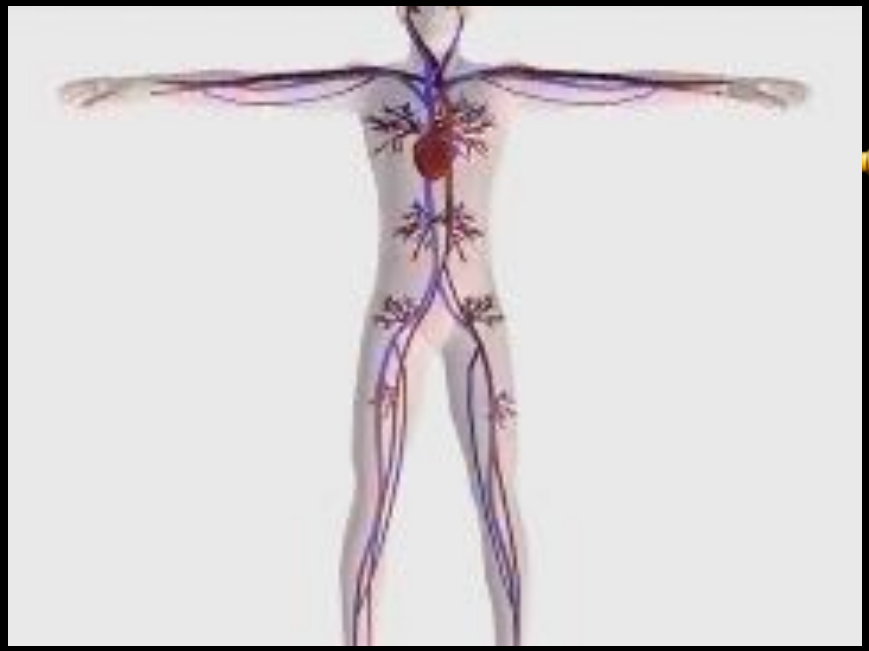
Cardio Pulmonary cerebral Resucitation (CPCR)



Dr Ali Ashraf
Intensivist
GUMS Poorsina Hosp

History

Bible prophet Elisha

first medical report in 1744 by Tossach

mouth-to-mouth 1740

1878 by Boehm Closed chest cardiac massage

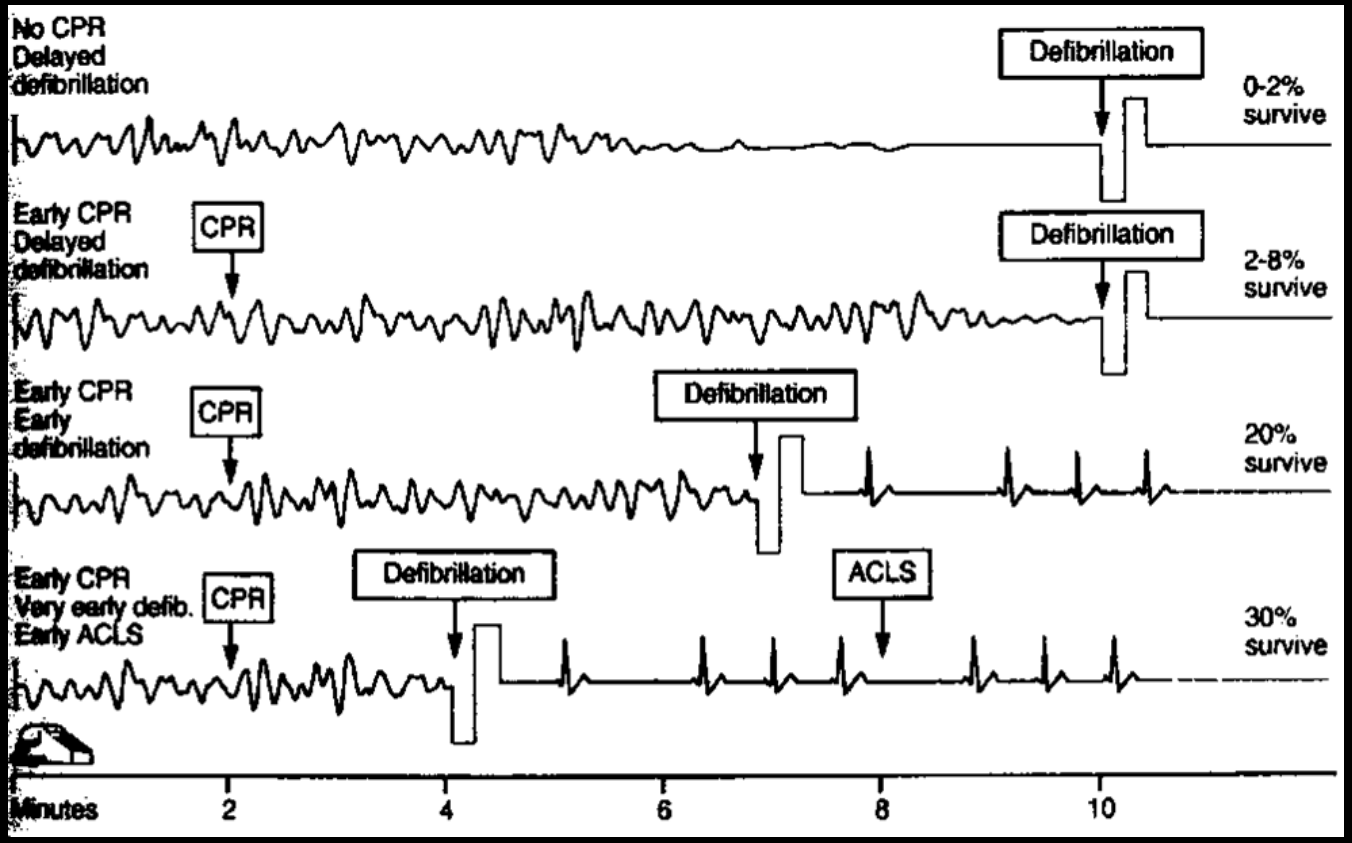
1891 first recorded chest compression

history

- early 90's, the guideline was 5 compressions and 1 breath.
- late 90's, the compressions were raised to 15 with 1 breath.
- In 2005, compressions was raised once again, to 30 compressions with 2 breaths.
- On March 31, 2008, hands only CPR was introduced to the guidelines

CPR

too late to learn


No CPR
Delayed
defibrillation
Defibrillation
0-2%
survive
Early CPR
Delayed
defibrillation
CPR
Defibrillation
2-8%
survive
Early CPR
Early
defibrillation
CPR
Defibrillation
20%
survive
Early CPR
Very early defib.
Early ACLS
CPR
Defibrillation
ACLS
30%
survive
Minutes
2
4
6
8
10

The purpose of BLS

Failure of the circulation for three to four minutes ➡ **irreversible cerebral damage**

CPR

- All you really need to do is put your hands in the middle of the breast bone and push down two inches hard and fast

3 elements of Basic life support

"ABC": *Airway*

Breathing

Circulation

3 elements of Basic life support

"CAB": *Circulation*

Airway

Breathing

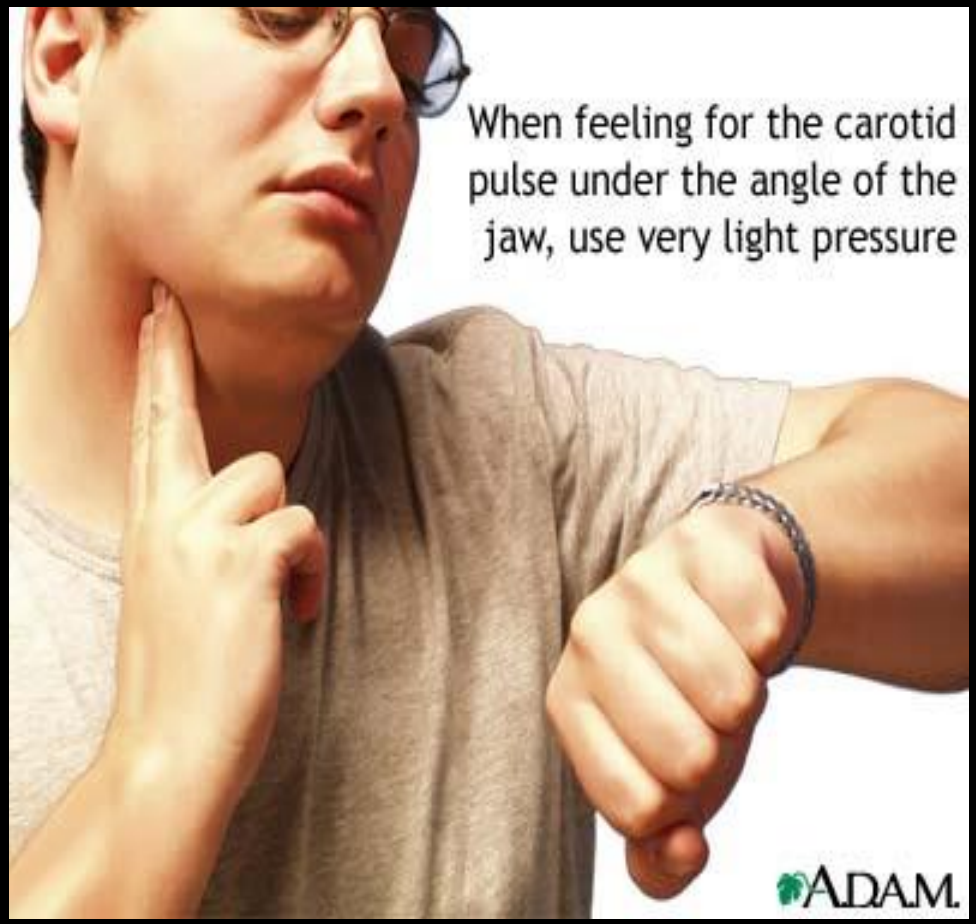
Sequence of actions for adult basic life support

1. Ensure safety of rescuer and victim

2. Check the victim and see if he responds

   Gently shake his shoulders and ask loudly: "Are you all right?"

