications:
    - Extravasation of fluid into soft tissues
    - Bleeding
    - Infection
    - Skin sloughing
    - Fat embolism



EZ-io and needles; Reference: https://www.airmedicaljournal.com/article/S1067-991X(19)30220-2/fulltext

- Insertion sites: ADULTS: distal/proximal tibia, proximal humerus, iliac crest, femur, radius, clavicle, calcaneus, sternum

  CHILDREN: proximal/disal tibia, femur
- Devices: Power Driver (EZ-io,etc), Manual, Spring loaded (Big Bone Injection gun)
- Youtube: https://www.msdmanuals.com/professional/multimedia/video/v22759957

Hemodynamic management- crystalloide infusions I

- Can be hypertonic, isotonic and hypotonic
- With addition of macromolecules, with/without Glucose, with/without Electrolytes
- Indication: Volume therapy, Fluid resuscitation

Ringer lactate solution; Reference: https://www.indiamart.com/proddetail/ringer-lactate-20368473033.html

Ringer acetate solution; Reference: https://bluecaregroup.com/product/ringers-acetate/

Saline solution; Reference: https://en.wikipedia.org/wiki/Saline_(medicine)

Glucose solution;Reference: https://www.praxisdienst.de/Injektion+Infusion/Infusion+Transfusion/Infusionsloesungen/Glucose+Infusion+5.html

Hemodynamic management- crystalloide infusions II

Type	Full electrolyte solution	Balanced full electrolyte solution	K-free electrolyte solutions	Glucose solutions
Characteristics	Contain similar electrolytecomponents and -concentrations as blood plasma; Significant higher Cl-ion concentration than blood plasma	Contain similar electrolytecomponents and -concentrations as blood plasma; reduced concentration of Cl-ions due to addition of Anions (e.g. Malate, acetate, lactate)	Unphysiologic electrolyte components and-concentrations; NO potassium	Contains glucose; can be hyperontic or hypotonic
Indications	First choice for fluid rescusitation, simple hypovolemia	Fluid rescusitation, simple hypovolemia; in hepatic insufficiency prefer acetate and malate	Isotonic: for drug infusions, hypo-/isotonic dehydration; Hypertonic: short-term in significant hyponatremia; hypotonic: hypernatremia with hypertonic dehydration	Hypotonic: Hypernatremi with hypertonic dehydration, for drug infusion, glucose administration In hypoglycemia; Hypertonic: hypoglycemia, parenteral nutrition
Contraindications	Electrolyte disturbances	Electrolyte disturbances	Electrolyte disturbances	
Example	Ringer Solution	Ringer-lactate solution, ringer-acetate solution	Isotonic NaCl Solution 0,9%; hypertonic NaCl Solution; hypotonic NaCl Solution 0,45%	Hypotonic Glucose solution 5%; Hypertonic Glucose solution 20%

Hemodynamic management- colloidal infusion

- Are solutions with osmotically active macromolecules
- Mechanism of Action: Plasma expander (higher colloid osmotic pressure than blood plasma, pull fluids into circulation) or solutions are used to keep fluids in the circulation
- Indication: short-term fluid resuscitation
- No major advantage compared to crystalloid solutions
- Examples: HES/HAES, Gelatine, Humanalbumin, Dextrans
- HES/HAES associated with renal injury, anaphylaxis, pruritus
- HES/ HAES is contraindicated in Sepsis, burns, reduced renal function, intracranial bleeding, hyper hydration, dehydration, severe coagulopathies, severe hepatic insufficiency
- Human albumin associated with poorer outcome in patients with traumatic brain injury
- Dextrans and HES can have negative influence on coagulation

HES-solution; Reference: https://yaoota.com/en-eg/product/hemohes-6-sol-500-ml-price-from-seif-egypt

Humanalbumin solution; Reference: https://biosupply.fffenterprises.com/biologics/albumin/albuminex-5-500ml-bpl-albumin-kjda.html

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Quiz

Question 1

Which color of peripheral venous catheters has the highest and which the lowest water flow rate?

A. Orange,green

B. Orange, blue

C. Green,puple

D. Orange, purple

D

Question 2

What is NOT a crystalloid solution?

A. Ringer lactate

B. Glucose 5%

C. HAES

D. Ionosteril

C

Question 3

Which solution for intravenous infusion should be used with caution in renal failure due to the risk of severe hyperkalemia?

A. NaCL 0,9%

B. Ringer lactate

C. Glucose 5%

D. HAES

B

Question 4

What is a common complication in all circulatory accesses (i.i./I.o./central)?

A. Fracture

B. Arrhythmias

C. Pneumothorax

D. Infection

D

Question 5

What is a possible side effect of to fast correction of Hyponatremia?

A. Osmotic demyelination syndrome

B. Shock

C. Thrombosis

D. Infection

A

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ACLS- Important Drugs

Important Drugs- Adrenalin/Epinephrine/Suprarenin

- Class: Sympathomimetic ((a1>ß1>ß2), Catecholamine
- Indications: Cardiac Arrest (VF, pulseless VT, Asystole, PEA), symptomatic bradycardia (used as alternative to dopamine), severe hypotension (used if atropine insufficient), anaphylaxis, asthma attack, shock
- Contraindications: Hypertonia, Tachycardia, Hyperthyreosis, AP, MI, Stroke, ICB
- Side Effects: anxiety, apprehensiveness, restlessness, tremor, weakness, dizziness, sweating, palpitations, pallor, nausea, vomiting, headache, angina, arrhythmias, hypertension, tachyarrhythmia, tachycardia, vasoconstriction, ventricular ectopy, stress cardiomyopathy, cerebral hemorrhage, disorientation, impaired memory, panic, psychomotor agitation, sleepiness, tingling, hyperglycemia
- Dosage:
  - CPR: I.v./I.o.: 1mg every 3-5min; endotracheal: 2-2,5mg in 10ml NaCl; continuous infusion: 0,1-0,5 µg/min;
  - CPR (child): 0,01/kg bodyweight every 3-5min
  - Bradycardia/Hypotonia: 2-10µg/min
  - Anaphylaxis: 0,5mg I.m.; 0,01-0,1 mg i.v.
- Application ways: i.v., i.o., i.m., endotracheal
- Half-life: 2-3min

Important Drugs- Dopamine

- Class: Catecholamine (ß1>a1>ß2)
- Indications: shock (CAVE: use with caution in cariogenic shock), hypotension, symptomatic bradycardia (2nd choice after atropine)
- Contraindications: Hypertension, ventricular fibrillation, Tachyarrhythmia, pheochromocytoma, glaucoma
- Side Effects: ventricular arrhythmia, atrial fibrillation, ectopic beats, tachycardia, anginal pain, palpitation, cardiac conduction abnormalities, widened QRS complex, bradycardia, hypotension, hypertension, vasoconstriction, dyspnea, nausea, vomiting, azotemia, headache, anxiety, piloerection
- Dosage: 2-20µg/kg/min
- Application: i.v. (preferred via a central line)
- Half-life: 2 min

Important Drugs- Noradrenalin

- Class: Sympathomimetic (a1>ß1>ß2), Catecholamine
- Indications: shock, hypotension
- Contraindications: hypersensitivity, hypotension due to volume deficit, vascular thrombosis
- Side Effects: hypertonia, bradycardia, arrhythmias, hypoperfusion of vital organs (kidneys, bowel), confusion, anxiety, dyspnea, headache, nausea, vomiting, sweating, tremor, restlessness, urinary retention, gangrene, dizziness,
- Dosage: 2-20µg/ min I.v.
- Application: i.v. (preferred via a central line)
- Half-life: 2min

Important Drugs- Amiodarone

- Class: Class III Antiarrhythmic
- Indications: Ventricular Fibrillation, Ventricular Tachycardia, Atrial fibrillation, atrial flutter
- Side Effects: hypotension, bradycardia, heart block, QT-Interval prolongation, hyper/hypothyreosis, pulmonary fibrosis, constipation, hepatotoxicity, and many more
- Dosage: during CPR after 3rd unsuccessful defibrillation: 300mg I.v./I.o. when another 150mg if needed—> max cumulative dose in 24h 2,2g I.v.
- Application: i.v. / i.o.
- Half-life: 15-142 days

Important Drugs- Lidocaine

- Class: Class Ib Antiarrhythmic
- Indications: alternative to amiodarone, stable monomorph VT with persistent ventricular function, stable polymorph VT, Torsades de pointes, digitalis induced arrhythmia
- Side Effects: cardiovascular depression(bradycardia, hypotension), lightheadedness, nervousness, apprehension, euphoria, confusion, dizziness, drowsiness, tinnitus, blurred or double vision, vomiting, sensations of heat, cold or numbness, twitching, tremors, convulsions, loss of consciousness, respiratory depression and arrest, hypersensitivity
- Dosage: 1-1,5mg/kg I.v./I.o. then 0,5-0,75mg/kg every 5-10min max 3 doses/ 3mg/kg
- Application: i.v./ i.o.
- Half-life: 1,5-2h

Important Drugs- Magnesiumsulfate

- Class: Electrolytes
- Indications: Torsades de pointes, hypomagnesemia, digitalis-toxicity, convulsions,
- Contraindications: heart block or myocardial damage
- Side Effects: hypotension, flushing, sweating, hypothermia, stupor
- Dosage:
    - 1-2g I.v./I.o. in cardiac arrest with hypomagensemia/torsades de pointes
    - 1-2g in torsades de pointes with pulse or Acute MI with hypomagnesemia
- Application: i.v./ i.o.

Important Drugs- Adenosine

- Class: Antiarryhthmic Class V
- Indications: stable tachycardia with thin QRS-complexes (Reentry, AV, Sinustachycardia), medicamentous cardioversion
- Contraindications: toxic/drug-induced tachycardia or av-block, sick-sinus-syndrome, hypersensitivity
- Side Effects: AP, asystole, hypotension, sinus-bradycardia, facial flushing, headache, sweating, palpitations, dyspnea, chest pressure, hyperventilation, head pressure, Lightheadedness, dizziness, tingling in arms, numbness, apprehension, blurred vision, burning sensation, heaviness in arms, neck and back pain,Nausea, metallic taste, tightness in throat, pressure in groin, seizure, bronchospasm
- Dosage: initial dose 6mg I.v. than 12mg after 1-2min, than 12mg again after 1-2min—>continuous ECG-recording during application
- Application: i.v. as a bolus
- Half-life: < 10sec

Important Drugs- Atropine

- Class: Parasympatholytic/ Antimuscarinic drug
- Indications: bradycardia, AV-Block, organophosphate intoxication, mushroom intoxication
- Side Effects: tachycardia(sinus, supra ventricular, junctional, ventricular), bradycardia, palpitations, ventricular arrhythmia, ventricular flutter, ventricular fibrillation, atrial arrhythmia, atrial fibrillation, asystole, syncope, myocardial infarction, mydriasis, ileum (paralytic), hyperpyrexia, somnolence, lethargy, chest pain, dehydration, hallucinations, etc.
- Dosage:
    - Bradycardia: 0,5mg i.v. every 3-5min, max 0,04mg/kg or 3mg
    - Organophosphate intoxication: 2-4mg
- Application: i.v./i.o.
- Half-life: ~ 20min

Important drugs- MI therapy

M	Morphine
O	Oxygen
N	Nitroglycerin
A	Aspirin
B	Beta blockers
H	Heparin

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Quiz

Question 1

When do you give Adrenaline during CPR?

A. Every minute

B. Every hour

C. After the first shock

D. As soon as possible and than every 3-5 min

D

Question 2

What is not a catecholamine?

A. Adrenaline

B. Amiodarone

C. Noradrenaline

D. Dopamie

B

Question 3

What is the first-line drug in symptomatic bradycardia?

A. Adrenaline

B. Theophylline

C. Atropine

D. Noradrenaline

C

Question 4

What is the dosage of Amiodarone (first dose) during CPR?