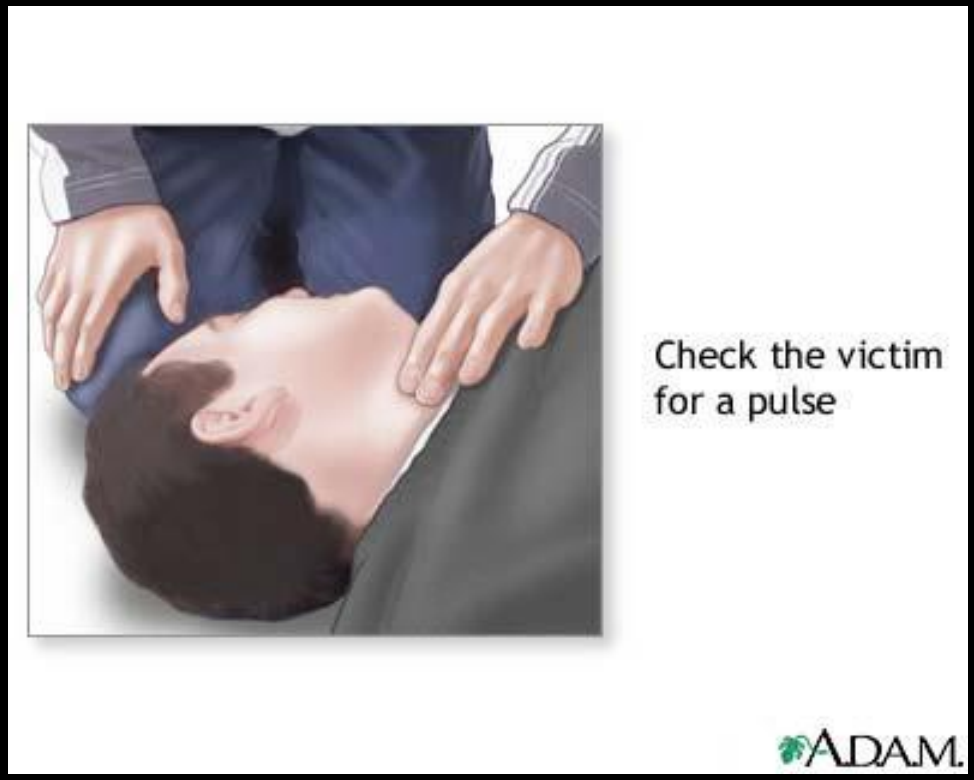
Pulse check


When feeling for the carotid pulse under the angle of the jaw, use very light pressure
A.D.A.M.

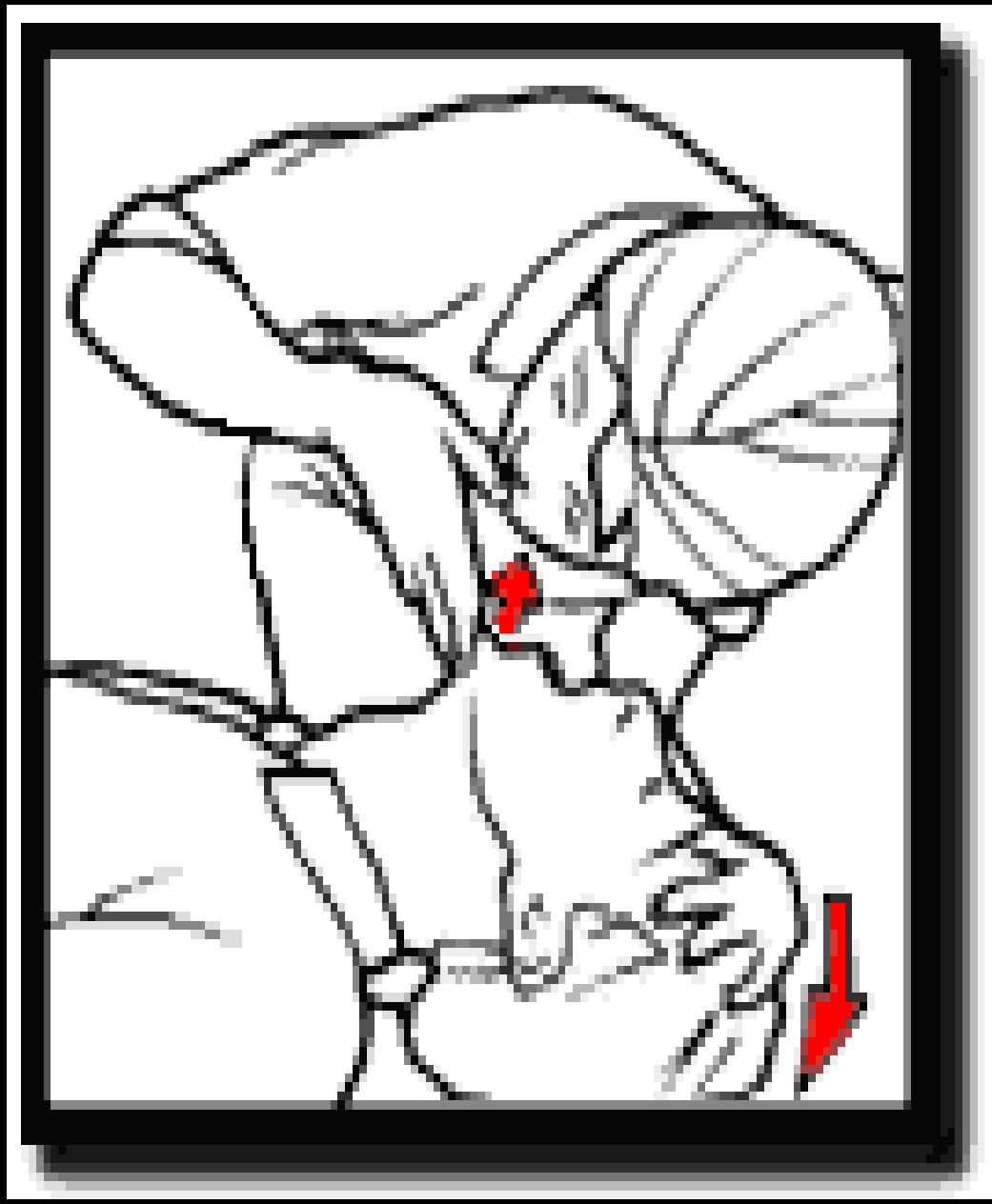

The radial pulse is felt on the wrist, just under the thumb
A.D.A.M.

- **The"gold standard" sign of cardiac arrest:**

  an absent carotid (or other large artery) pulse



Assess the victim for signs of a circulation:



A. If there are no signs of a circulation, or you are at all unsure, start chest compressions:

- **depress sternum** between **4 - 5 cm**
- repeat at **a rate of> 100 times** a minute
- continuing compressions and breaths in a **ratio of 30:2**
- Only stop to recheck for signs of a circulation

CPR Starts with Compressions

- Many adults with witnessed arrest have ventricular fibrillation (VF)/pulseless ventricular tachycardia (VT), and requirechest compressions early defibrillation

- •Chest compressions can be started immediately (no equipment needed)
- •Opening airway, providing ventilation may significantly delay other actions
- •Ventilation delayed by 18 seconds or less

Healthcare Provider ADULT BLS Sequence

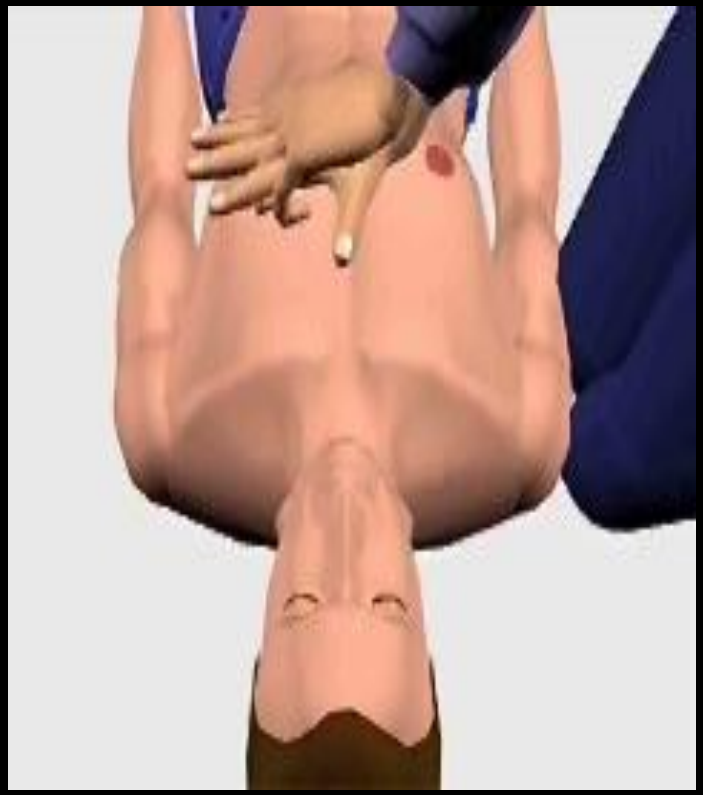
- Recognize unresponsive adult with no breathing or no normal breathing (ie, only agonal gasps)
- Activate emergency response, retrieve AED (or send someone to do this)
- Check for pulse (*no more than 10 seconds)*
- If no pulse, begin sets of 30 chest compressions and 2 breaths
- Use AED as soon as available

Primary Emphasis on Chest Compressions

- All rescuers should, at a minimum, provide chest compressions.
- If bystander not trained (adult arrest): Hands-Only CPR
- If bystander trained and able: perform compressions and ventilations at rate of 30:2
- Healthcare provider: perform compressions and ventilations at rate of 30:2
- For all pediatric arrest, compressions and ventilations still recommended

how many chest compressions are needed?

- The recommended rate of >100/minute

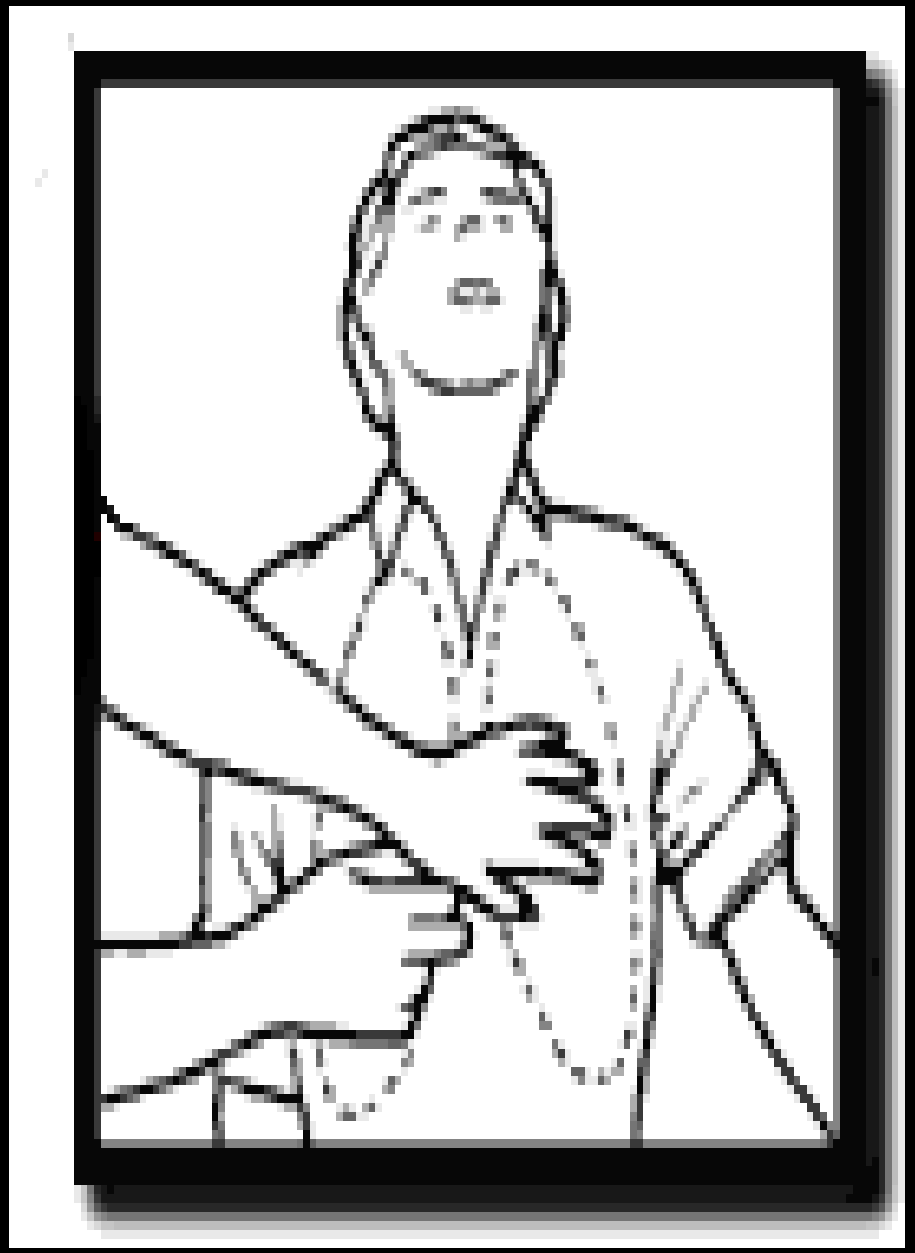


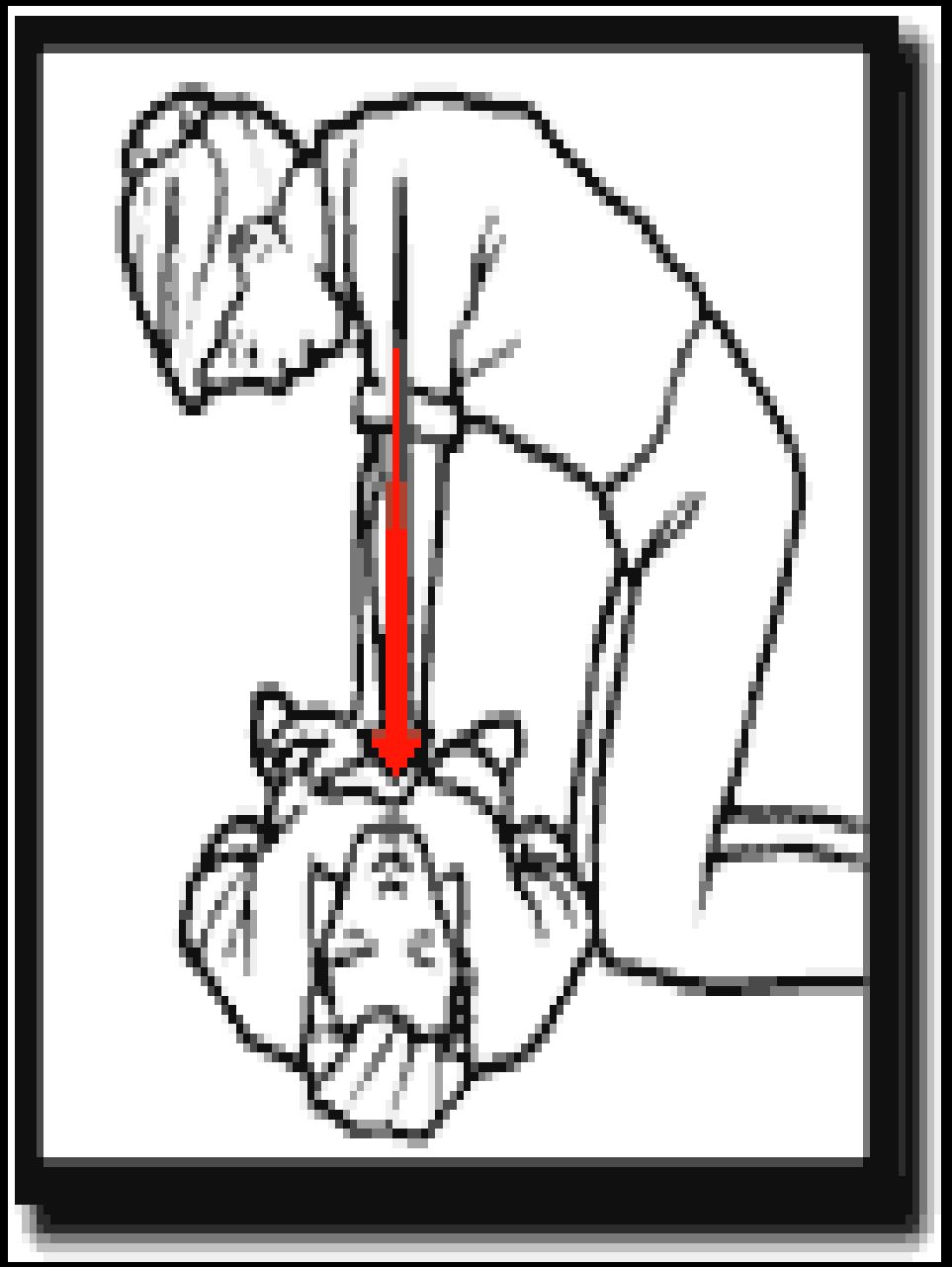
Hard and Fast

"push hard and push fast".

- After giving a chest compression,

  allow the chest to come back up completely allow the heart to fill
- with blood - before pushing down again.

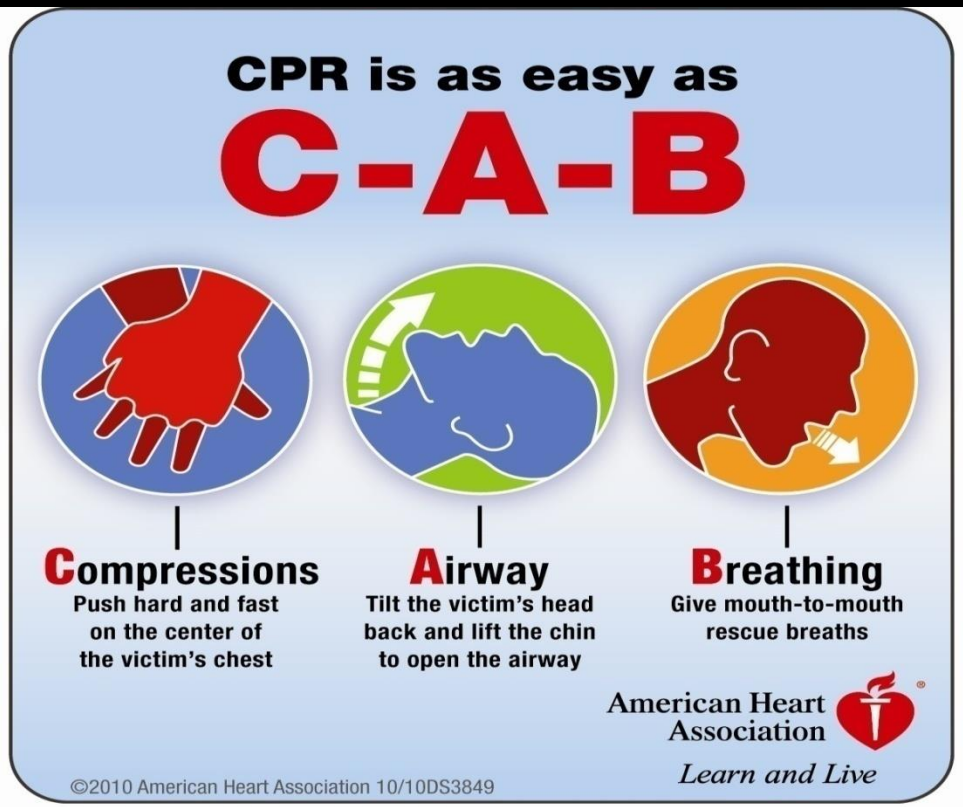




Precordial Thump

- The precordial thump should not be used for unwitnessed out-of-hospital cardiac arrest.
- The precordial thump may be considered for patients with witnessed, monitored, unstable VT (including pulseless VT) if a defibrillator is not immediately ready for use, but it should not delay CPR and shock delivery.