A. 300mg

B. 100mg

C. 150mg

D. 10mg

A

Question 5

Which drugs are used in the therapy of myocardial infarction?

A. Aspirin

B. Methylphenidate

C. Theophylline

D. Morphine

E. Antiemetic

A, D, E

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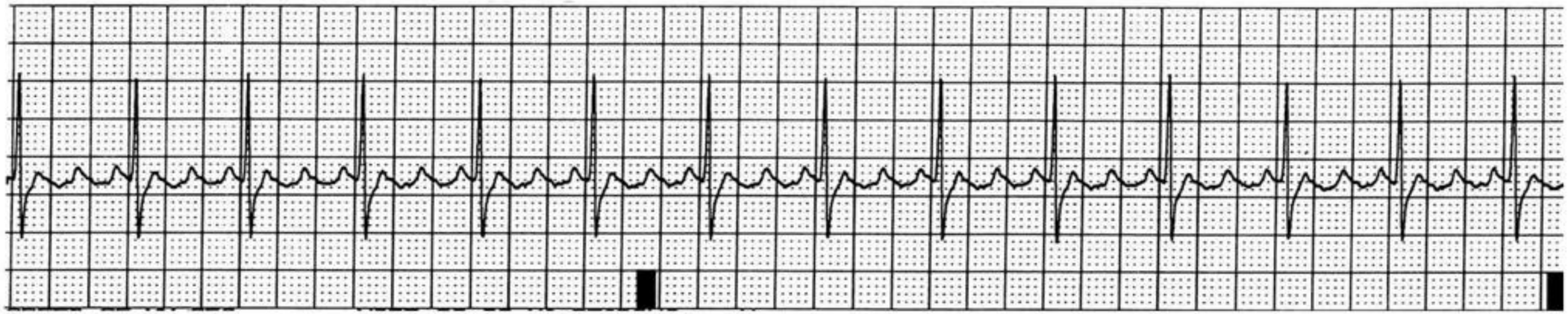
ACLS- Important ECGs

Important ECGs- Atrial Fibrillation

- Frequency of atria is 350-500 beats/min
- Causes: Hypertension, coronary artery disease, cardiomyopathy, valvular heart disorders (mitral stenosis, mitral regurgitation, tricuspid regurgitation), hyperthyroidism, binge alcohol drinking (holiday heart), pulmonary embolism, atrial septal defects, congenital heart defects, COPD, myocarditis, pericarditis
- Therapy: Anticoagulation, antiarrhytmics, cardioversion

Important ECGs- Atrial Flutter



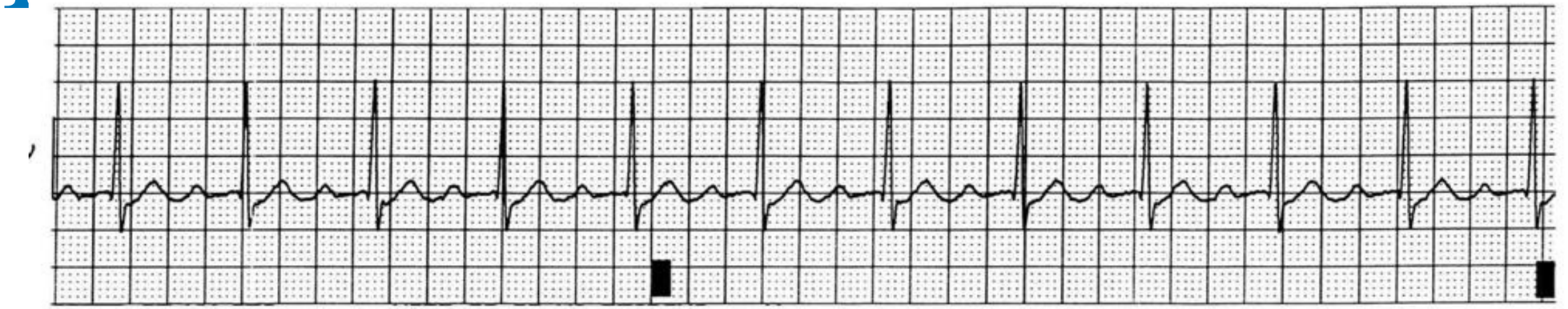
- Frequency of atria is 300 beats/min, usually more regular than Afib
- Causes: similar to atrial fibrillation
- Therapy: Rate control (antiarryhthmics), anticoagulation, caridoversion

Important ECGs- AV-Block (Part I)

4 Types of AV-Block:

- Causes: drugs, idiopathic fibrosis/ sclerosis, ischemic heart disease, drugs, increased vagal tone (young, athletes), valvulopathy, congenital heart disease, genetics
- AV Block Grade I (PR-interval > 20msec)
  - Physiologic
  - Therapy: never/ rarely requires therapy
- AV Block Grade IIa (Mobitz I- PR-Interval progressively lengthens with every beat)
  - Physiologic / pathologic
  - Therapy: if symptomatic-> pacemaker insertion
- AV Block Grade IIb (Moritz II- PR-Interval remains constant, beats intermittently not conducted to ventricles)
  - always pathologic
  - Therapy: -> pacemaker insertion
- AV-Block III (no electrical communication between atria and ventricles)
  - Always pathologic
  - Therapy:-> pace maker insertion, or stop causative agent

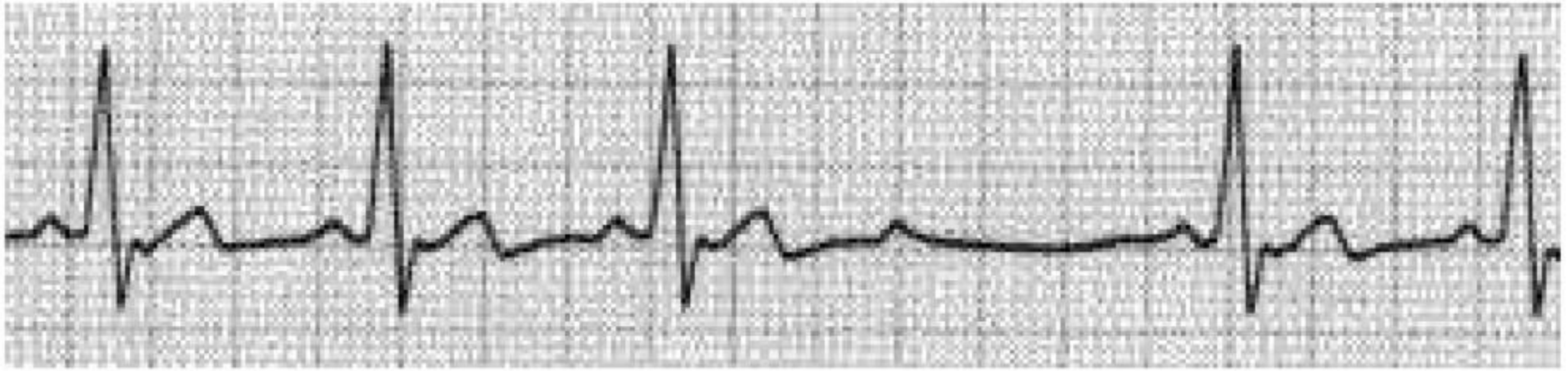
Important ECGs- AV-Block (Part II)