A.D.A.M.

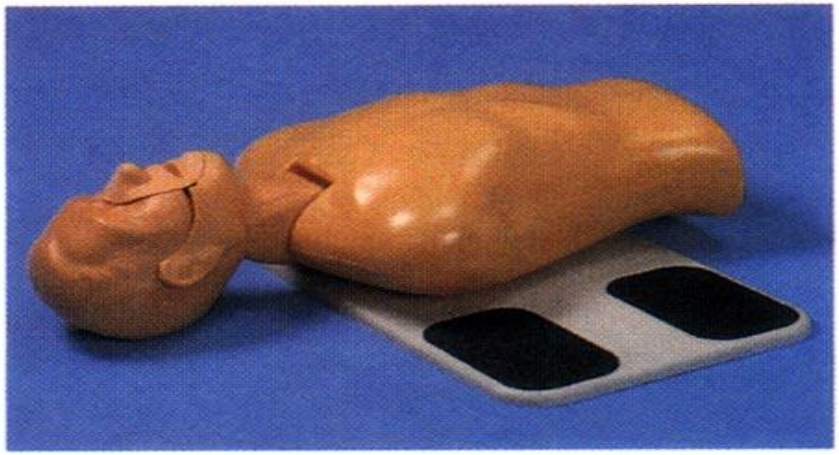

CPR is as easy as
C-A-B
Compressions
Push hard and fast on the center of the victim's chest
Airway
Tilt the victim's head back and lift the chin to open the airway
Breathing
Give mouth-to-mouth rescue breaths
American Heart Association
Learn and Live
©2010 American Heart Association 10/10DS3849

IAC-CPR

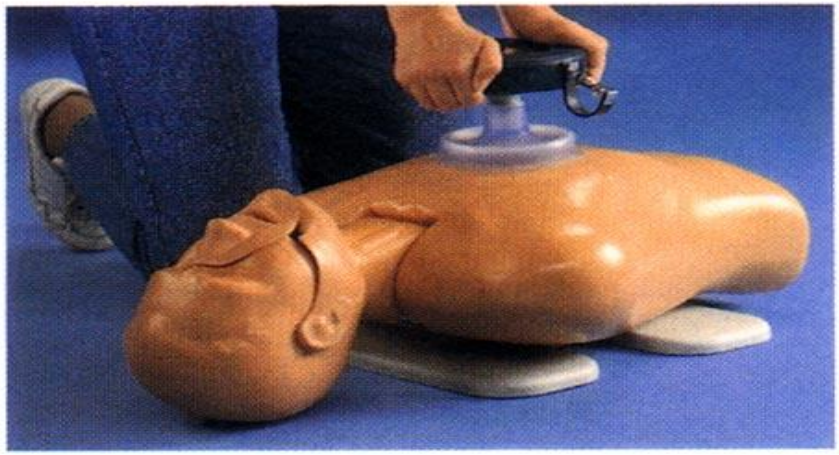
- Abdominal compression during the relaxation phase of chest compression
- "Priming of the intrathoracic pump" before systole

ACD-CPR

- A suction-cup device to pull up the chest during chest relaxation
- “Prime the thoracic pump”
- Place over mid-sternum
- A rate of 80-100/min with compression depth of 1.5~2.0 inches



Ambu Man 及 ACD CPR 壓板配置



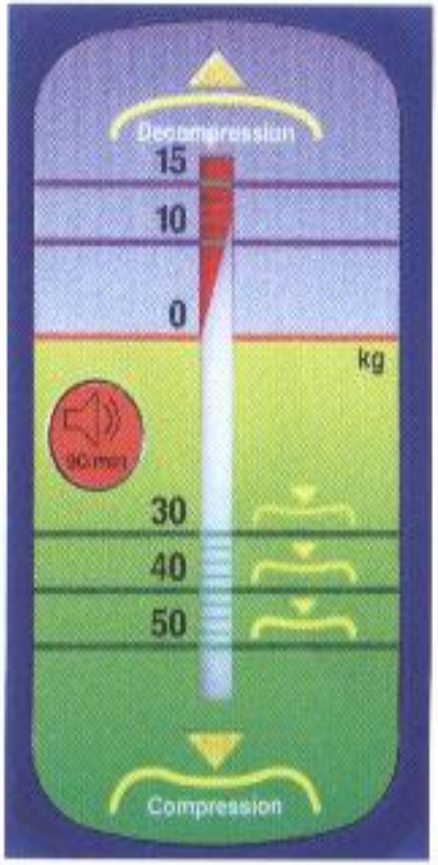
實施 ACD CPR 訓練

ACD-CPR cont.

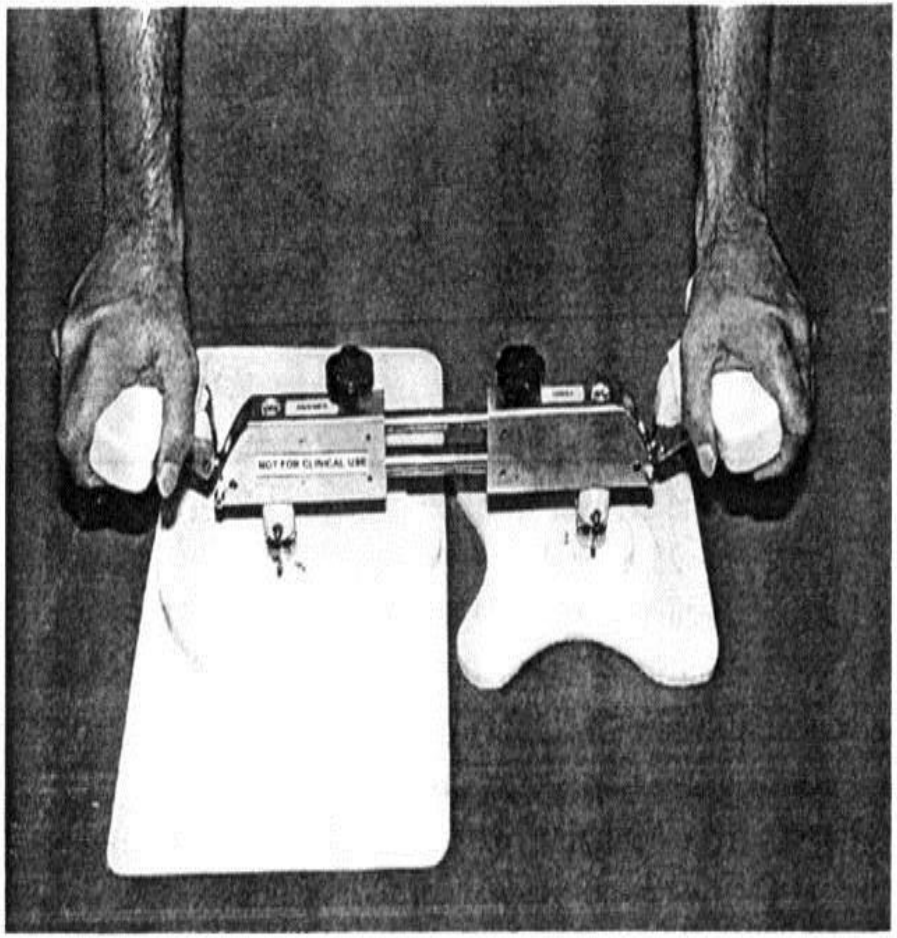
The scale indicates correct compression pressure for chests with "soft", "normal" or "stiff" characteristics.

Compressions made according to these indications ensure a compression depth of 30 to 50 mm.

The correct values (10-15 kg) for decompression are also indicated on the scale.



PTAD - CPR



Lifestick resuscitator.

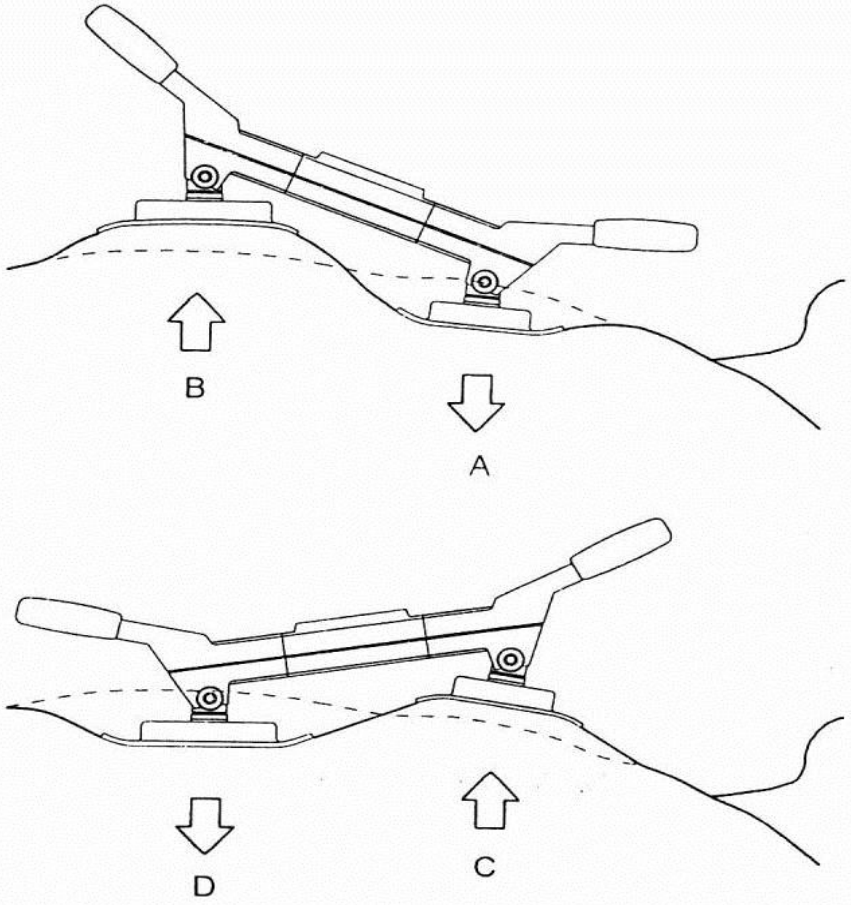


FIG 2. Sequencing compression-decompression with the Lifestick resuscitator. The subject's head is on the right. Chest compression (A) is coincident with abdominal decompression (B). This is followed by chest decompression (C) and abdominal compression (D).

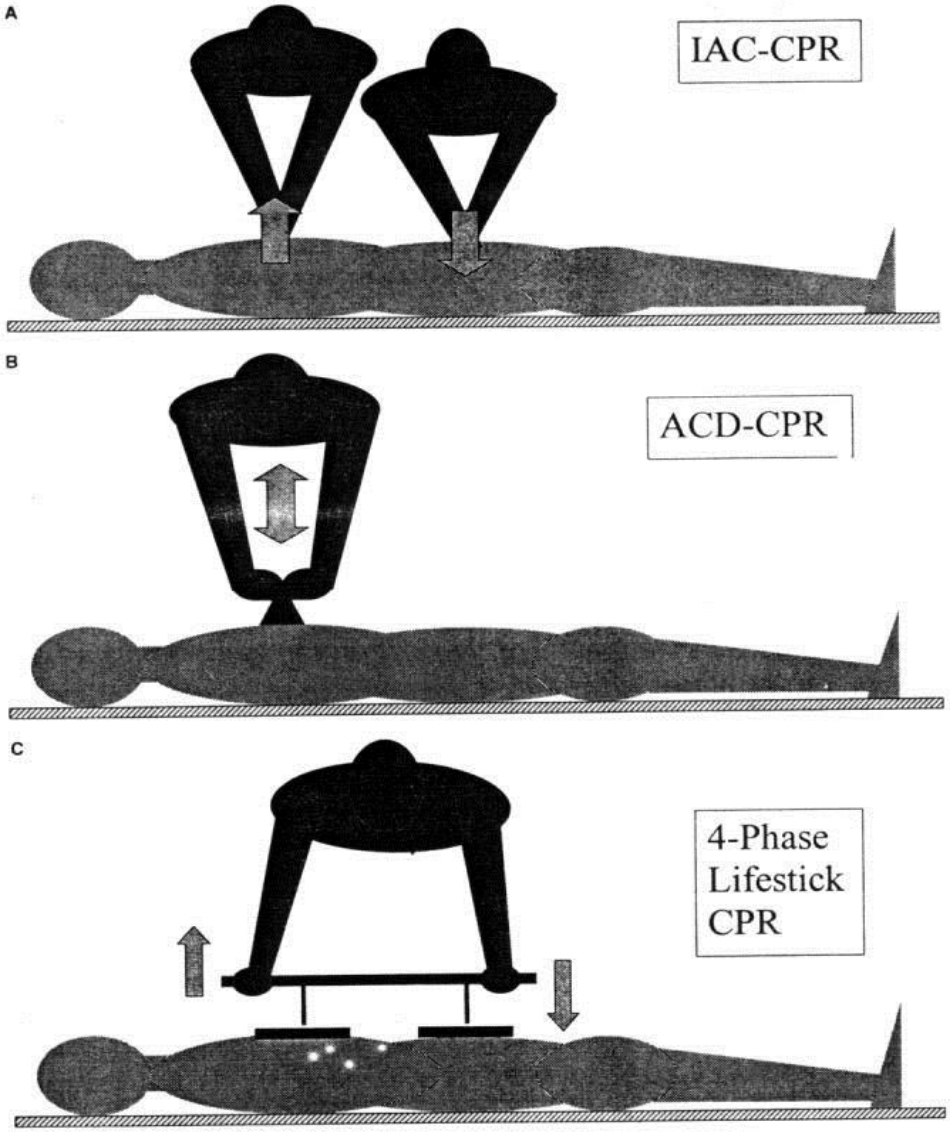
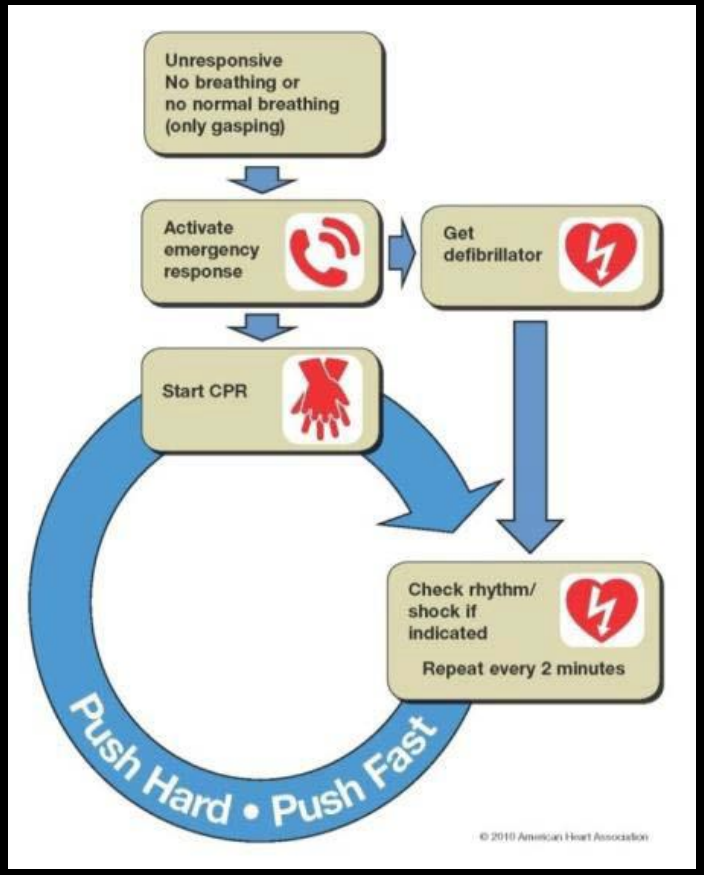


Figure 1. Schematics of 3 modified CPR techniques.

Compressions

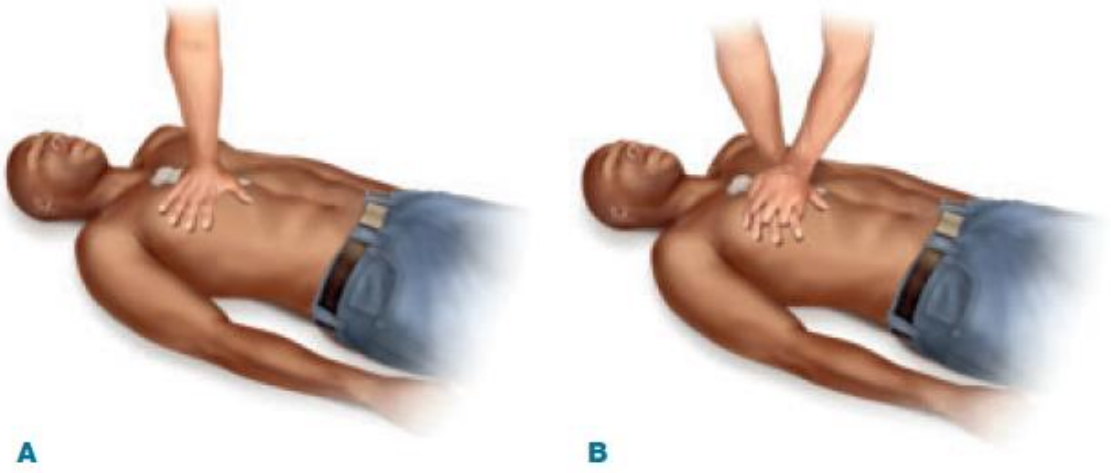
- A compression is the act of pushing on the chest
- People often don't push hard enough because they're afraid of hurting the victim
- An injury is unlikely, but it is better than death
- It is better to push too hard than not hard enough

Universal Algorithm for Adult CPR



Compressions

Step	Action
1	Make sure the person is lying on his back on a firm, flat surface.
2	Move clothes out of the way.
3	Put the heel of 1 hand on the lower half of the breastbone. Put the heel of your other hand on top of the first hand.
4	Push straight down **at least 2 inches** at a rate of **at least 100 compressions a minute.**
5	After each compression, let the **chest come back up** to its normal position.



Give Breaths

- Compressions are the most important part of CPR
- If you are also able to give breaths, you will help even more
- Your breaths need to make the chest rise
- When the chest rises, you know the person has taken in enough air

Cont.