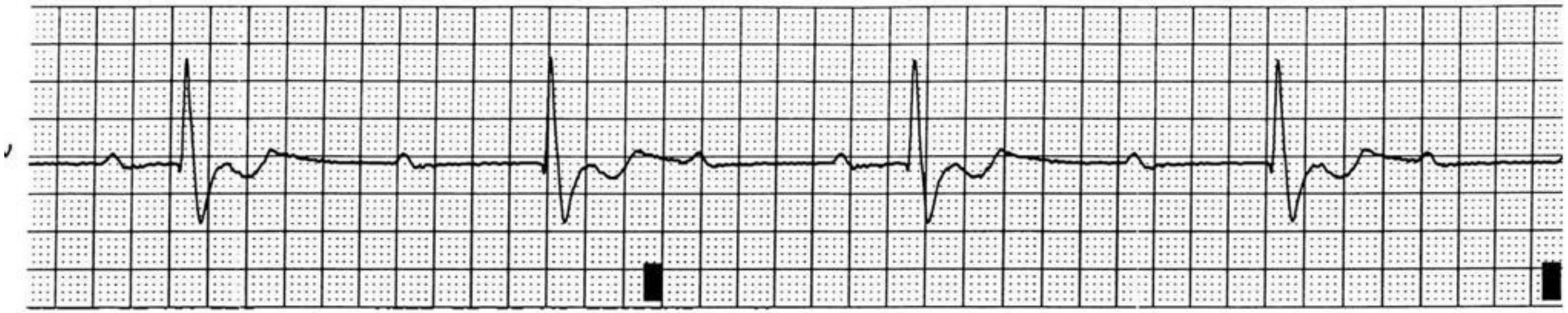
AV-Block Grade 1

AV-Block Mobitz I

Important ECGs- AV-Block (Part II`

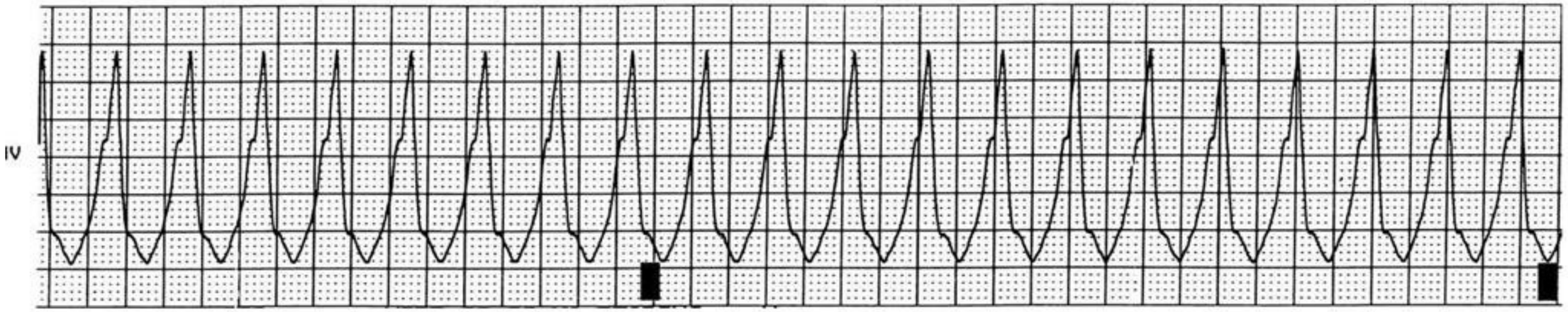


AV-Block Mobitz II



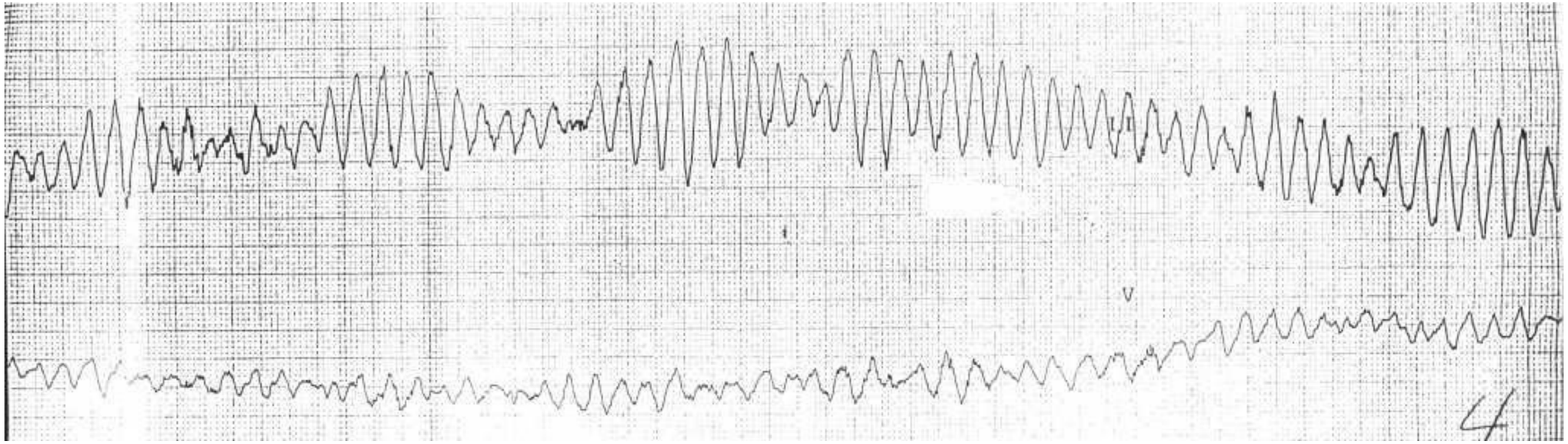
Av-Block Grade III

Important ECGs- Ventricular Tachycardia



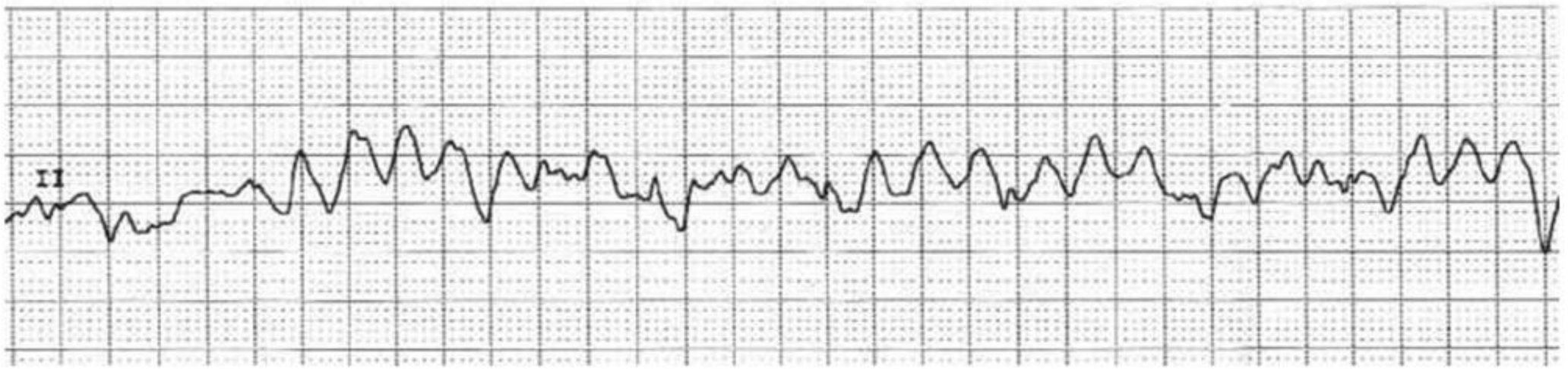
- Can be with or without pulse: with pulse—>cardioversion or antiarrhythmics; without pulse: defibrillation& CPR
- Causes: myocardial infarction, cardiomyopathy, electrolyte abnormalities, acidemia, hypoxemia, adverse drug effects, long QT syndrome

Important ECGs-Torsades de point



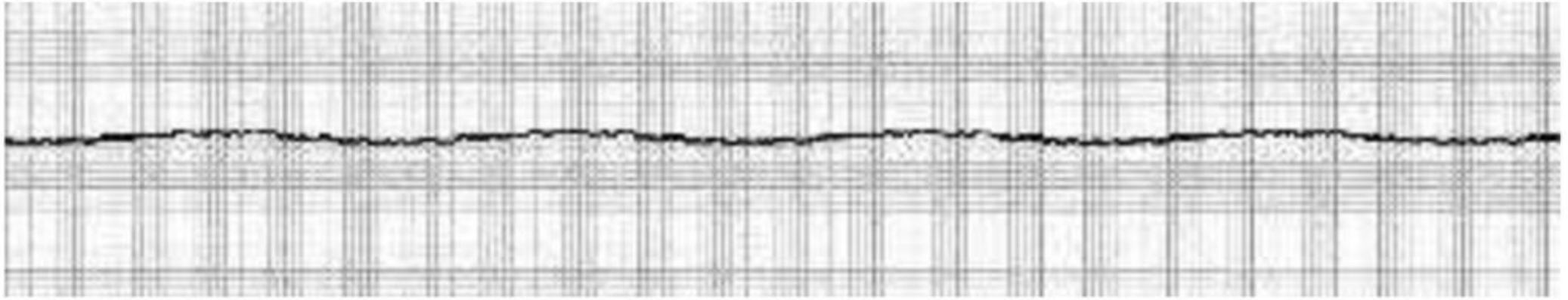
- Special type of ventricular tachycardia
- Associated with long-QT-syndrome
- Therapy: unsynchronised cardioversion=defibrillation, 2g Magnesiumsulfate, correct electrolyte abnormalities, find and treat etiology

Important ECGs- Ventricular Fibrillation



- Causes: heart disease (MI,etc), electrolyte abnormalities, acidosis, hypoxemia, ischemia
- Therapy: CPR with defibrillation—>ACLS

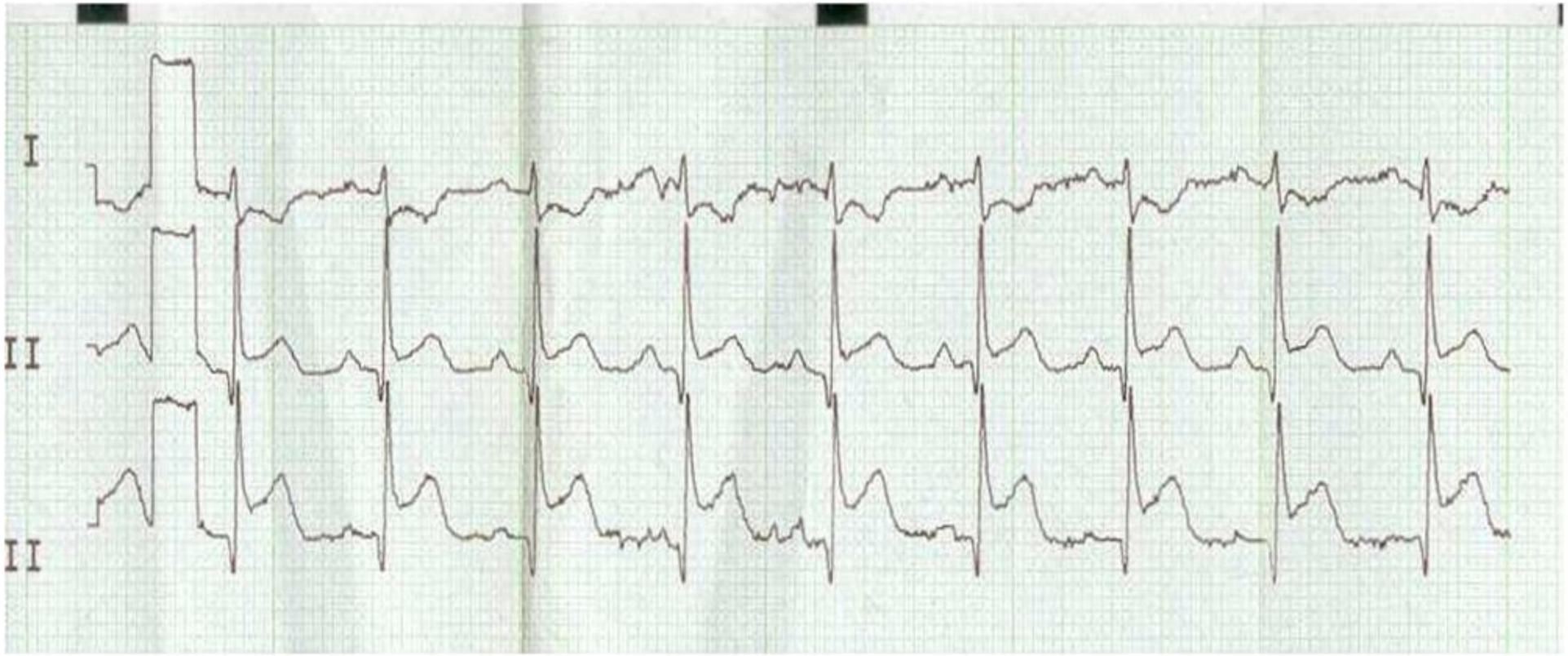
Important ECGs- PEA &Asystloy



Asystole

- Causes: heart disease, ventillatory failure, metabolic disturbances, shock (due to non-cardiac etiologies); in children predominant cause is respiratory failure
- PEA = pulseless electric acitvity, no mechanical action of the heart but electrical activity present- can look like any rhythm, can be regular/ irregular/wide/ thin anything but without pulse

Important ECGs- STEMI



- ST-Elevation Myocardial Infarction= transmural MI
- Therapy: Morphine, Oxygen, Nitroglycerin, Aspirin, Beta-blockers, Heparin—> Revascularization (stent-implantation/ Bypass Surgery)

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Quiz

Question 1

What is the treatment of Ventricular tachycardia WITH pulse?

A. Defibrillation

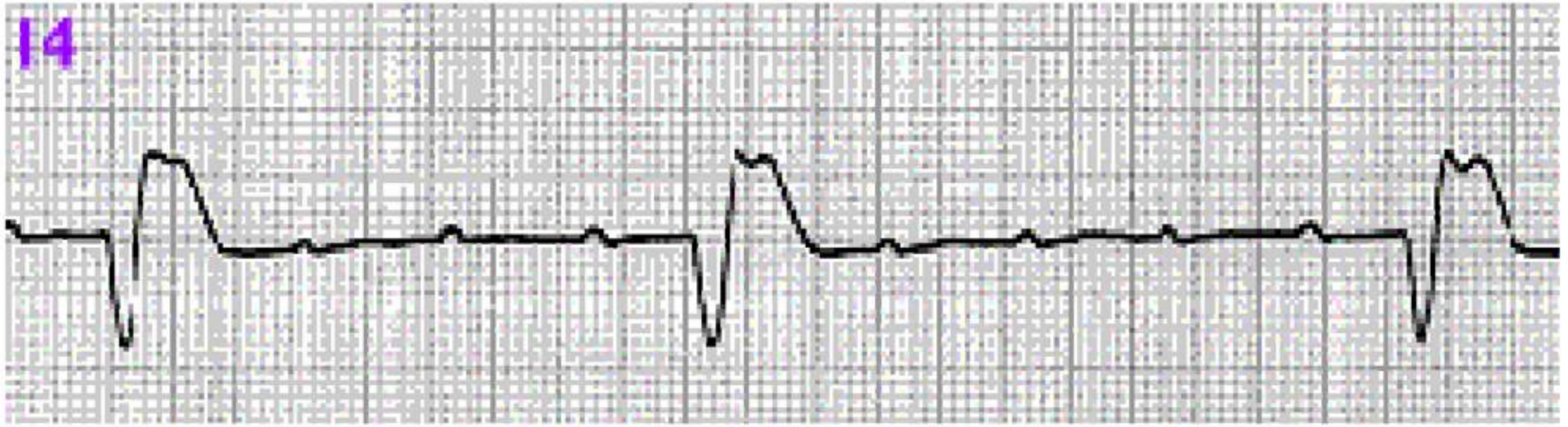
B. Cardioversion

C. Pacemaker

D. Adenosine

B

Question 2



What rhythm do you see?