A. If you are confident that you have detected signs of a circulation:
B. Look, listen and feel for **no more than 10 seconds** to determine if the victim is breathing normally

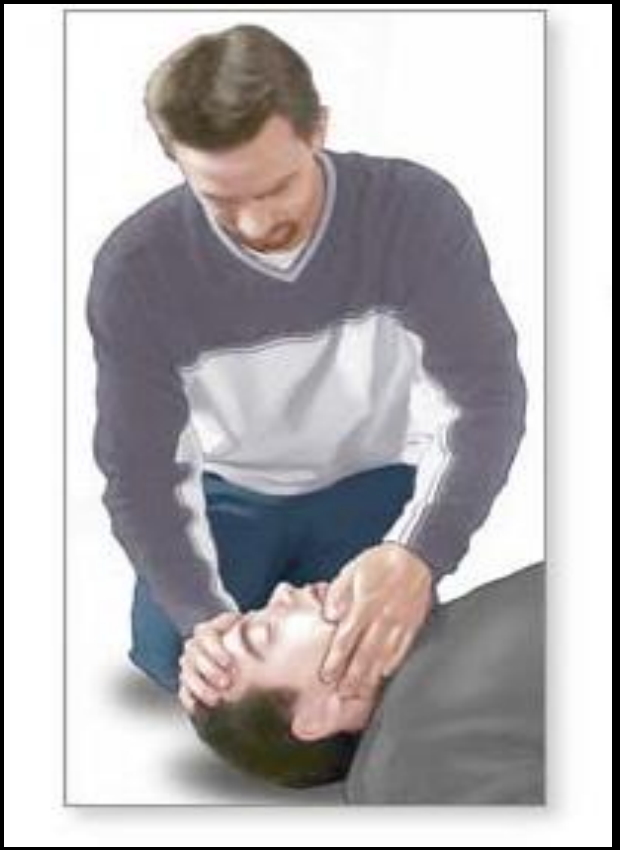
Sequence of actions

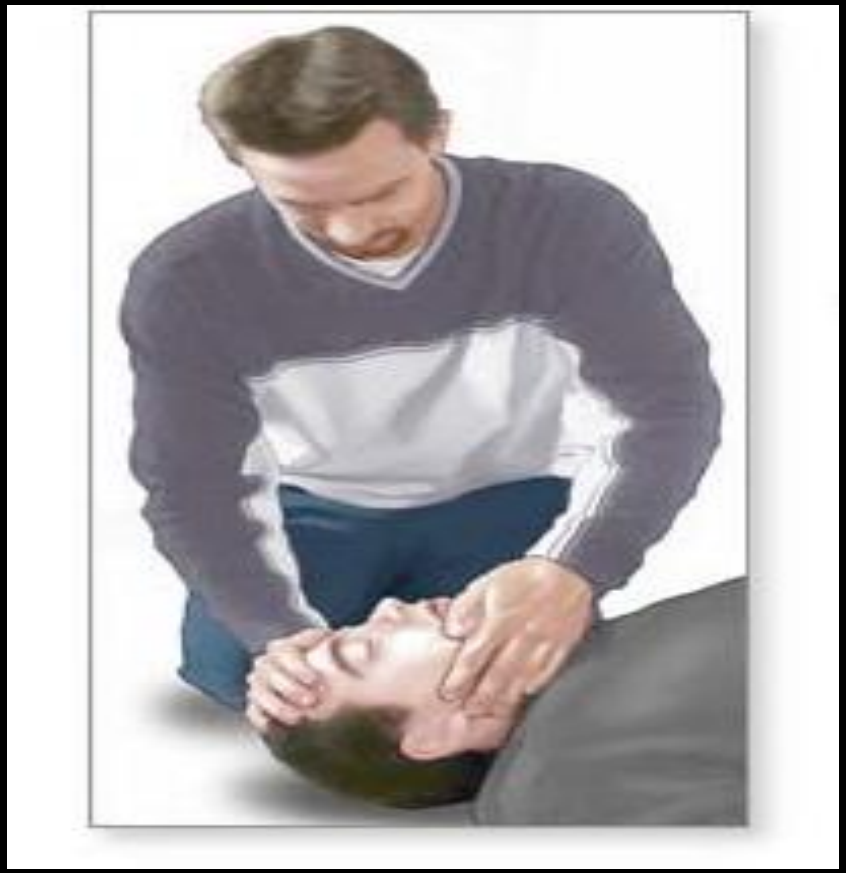
B. If he does not respond:

Shout for help

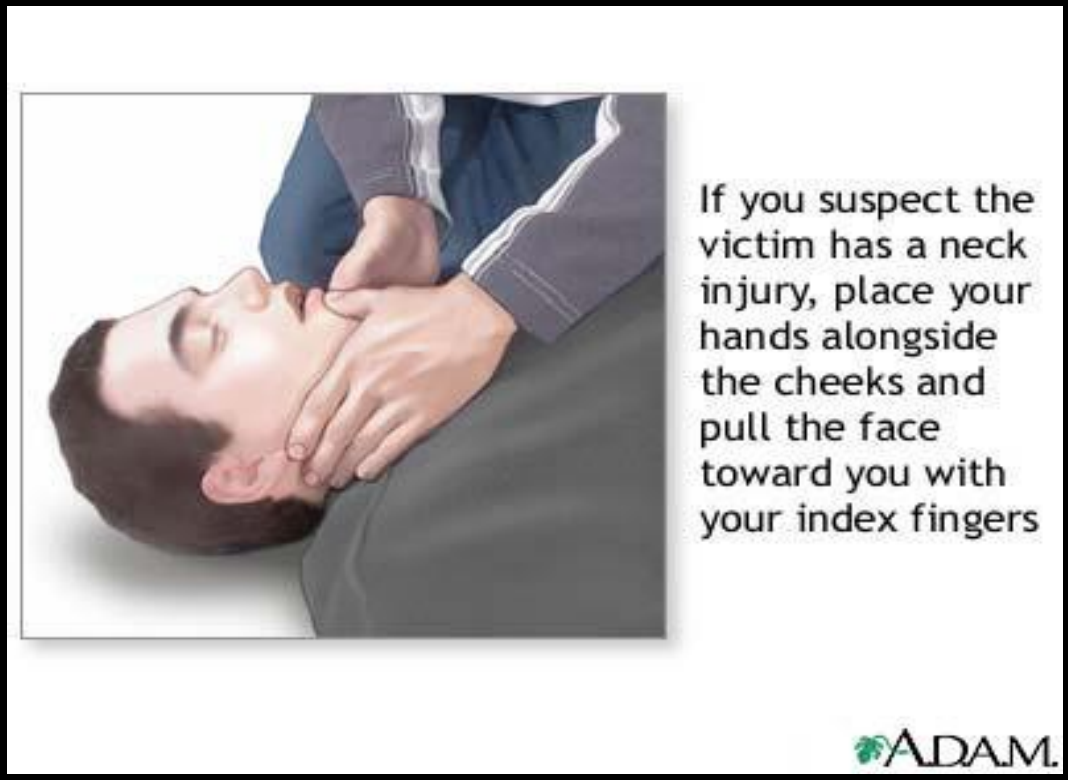
turn the victim on to his back

open the airway





if trauma (injury) to the neck is suspected

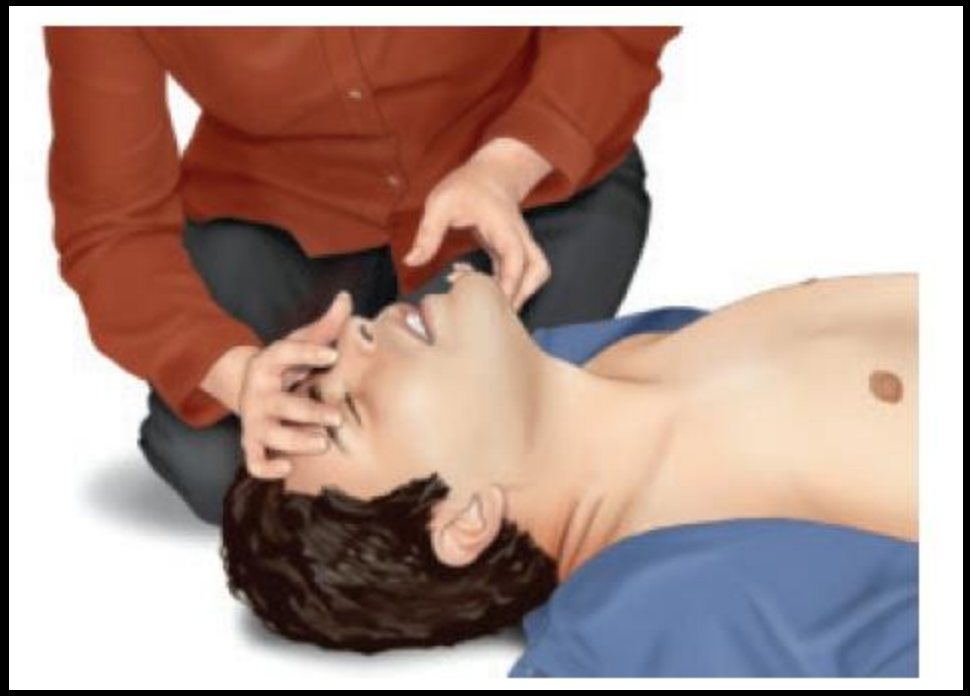


Try to avoid head tilt !

The kiss of life

Open the Airway

Step	Action
1	Put 1 hand on the forehead and the fingers of your other on the bony part of the chin.
2	Tilt the head back and lift the chin.



Give Breaths

Step	Action
1	While holding the airway open, pinch the nose closed.
2	Take a breath. Cover the person's mouth with your mouth.
3	Give 2 breaths (blow for 1 second each). Watch **for the chest to begin to rise** as you give each breath.

Period

- Shorter Breaths
- Every rescue breath
- Should be given over one second
- and should make the chest visibly rise.

2015 ACLS Guidelines-CPR

- High quality CPR continues to be of primary importance in optimizing outcomes

Compression Quality

- Emphasis is being placed on high quality CPR with compressions of adequate depth **(2-2 1/2″)** and rate, allowing complete chest recoil

Ventilation

- Excessive ventilation can have detrimental effects on the patient who is in cardiac arrest or other low-blood-flow states. Therefore excessive ventilation should be avoided

CPR Sequence

- It is true that the sequence of BLS steps has changed from A-B-C to C-A-B

CPR Sequence

- Encourage Hands only (compressions only) CPR for the untrained lay rescuer.

Single rescuers for all victims

- One Easy Ratio
- 30 compressions to two breaths.
- (except newborns).