A. AV-Block Grade I

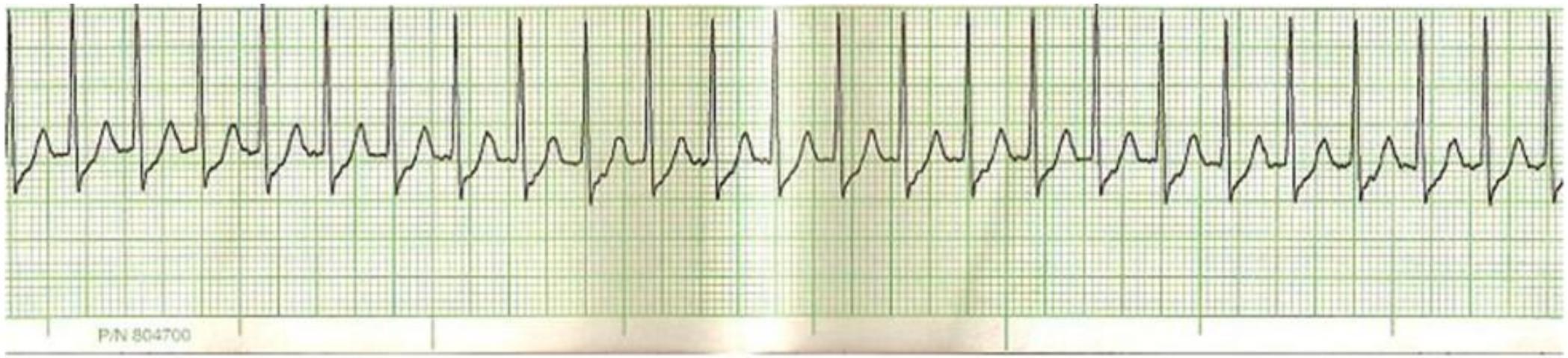
B. Ventricular Tachycardia

C. Sinus bradycardia

D. AV-Block Grade III

D

Question 3



What rhythm do you see?

A. Supraventricular tachycardia

B. Ventricular tachycardia

C. Ventricular fibrillation

D. Atrial fibrillation

A

Question 4

What rhythm do you see?

A. Asystole

B. Atrial fibrillation

C. Ventricular fibrillation

D. Torsades de pointes

B

Question 5

What is the difference between AvBlock Grade II Mobitz I and Mobitz II (what is correct for Mobitz I)?

A. PR-Interval stays the same

B. Is always physiologic

C. PR-Interval gets continuously longer

D. Is treated with cardioversion

C

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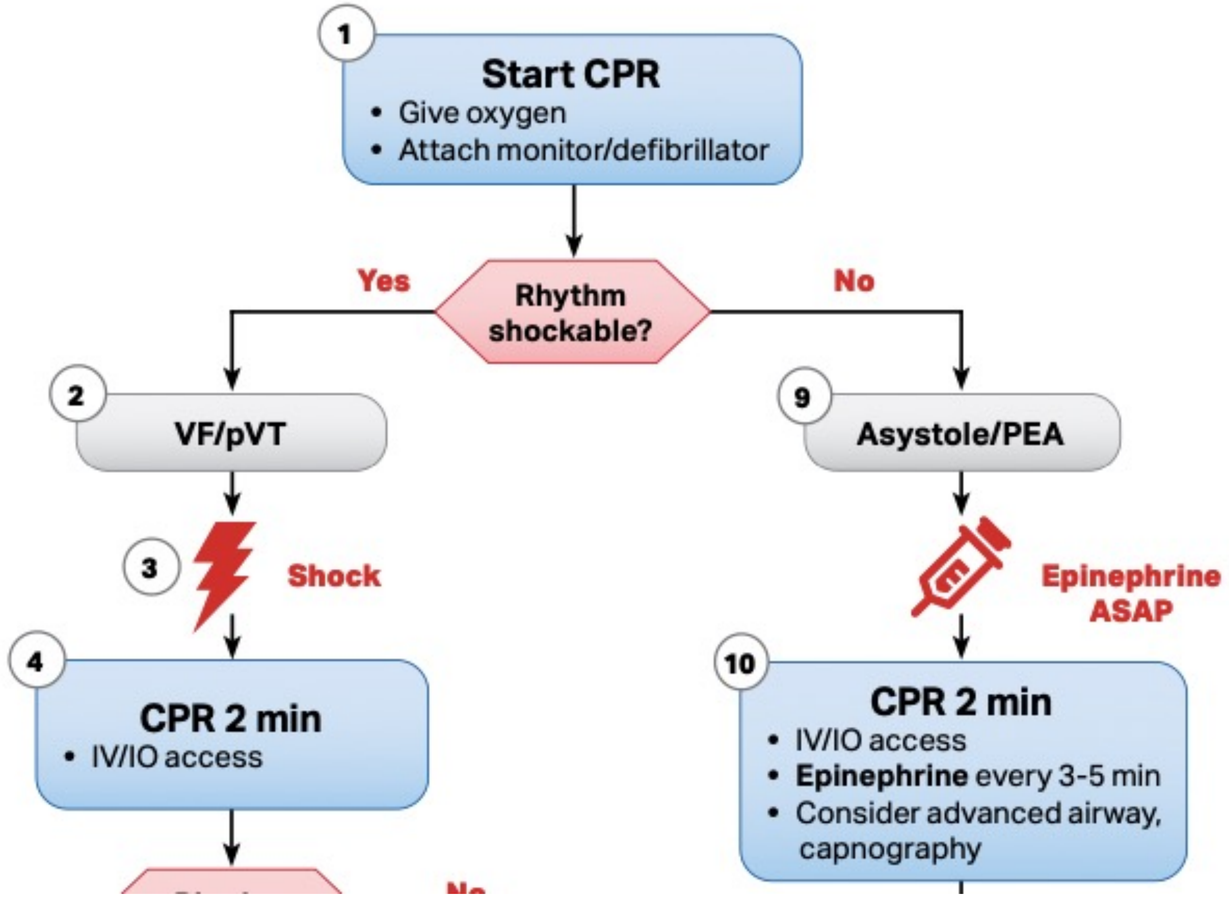
ACLS-important algorithms

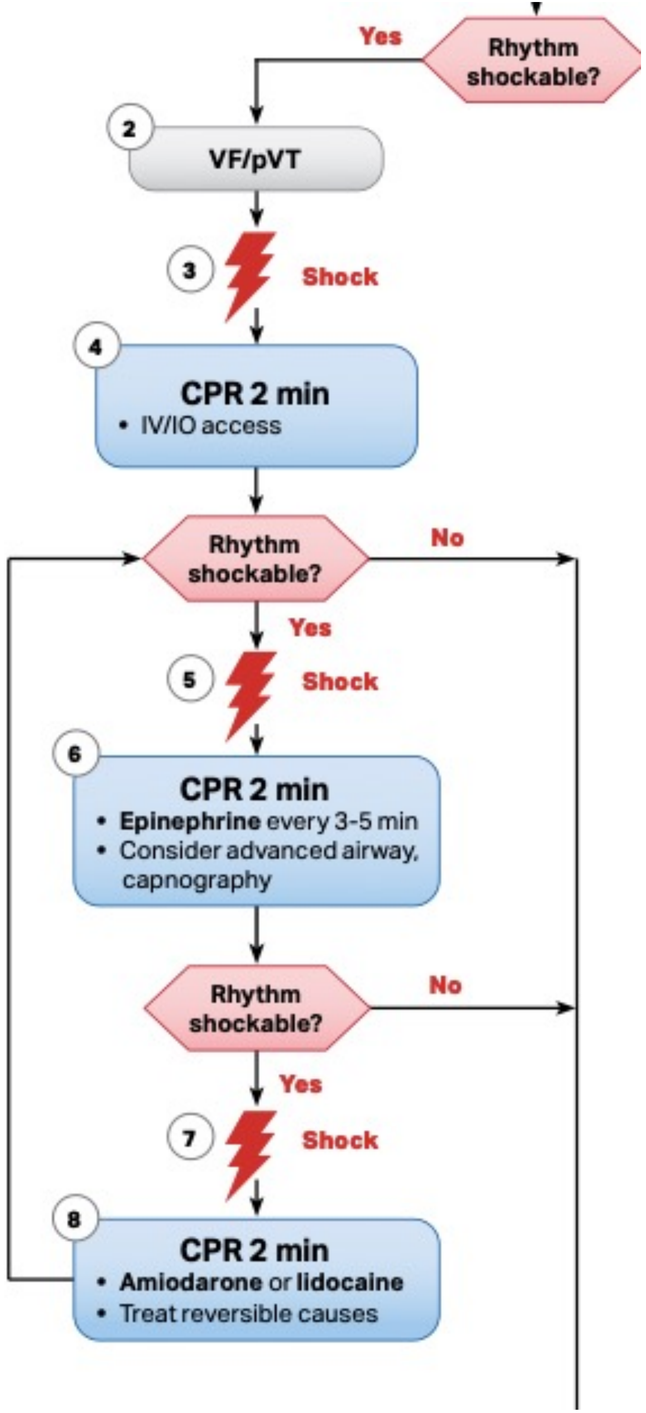
ACLS- Algorithm for Cardiac Arrest I



- **Shock:**
  - **Patches for defibrillation applied like in BLS!**
  - 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: 360J

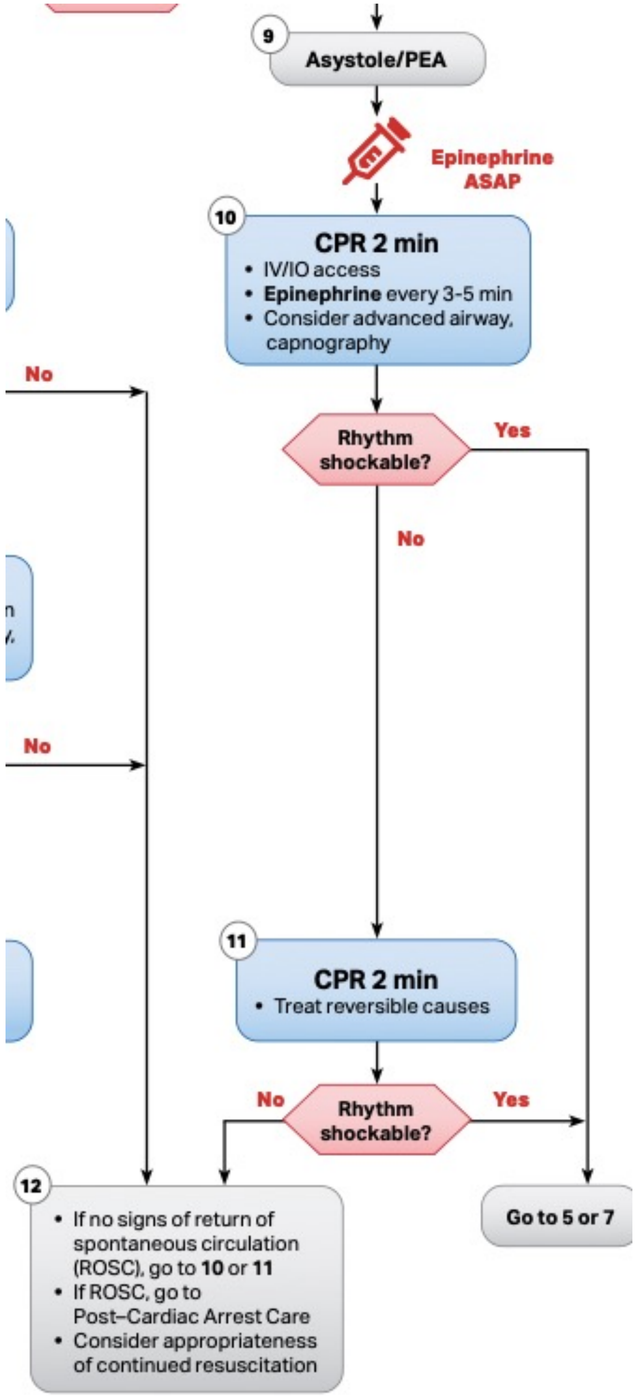
ACLS- Algorithm for Cardiac Arrest II

- VF= Ventricular Fibrillation
- pVT= pulsless Ventricular Tachycardia
- IV= intravenous access
- IO = Intraosseous access
- Drugs:
  - Epinephrine: 1mg every 3-5min iv/io
  - Amiodarone: first dose: 300mg; second dose: 150mg
  - Lidocaine: First dose: 1-1.5 mg/kg; second dose: 0.5-0.75 mg/kg



ACLS- Algorithm for Cardiac Arrest III

- VF= Ventricular Fibrillation
- pVT= pulsless Ventricular Tachycardia
- IV= intravenous access
- IO = Intraosseous access
- Drugs:
  - Epinephrine: 1mg every 3-5min iv/io
- Reversible causes-> next slide



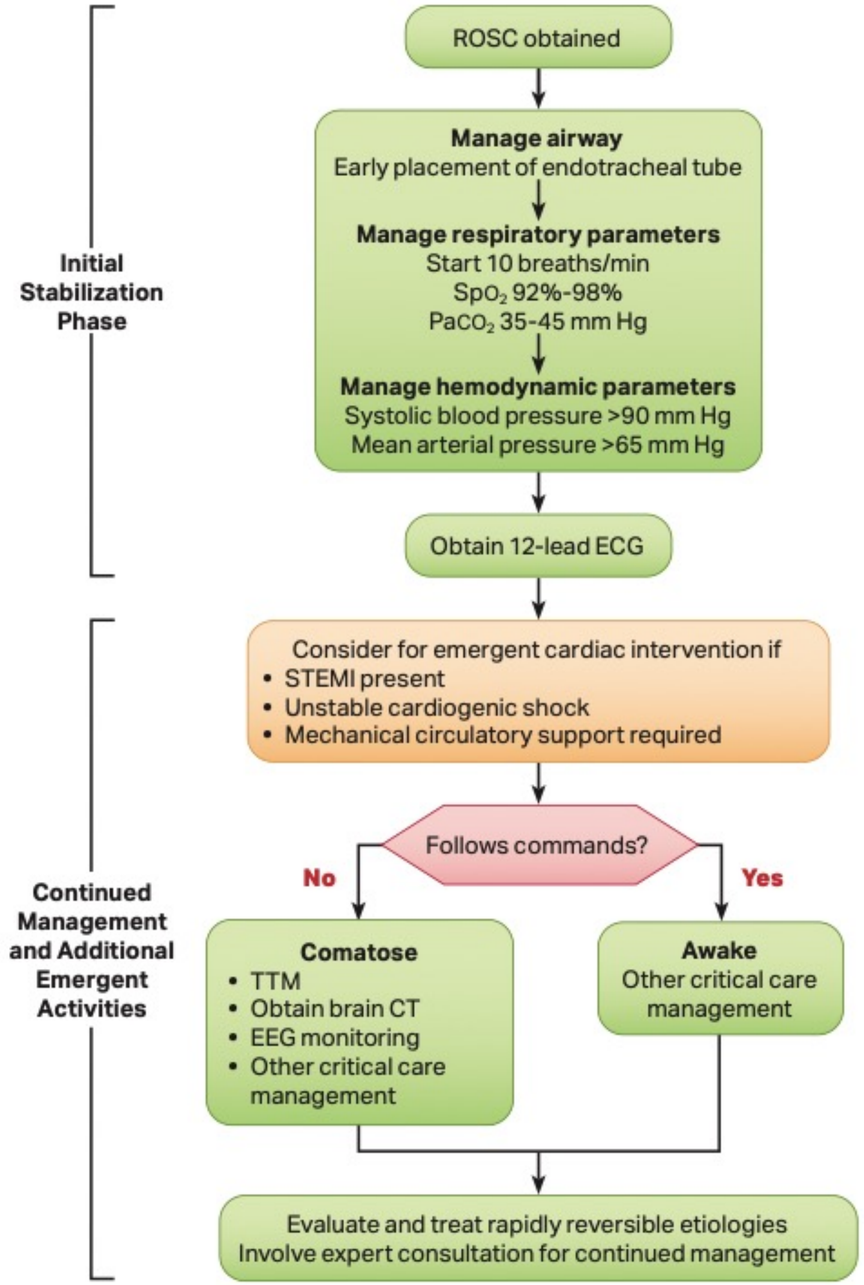
ACLS- reversible causes of cardiac arrest

- **H**ypovolemia
- **H**ypoxia
- **H**ydrogenion(acidosis)
- **H**ypo-/hyperkalemia
- **H**ypothermia
- **H**ypoglycemia

- **T**ensionpneumothorax
- **T**amponade,cardiac
- **T**oxins
- **T**hrombosis,pulmonary
- **T**hrombosis,coronary

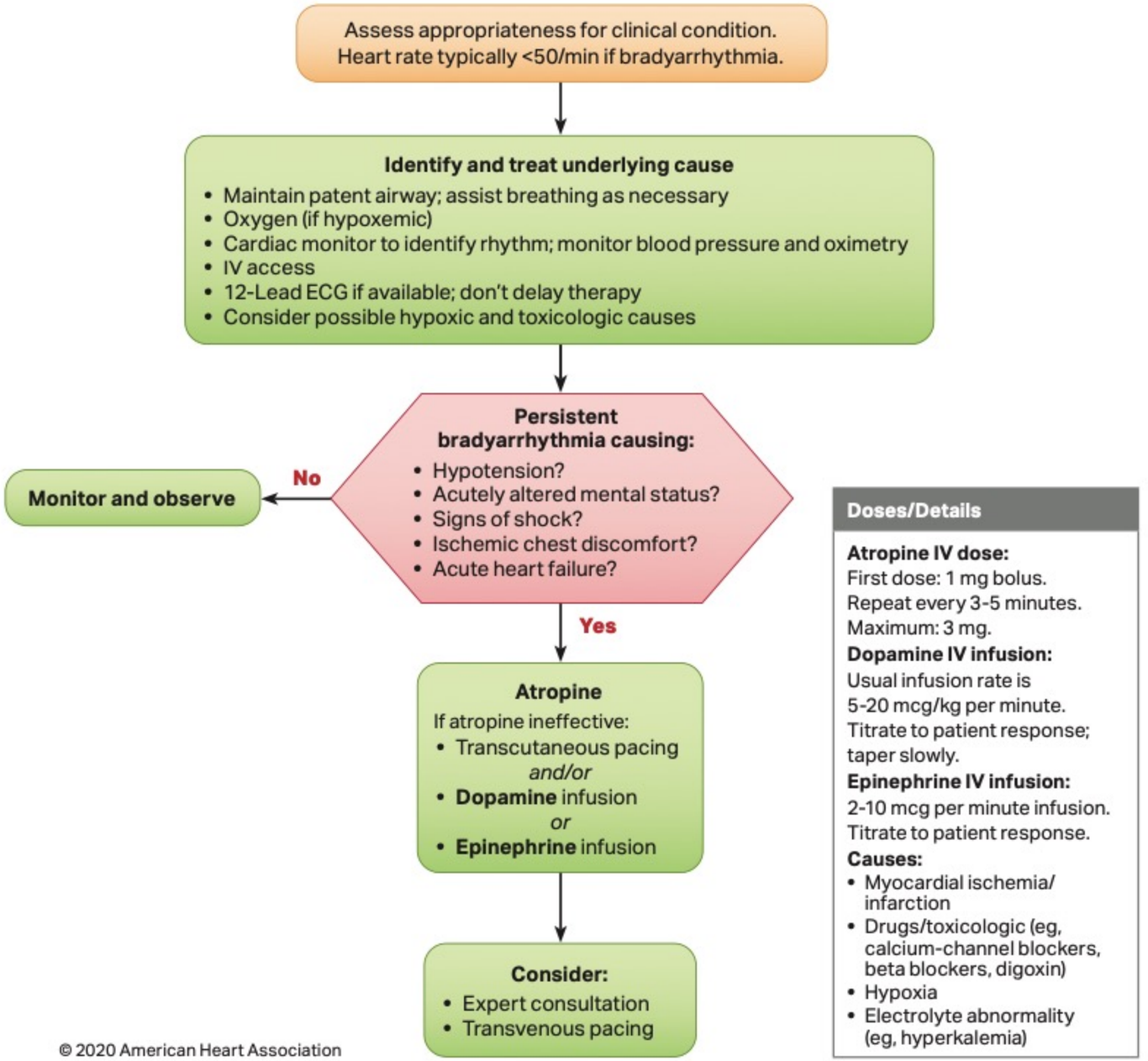
ACLS- Algorithm for ROSC

- ROSC= Return Of Spontaneous Circulation
- TTM= Targeted Temperature Management (If patient does not follow commands, start TTM as soon as possible; begin at 32-36°C for 24 hours by using a cooling device with feedback loop)



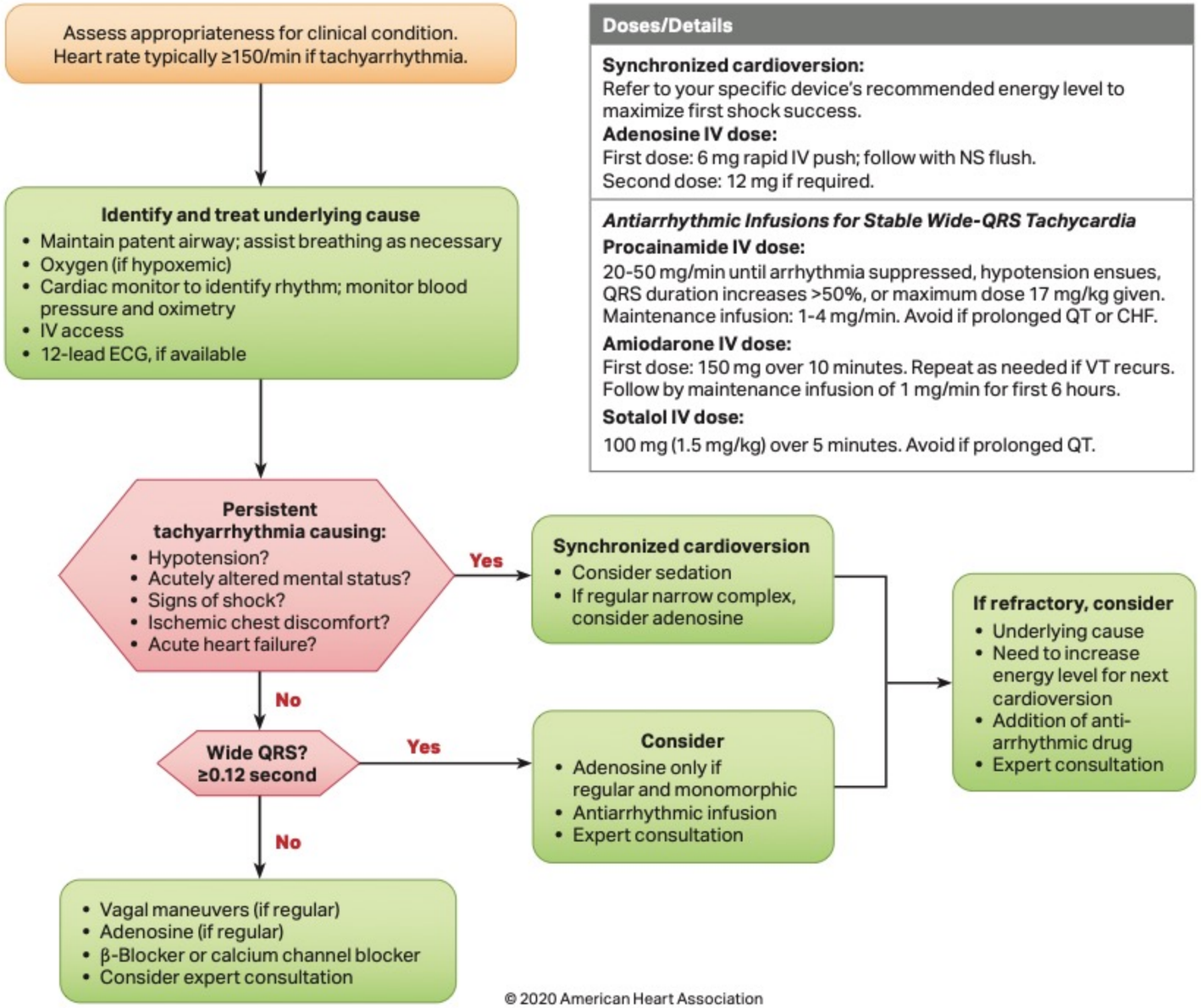
ACLS- Algorithm for Bradycardia

- Causes:
  - Myocardialischemia/ infarction
  - Drugs/toxicologic(eg, calcium-channel blockers, beta blockers, digoxin)
  - Hypoxia
  - Electrolyte abnormality (eg, hyperkalemia)
- Drugs:
  - Atropine: iv. 1 mg bolus. Repeat every 3-5 minutes. Maximum: 3 mg
  - Dopamine IV infusion: Usual infusion rate is 5-20 mcg/kg per minute. Titrate to patient response; taper slowly.
  - Epinephrine IV infusion: 2-10 mcg per minute infusion. Titrate to patient response
- If medical therapy unsuccessful-> consider electrical therapy (Pacing)