CALL

CALL 911

BLOW

TILT HEAD, LIFT CHIN, CHECK BREATHING

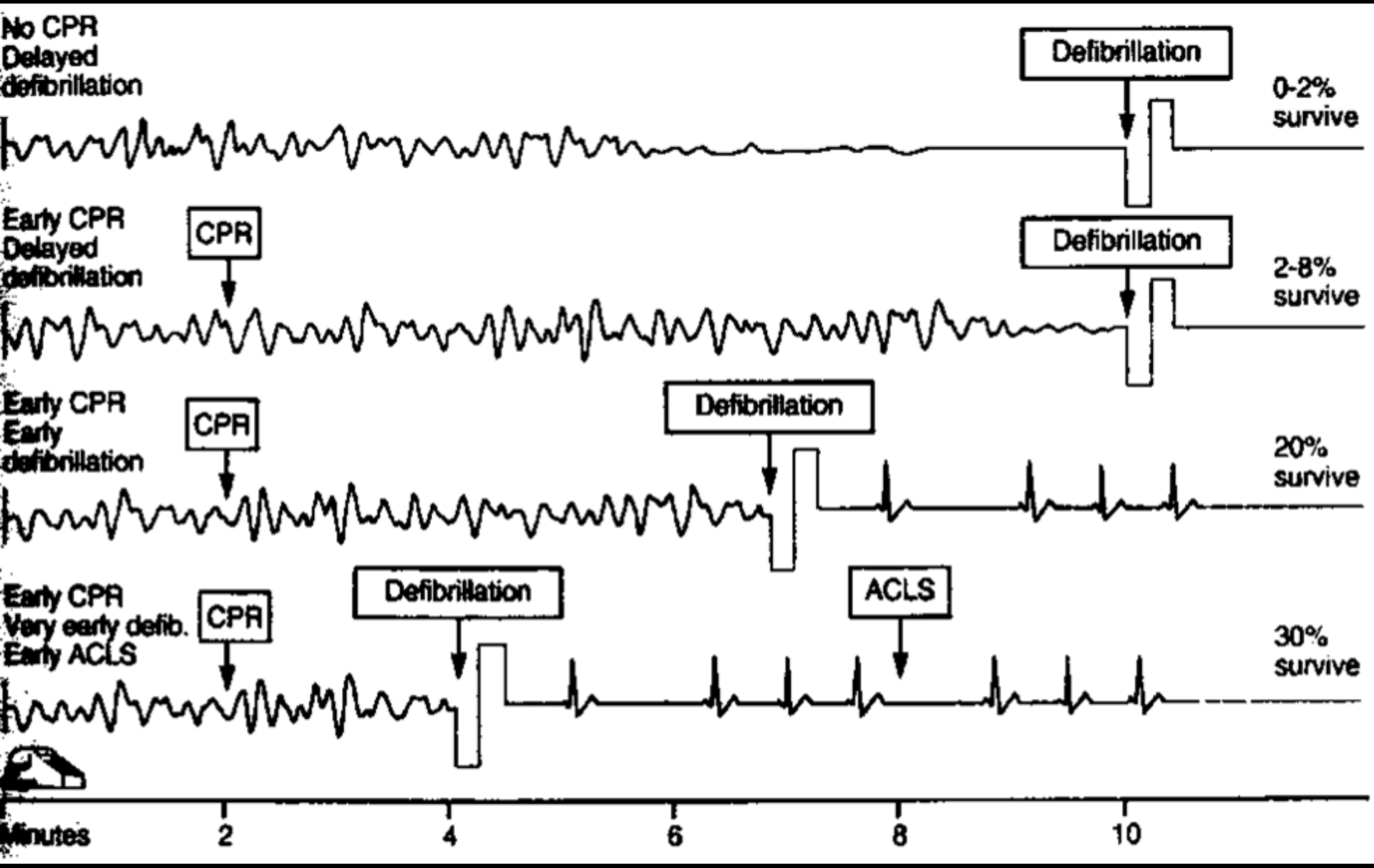
GIVE TWO BREATHS

PUMP

POSITION HANDS IN THE CENTER OF THE CHEST

FIRMLY PUSH DOWN TWO INCHES ON THE CHEST 15 TIMES

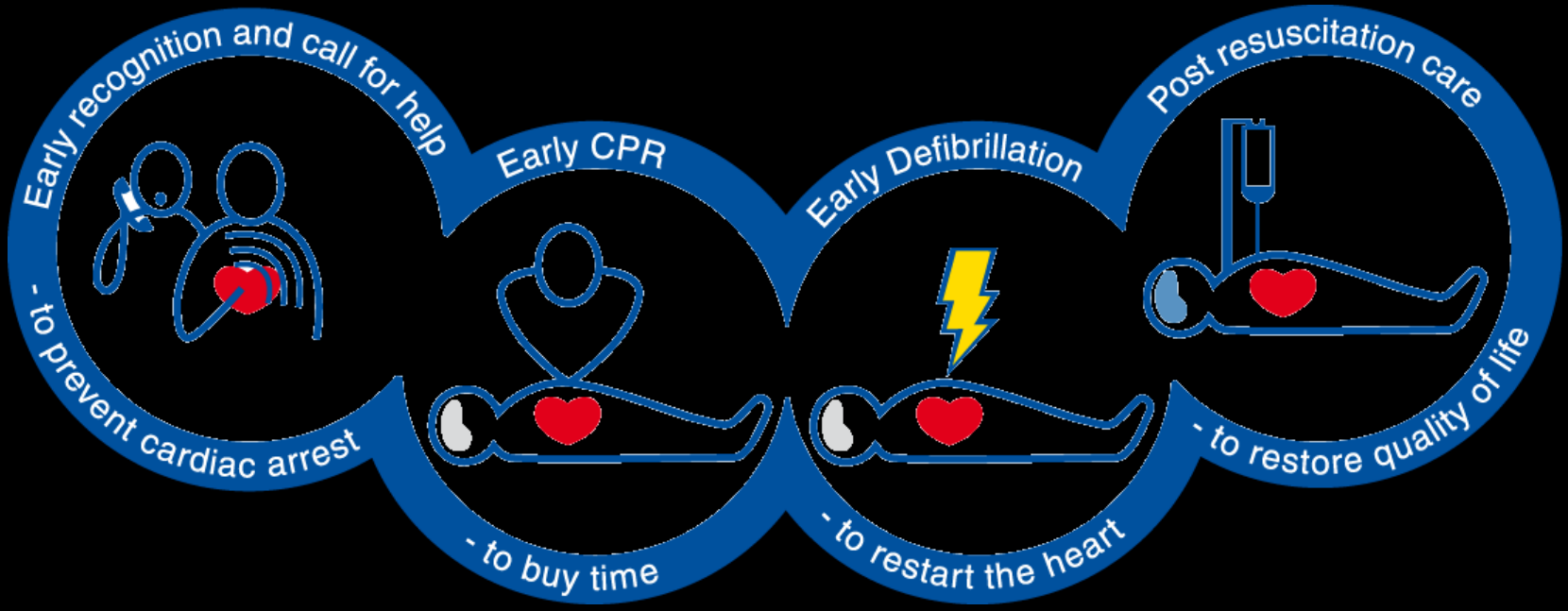
CONTINUE WITH TWO BREATHS AND 15 PUMPS UNTIL HELP ARRIVES


No CPR
Delayed defibrillation
Defibrillation
0-2% survive
Early CPR
Delayed defibrillation
CPR
Defibrillation
2-8% survive
Early CPR
Early defibrillation
CPR
Defibrillation
20% survive
Early CPR
Very early defib.
Early ACLS
CPR
Defibrillation
ACLS
30% survive
Minutes
2
4
6
8
10

Use an AED

- If you start CPR and then use an AED within a few minutes, you will have the best chance of saving a life
- AEDs are safe, accurate, and easy to use