ACLS- Algorithm for Tachycardia

- Electrical therapy:
  - Synchronized cardioversion:
    - Atrial Fibrillation: start with 50J and titrate up to 200J
    - Ventricular Tachycardia: Monomorphic: initial dose: 100J—>stepwise increase up to 200J; Polymorphic: initial dose 200J
- Medical therapy:
    - Adenosine: First dose: 6 mg rapid IV push; Second dose: 12 mg if required.
    - Antiarrhythmic Infusions for Stable Wide-QRS Tachycardia with Procainamide, Amiodarone, Sotalol



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Quiz

Question 1

What is the adult dosage I.v./i.o. of adrenalin/epinephrine in CPR?

A. 0,01mg/kg bodyweight

B. 3-5mg

C. 1mg

D. 10mg

C

Question 2

In which interval adrenaline is administered during CPR?

A. After every shock

B. Every minute

C. As a continous infusion

D. Every 3-5min

D

Question 3

What are shockable rhythms?

A. PEA

B. Asystoly

C. Pulseless ventricular tachycardia

D. Atrial fibrillation

C

Question 4

Which reversible causes of cardiac arrest can be „simply“ reversed <by only doing ACLS-CPR>?

A. Cardia thrombosis

B. Acidosis

C. Hypoxia

D. Toxins

C

Question 5

What is the first-line drug used in the management of symptomatic bradycardia?

A. Adrenaline

B. Dopamine

C. Noradrenaline

D. Atropine

D

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Cases

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Case I- Sepsis

A 47-year-old man who runs a yard service in Tallahassee cuts his thumb while attaching an accessory to one of his mowers.

The next morning, his thumb is sore and the skin surrounding the cut is red.

The man has thirty very impatient customers scheduled for lawn mowing that day so he heads out early and works until early evening.

By the time he gets back home, the thumb is swollen and throbbing, and yellowish-white pus is oozing out of the injured area. He also notices two red streaks going up the inside of his forearm.

Just as he begins to think about getting some medical attention for his thumb, the man experiences a shaking chill and becomes queasy. His wife then drives him to the ER at the nearest hospital, which takes about 35 minutes because of heavy traffic.

Upon their arrival at the ER, the man's temperature has reached 39.7ºC. He is flushed and ill-appearing, with a pulse of 125 and a blood pressure of 100/60 mm Hg. (His normal BP is 145/85 mm Hg.) There are no other remarkable findings on physical examination.

Question 1

Your preliminary diagnosis is SIRS/Sepsis- what are the criteria for this diagnosis?

A. Fever, AV-Block, Hyperventillation

B. Hypothermia, Leucocytosis, Hypertension

C. Fever, Tachycardia, Tachypnea, obvious sign of infection

D. Hypertheria, Tachypnea, Leukopenia

C

Question 2

What should you do right away?

A. Antibiotic regimen that covers only anaerobes

B. Antibiotic regimen with broad coverage of both Gram-positive and Gram-negative bacteria.

C. Antibiotic regimen that covers gram-positives and anaerobes

D. Antibiotic regimen that covers gram-negatives and fungi

B

Question 3

What is a potential differential diagnosis if there would not be an obvious infection present?

A. Spinal shock

B. Anaphylactic event

C. Inguinal hernia

D. acute pancreatitis

D

Question 4

What tests should you perform?

A. Swab from the thumb

B. Complete Blood Count

C. Blood cultures

D. Magnetic resonance imaging from the hand

E. Urine analysis

B, C

You order Blood cultures and a CBC with differentials. You receive following results:

The lab isolates a Gram-positive coccus from the blood cultures.

It is catalase positive and coagulase positive.

The CBC shows WBC count of 14,575/microliter with differential 69 segs, 9 bands, 16 lymphs, and 6 monos, Hgb 14.1 g/dL, Hct 42.2%, MCV 90 fL, and platelet count: 230,000 per L

Question 5

After receiving the test results- what is the causative agent of the ongoing infection?

A. Streptococcus pneumoniae

B. Enterococcus

C. S. Aureus

D. S. Epidermidis

C

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Case II-MI

You (doctor) come to an sports festival with your ambulance crew. After a 1500m run you are called to a 42 year old man, who started having left-thoracal pain and chest tightness.

The dyspneic patient tells you that 8 weeks ago he stopped smoking and now he finally wanted to start doing sports again to loose weight (110kg on 1,84m). The pain started after 2 rounds and did not stop even after he stopped running.

The patient additionally complains about massive nausea and tells you that the pain is radiating from his chest into hhis left shoulder and arm.

Question 1

What is your diagnosis?

A. Gastric regurgitation

B. Esophageal rupture

C. Gallbladder colic

D. Myocardial infarction

E. Intercostal neuralgia

D

Question 2

What are NOT your first measures?

A. Lift the upper body

B. Central access

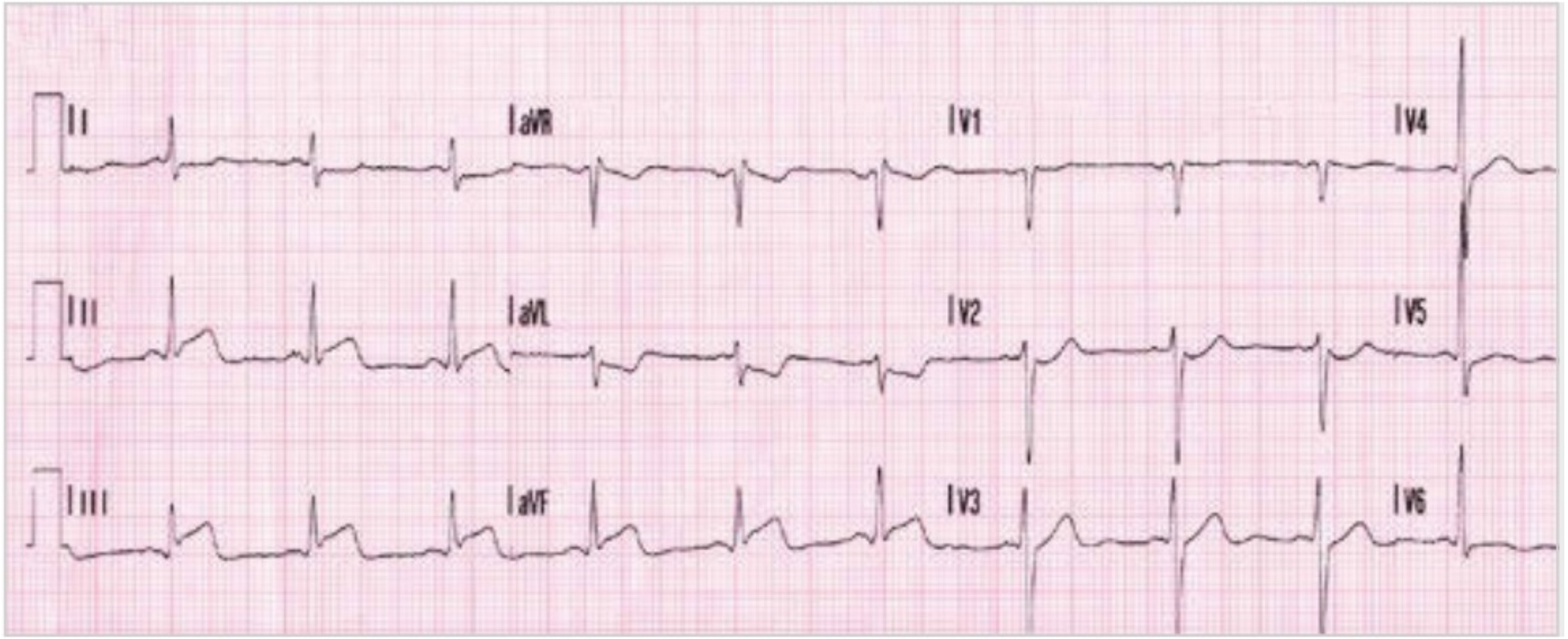
C. Monitor the patient with HR,BP, SpO2, ECG (12-leads)

D. Peripheral venous access

E. Intubation

B, E

Question 3



You get the following ECG recording from your crew. Does it confirm your diagnosis?

A. Yes

B. No

Explain!

A

Explanation: actue posterior wall cardiac infarction with St-Segment elevation in II,III,avF

Question 4

Which drugs does the therapy for your patient contain?

A. Antiemetic

B. Viagra

C. Aspirin

D. Heparin

E. Propofol

F. Adrenaline

G. Morphine

H. Tramadol

I. Nitroglycerine

A, C, D, G, I

Question 5

What invasive procedures can be done in a specialised cardiac unit to improve the outcome of the patient?

A. Stentimplantation

B. Intubation

C. Heart transplantation

D. Bypass surgery

A, D

Question 6

What are NOT potential risk factors for myocardial infarction?

A. Hyperlipidemia

B. Balanced diet

C. Adipositas

D. Regular physical activity

E. Diabetes mellitus

B, D

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Case III-Sepsis

A 60-year-old woman with stage IV cervical carcinoma undergoes extensive pelvic surgery (pelvic exenteration) in order to remove the tumor. The surgical procedure involves removal of all pelvic organs, removal of a segment of the ileum to construct a new bladder, and a colostomy.

At first, the patient appears to be recovering very nicely. During the evening of the third postoperative day, however, the nurse on the night shift notes that the patient's respiratory rate, which was 16-18 per min, has increased to 26 per min. The patient claims that she doesn't feel overly sick.

She is not short of breath or in pain, and her temperature is actually slightly subnormal (36.2ºC). By the next morning, she has slight fever (38.3ºC), but she continues to feel reasonably good. Her surgical wound shows no signs of infection, and her abdomen is no more tender than expected. Later in the day, however, it becomes quite clear that the patient is in serious trouble. She is flushed, anxious, and restless. Her BP has dropped from 135/75 to 105/55, and her temperature is 39.2ºC.

Question 1

What is your preliminary diagnosis?

A. SIRS

B. Sepsis

C. Pulmonary embolism

D. Bleeding

B

Question 2

How should you NOT handle this situation?

A. Blood cultures

B. Give the patient benzodiazepines to calm her down

C. Start Antibiotic treatment with broad range of Gram-positive and Gram negative bacteria

D. Intubate the patient immediately

E. Treat hypotension with fluid resuscitation

B, D

The patient's condition worsens despite your efforts.

The following morning, she is short of breath and there is excess fluid throughout her lungs.

Intravenous fluids are cut back, and a vasopressor is now required to maintain her blood pressure.

Because of this, she is transferred to the ICU for monitoring.

The patient turns out to have a cardiac output nearly double the normal for a resting adult of her size.

Over the next 24 hrs, the patient continues to do poorly. Her urine output decreases almost to zero, and she requires mechanical ventilation to maintain oxygenation. She becomes increasingly edematous.

The blood cultures taken earlier are negative.

Question 3

What can you do to resolve this case?

A. exploratory surgery

B. Continue with antibiotic therapy

C. Perform an ultrasound examination

D. Perform a CT-scan

A

Exploratory surgery shows that the suture line attaching the ileum to the colon is partially disrupted, with leakage of bowel contents, intense inflammation of the mesentery, and early abscess formation.

Question 4

What was the most likely causative agents?

A.Mixed infection with Gram negatives and anaerobes

B.Gram negatives and gram positives

C.Mixed infection with gram-negatives, gram positives and fungi

D.Mixed infection with bacteria and viruses

A

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Case IV- Arrhythmia

You come as a doctor to a 78 year old lady with acute dyspnea. Before entering the room, in which the patient sits in a chair, you can hear obvious crackeling rales.

Your crew starts immediately with Oxygen-therapy via mask and attaches the monitoring to the patient (HR, SpO2,BP,ECG).

The patient reports that she has troubles with breathing since some days and it continuously gots worse. The respiratory rate of the patient is increased.

As you start to examine the patient you feel an irregular pulse (~ 120bpm) and that the patient is diaphoretic. Also her jugular veins are congested.

On the ECG-recording you see an Tacharrhythmia absoluta.

During auscultation you her wet crackles on all parts of the lung-basally the breathing sounds are reduced.

The patient gets more and more anxious and begs you to do something so she could breathe better again.

Question 1

What is your diagnosis?

A. Myocardial infarction

B. Pulmoary embolim

C. Pulmoary edema

D. Acute cardiac decompensation

D

Question 2

What are the measures you take? Name and explain them!

- Oxygen therapy

Lift her upper body

Continous monitoring of vital parameters+ ECG

Peripheral venous access

Drug therapy with: Furosemide, Nitroglycerine, morphine, heparin, aspirin

Question 3

The condition of the patient continuously worsens regardless of your therapy. The patient becomes unconscious and stops breathing. What do you do?

A. Call the ambulance

B. Declare the patient as dead

C. Place the patient on the ground and start CPR

D. Start singing „highway to hell“

C

Case V- trauma

On a sunny Sunday afternoon you get called to a motorcycle accident.

After you arrive at the scene you find the motorcycle driver lying on the floor. Your crew already removed the helmet and places a peripheral access on the left forearm. One member of the crew starts mask-bag-ventillation.

Your crew members report following parameters to you:

The patient is unconscious and does not react to any pain stimuli.

The patient has a anisocoria right> left

Systolic BP 90mmHg

Hr 100/min

Bodycheck: closed Head trauma, multiple rib fractures, right Upper arm fracture and right lower leg fracture

The police informs you that the motorcycle driver fell without any external impact.

Question 1

Do you agree with your crew member to remove the helmet?

A. Yes-> explain!

B. No -> explain

A- you have to remove the helmet carefully so you could stabilise the patient respiratory.

Question 2

What grade on the Glasgow coma scale would you give your patient?

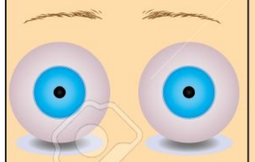
A. 5

B. 7

C. 3

D. 15

Glasgow Coma Scale

Behaviour	Response
 Eye Opening Response	4. Spontaneously 3. To speech 2. To pain 1. No response
 Verbal Response	5. Oriented to time, person and place 4. Confused 3. Inappropriate words 2. Incomprehensible sounds 1. No response
 Motor Response	6. Obeys command 5. Moves to localised pain 4. Flex to withdraw from pain 3. Abnormal flexion 2. Abnormal extension 1. No response

Total Score

Best score - 15
Comatosed - ≤8
Unresponsive - 3

C

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Case VI- pulmonary embolism

You come to a 67-year-old woman, who complains about massive dyspnea, with unproductive cough and chest tightness. The dyspnea suddenly appeared during her long bus ride (>6h).

She does not have any known diseases only chronic bronchitis due to smoking. She takes hormones to prevent osteoporosis.

Physical examination of the patient reveals following:

Height: 165cm; bodyweight:79kg; HR: 110 bpm, Respiratory rate 30/min and BP 130/90mmHg

Heart and lung auscultation are without any pathological finding.

Question 1

What is your suspected diagnosis?

A. Myocardial infarction

B. Venous thrombosis

C. Stroke

D. Atypical Pneumonia

E. Pulmonary embolism

E

Because:

- Acute dyspnea attack during a long bus ride
- Riskfactors present (hormonal therapy, obesity)

Question 2

What is NOT a part of your list of differential diagnosis?

A. Myocardial infarction with left heart insufficiency

B. Gastric ulcer

C. Pneumothorax

D. Acute airway obstruction due to her chronic bronchitis

E. Pneumonia

B, E

Question 3

Which of the following diagnostic methods do you use to confirm your diagnosis?

A. Blood Gas analysis

B. Blood work, esp D-Dimer

C. Endoscopy

D. Bronchoscopy

E. ECG

F. X-ray of the chest

G. Spirometry

H. CT- Angiography

I. Echocardiography

A, B, E, F, H, I

Question 4

What are NOT one of your first measures?

A. The patient is not allowed to move anywhere
B. Anticoagulation
C. Inhalation therapy with ß-mimetics
D. Heparin administration
E. Oxygen-therapy
F. Immediate intubation
G. Analgesia
H. Thrombolytics

C, F

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Case VII- pulmonary edema

You arrive as a doctor to a 77-year old female patient, which called you for help due to string and continuously increasing dyspnea over multiple hours.

She does not complain about any pain.

From her medical history just arterial hypertension and a myocardial infarction are known.

Looking at the patient you see massive resting dyspnea and cyanosis.

Physical examination has to be performed with the patient sitting because she does not tolerate lying down.

During lung auscultation you hear wet crackles over the medial and basal parts of the lung on both sites. Additionally you hear and gallop rhythm on cardiac auscultation.

The Blood pressure is 170/100mmHg and SpO2 is 81%. You do an ECG.

Question 1

What do you see on the ECG?

A. Myocardial infarction

B. Supraventricular Tachycardia

C. Ventricular tachycardia

D. Atrial flutter

B

Question 2

What is your suspected diagnosis?

A. Pulmonary embolism
B. Myocardial infarction
C. Pneumonia
D. Pulmonary edema due to left heart failure

D

Question 3

What symptoms imply that the ethology is not primary pulmonal?

A. Orthopnea

B. Crackles over both lung sites

C. Dry crackles over the lung

D. No stridor, no rales, no prolonged exspirium

E. Galopp rhythm

F. Previous history of myocardial infarction

C

The rest of the mentioned symptoms all imply a primary pulmonale etiology

Question 4

What are is not one of your primary measures to stabilise the patient?

A. Oxygen therapy

B. Intubation

C. I.v. Furosemide

D. Nitroglycerine

E. Analgesia with morphine I.v.

B

Intubation only if the situation gets worse- not a primary measure

Question 5

In the hospital a chest X-ray is done.

What do you see? Explain!

Enlarged heart shadow and acute pulmonary Edema

Question 6

Which clinical NYHA stadium (clinical scale to grade degree of heart failure) is matched correctly with its definition?

A. NYHA I- complains with heavy exercise

B. NYHA III- complains at rest

C. NYHA IV- complains at rest

D. NYHA II- complains with low exercise

C

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Case VIII- Acidosis

During your night shift you get called to the surgical ICU. There you find a 58-year old patient, which is treated there due to a pulmonary embolism after a Hip-joint replacement surgery.

Her medical history includes: chronic renal failure (creatinine-now: 4,7,mg/dl), diabetes mellitus T II and chronic heart failure.

Due to hypotension the patient is treated with noradrenaline via an infusion pump.

With this therapy her BP is 90/40mmHg.

The patient is sleepy and does barely react to your questions. Her respirator is deep and a little bit fast.

The on-duty surgical colleague called you because the recent blood gas analysis of this patient worries him:

pH 7,13, pO 50,2 mmHg, pCO 28 mmHg, HCO^- 11 mmol/l, SpO2 84 %.

Question 1

What do you conclude from the blood gas analysis?

A. Respiratory acidosis

B. Metabolic acidosis

C. Metabolic acidosis compensated with hyperventilation

D. Metabolic alkalosis compensated with hyperventilation

C

Question 2

What are NOT causes for metabolic acidosis?

A. Hyperglycemia in Type I diabetic patients

B. Chronic diarrhoea

C. Intoxication with salicylates

D. Hyperventillation

D

Question 3

How is the breathing pattern of the patient called?

A. Biot breathing

B. Cheyne-stokes Breaking

C. Kussmaul breathing

D. Agonal breathing

C

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Case IX-Hypokalemia

A female patient comes into your office. She complains about Nausea and palpitations.

10 days ago she noticed swelling of her ankles, which she self-medicated since than with „waterpills“ twice a day from her husband who has renal failure.The patient hands you an empty box of furosemide 250 mg pills.

She also tells you that she is suffering a long time from chronic obstipation, which she treats with laxatives on a regular basis. Regardless of her therapy she complains that she did not have any stool since 6 days, but had to urinate more often and feels more and more weak.

Since 3 days she noticed that she has palpitations and her heart „skips a beat“ sometimes.

On her physical examination you notice several extrasystoles. The monitor shows polymorphic ventricular extrasystoles, which you can see on the picture on the next slide.

Question 1

What diagnosis you suspect due to the ECG?

A. Hyperkalemia due to the ST-segment depression
B. Hypokalemia due to a present U-wave
C. Hyponatremia due to widened QRS-complex
D. Myocardial infarction due to ST-sement depression

B

Question 2

What are NOT causes of Hypokalemia?

A. Hyperaldosteronism

B. Chronic diarrhoea

C. Cushing syndrome

D. Hyperventillation

D

Question 3

Which drugs can cause Hypokalemia?

A. ß-blockers

B. Diuretics

C. Digitalis

D. Atropine

C

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Case X-CPR

You arrive at the scene. You see an ~50-year old patient lying on the floor. Asking the bystanders they tell you that he collapsed and is now unconscious. The patient does not react to speech nor pain stimuli and does not breath. Pulse and Blood pressure can not be measured.

Question 1

The ECG monitor shows you following.

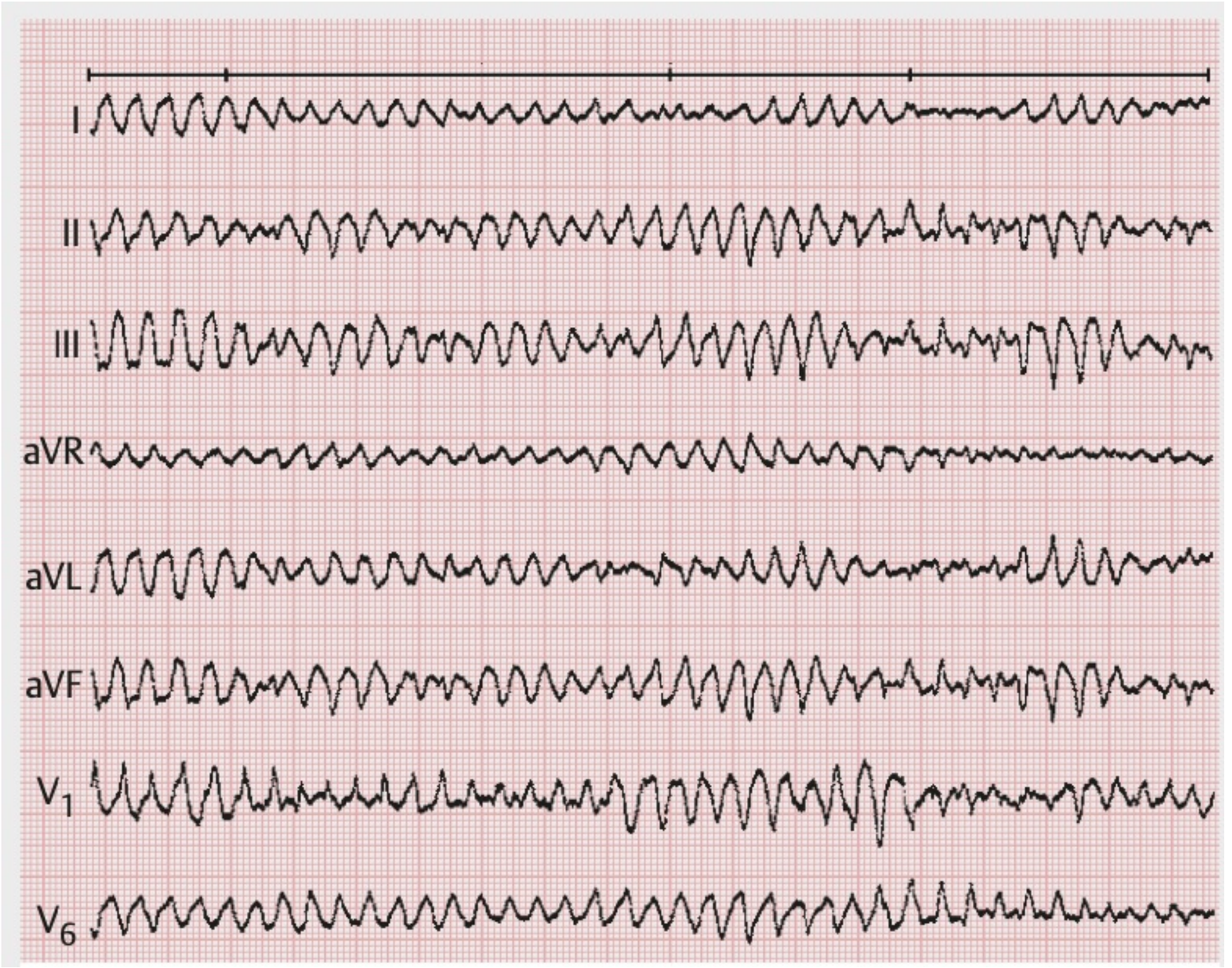
What do you see?

A. Torsades de pointes

B. Ventricular tachycardia

C. Ventricular fibrillation

D. Asystole



C

Question 2

What are potential causes of ventricular fibrillation? (Multiple answers)

A. Hypoxia

B. Hyperventillation

C. Psychosis

D. Electrolyte disturbances

E. Cardiomyopathies

A, D, E

Question 3

What do you do?

A. Start CPR and perform cardio version

B. Start CPR and defibrillate the patient

C. Place and peripheral venous access first and infuse fluids into the patient

D. Start CPR and install an external pacemaker

B

Question 4

What are reversible causes for cardiac arrest that could be simply reversed at the scene?

A. Hypoxia

B. Hypothermia

C. Pulmonary embolism

D. Myocardial infarction

E. Hypoglycemia

A, B, E

Question 5

What is the i.v. dose for adrenaline in adult CPR?

A. 5mg

B. 3mg

C. 1mg

D. 0,1mg

C

ERC vs AHA

ERC-ACLS (2021)

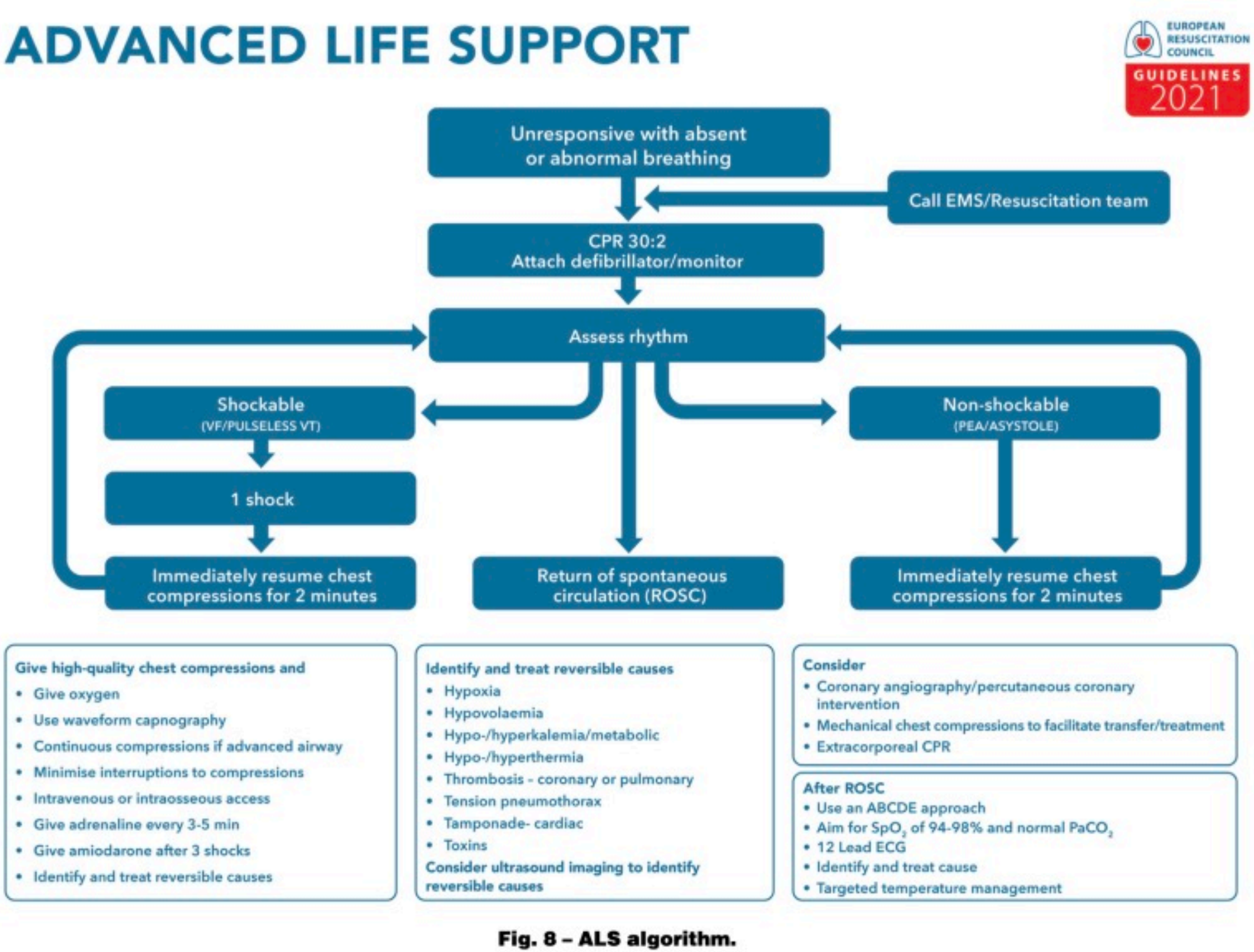
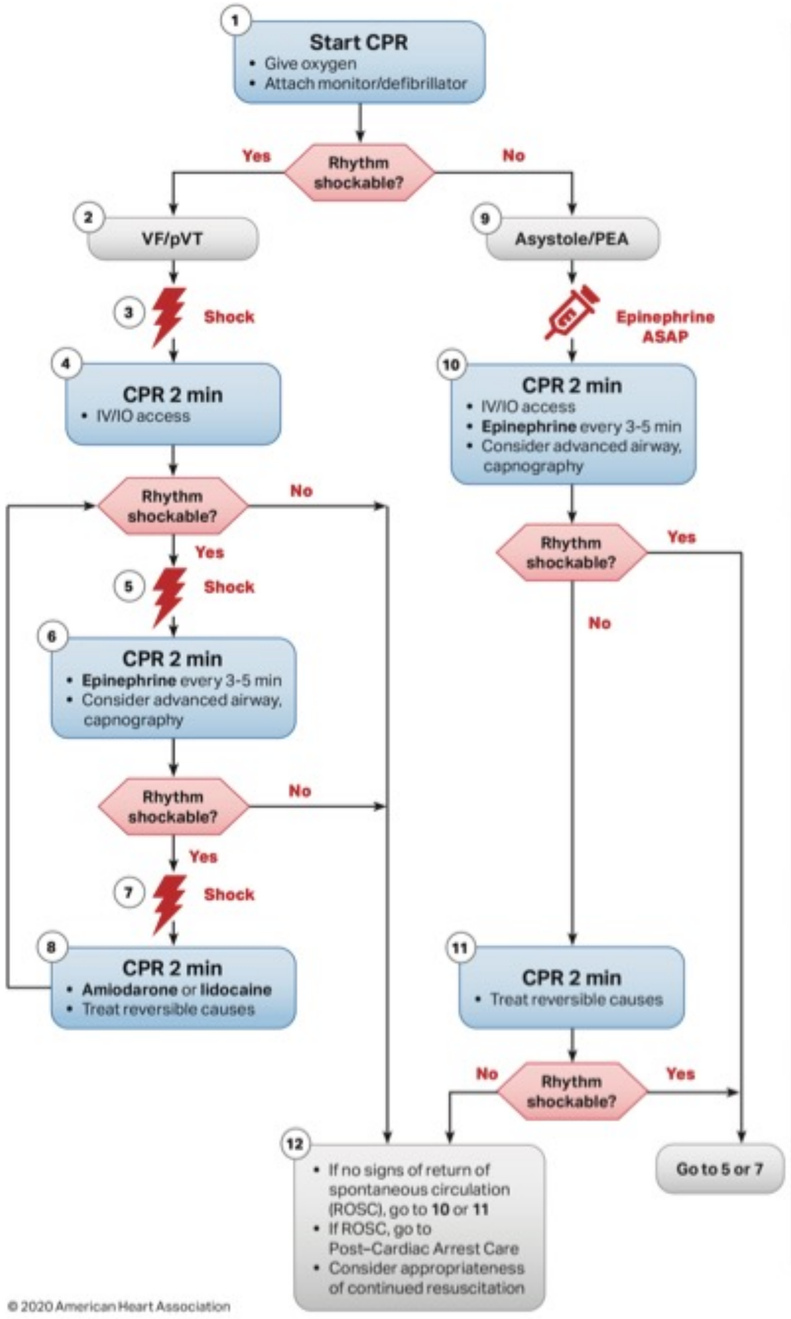


Fig. 8 – ALS algorithm.

AHA- ACLS (2020)

Figure 4. Adult Cardiac Arrest Algorithm.



CPR Quality

- Push hard (at least 2 inches [5 cm]) and fast (100-120/min) and allow complete chest recoil.
- Minimize interruptions in compressions.
- Avoid excessive ventilation.
- Change compressor every 2 minutes, or sooner if fatigued.
- If no advanced airway, 30:2 compression-ventilation ratio.
- Quantitative waveform capnography
  - If $PETCO_2$ is low or decreasing, reassess CPR quality.

Shock Energy for Defibrillation

- **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
- **Amiodarone IV/IO dose:** First dose: 300 mg bolus. Second dose: 150 mg.
  or
  Lidocaine IV/IO dose: First dose: 1-1.5 mg/kg. Second dose: 0.5-0.75 mg/kg.

Advanced Airway

- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitor ET tube placement
- Once advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions

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

Reversible Causes

- **H**ypovolemia
- **H**ypoxia
- **H**ydrogen ion (acidosis)
- **H**ypo-/hyperkalemia
- **H**ypothermia
- **T**ension pneumothorax
- **T**amponade, cardiac
- **T**oxins
- **T**hrombosis, pulmonary
- **T**hrombosis, coronary

Luckily ther are NO differences between these two algorithms!