Chain of survival



Chain of Survival

Early Access

Early CPR

Early Defibrillation

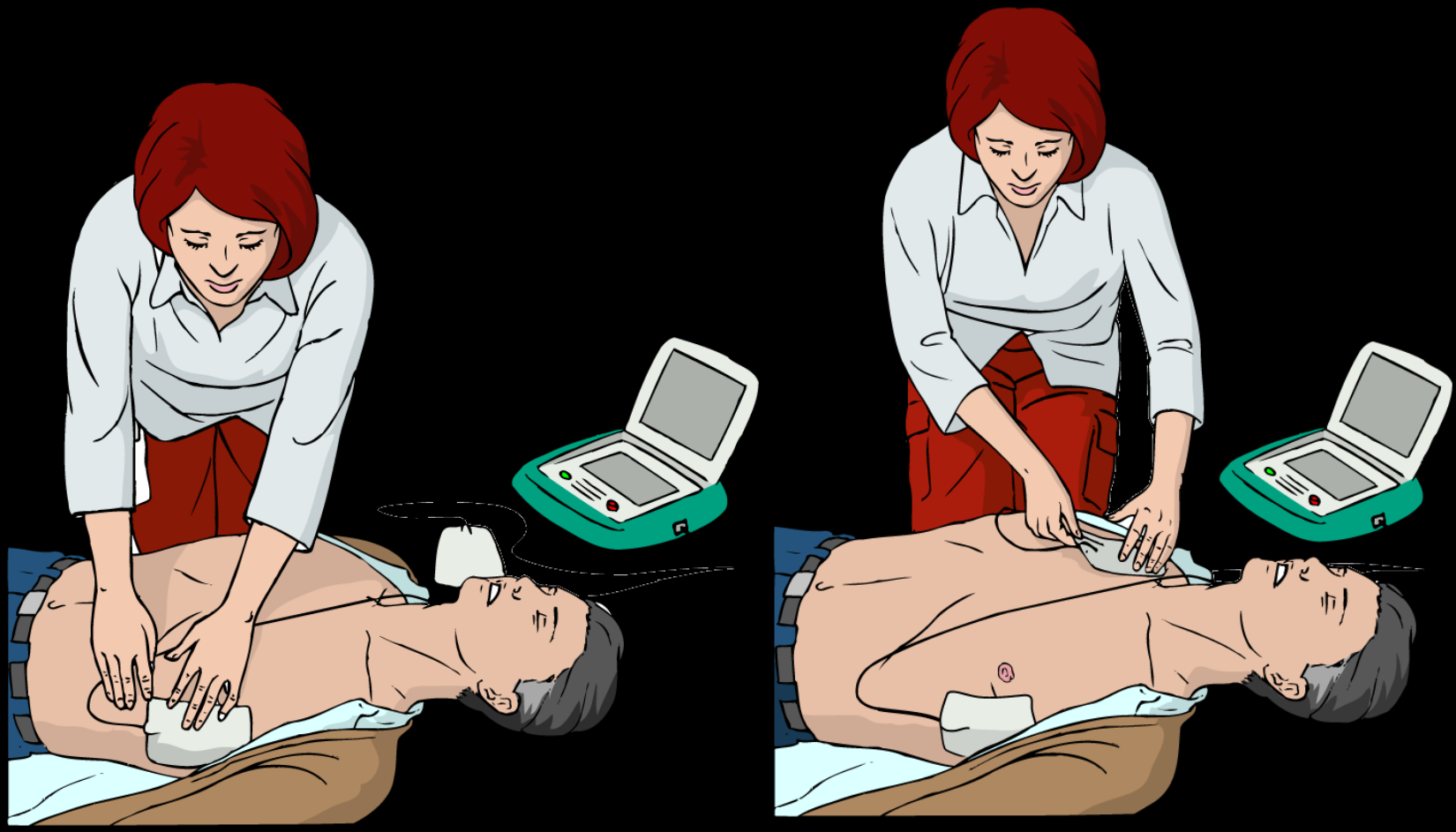
Early Advanced Care

Early Defibrillation

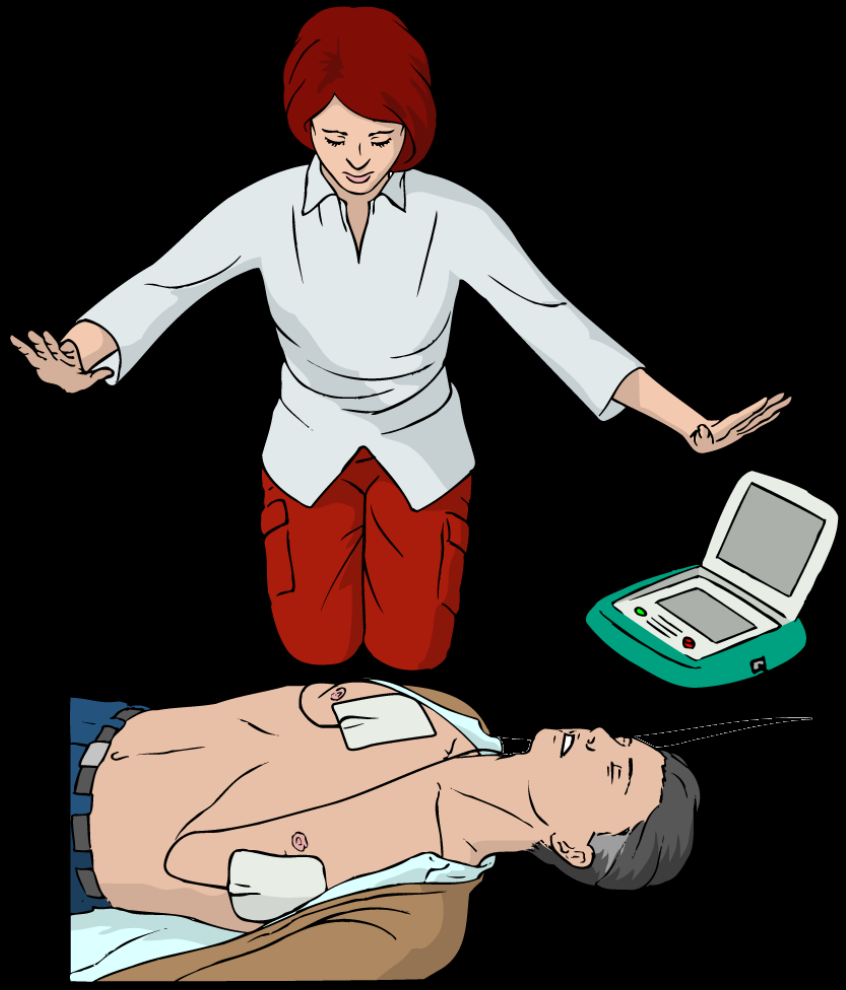
Switch on AED

- Some AEDs will automatically switch themselves on when the lid is opened

Attach pads to victims bare chest



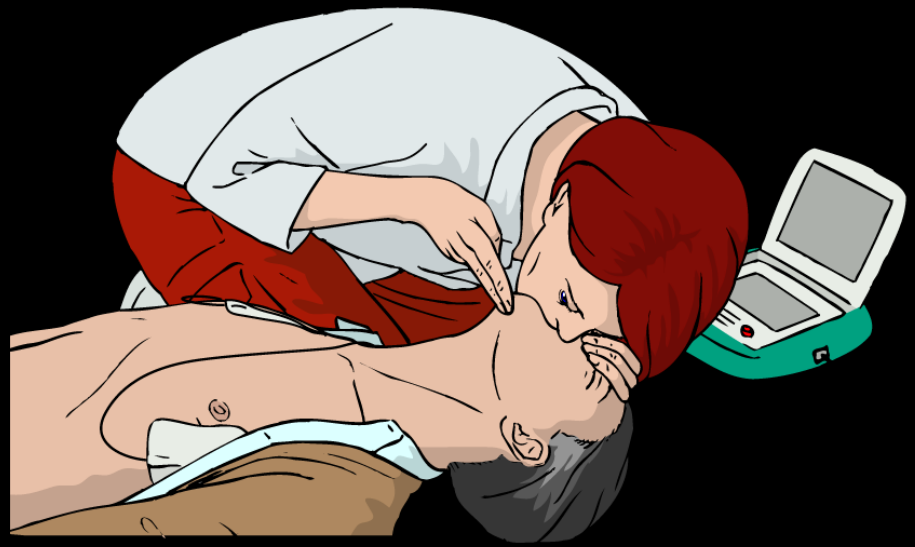
Analysing Rhythm: Do not touch victim



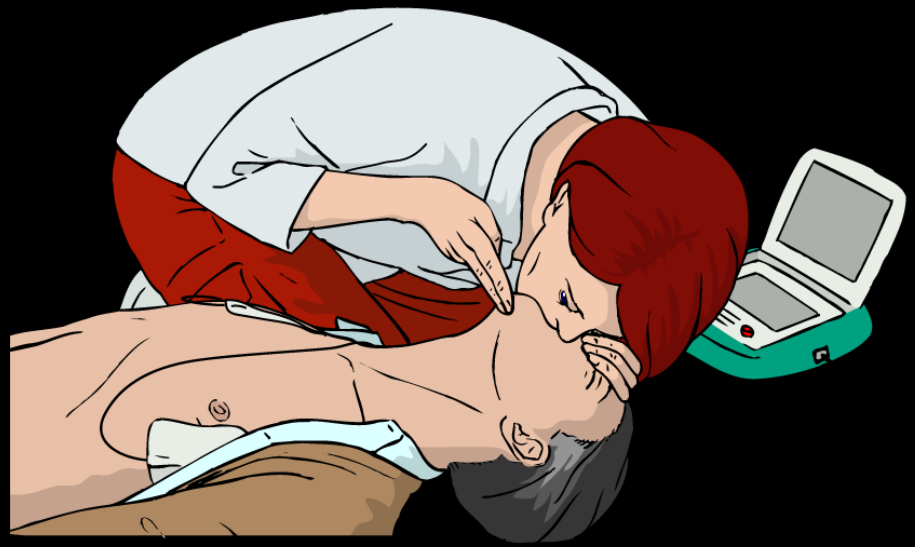
Shock indicated

- Stand clear
- Deliver shock

Shock delivered:
Follow AED instructions



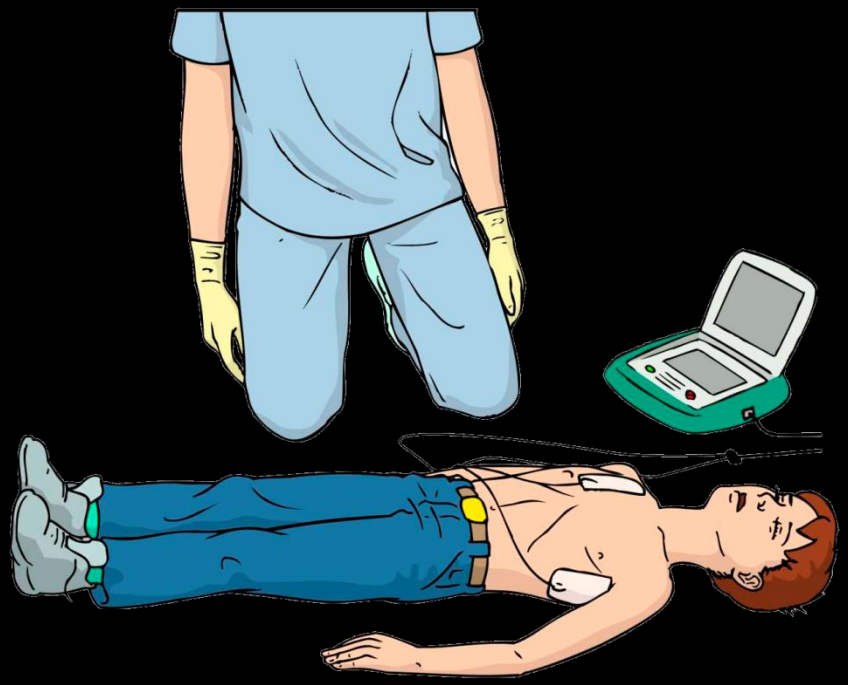
No shock advised:
Follow AED instructions



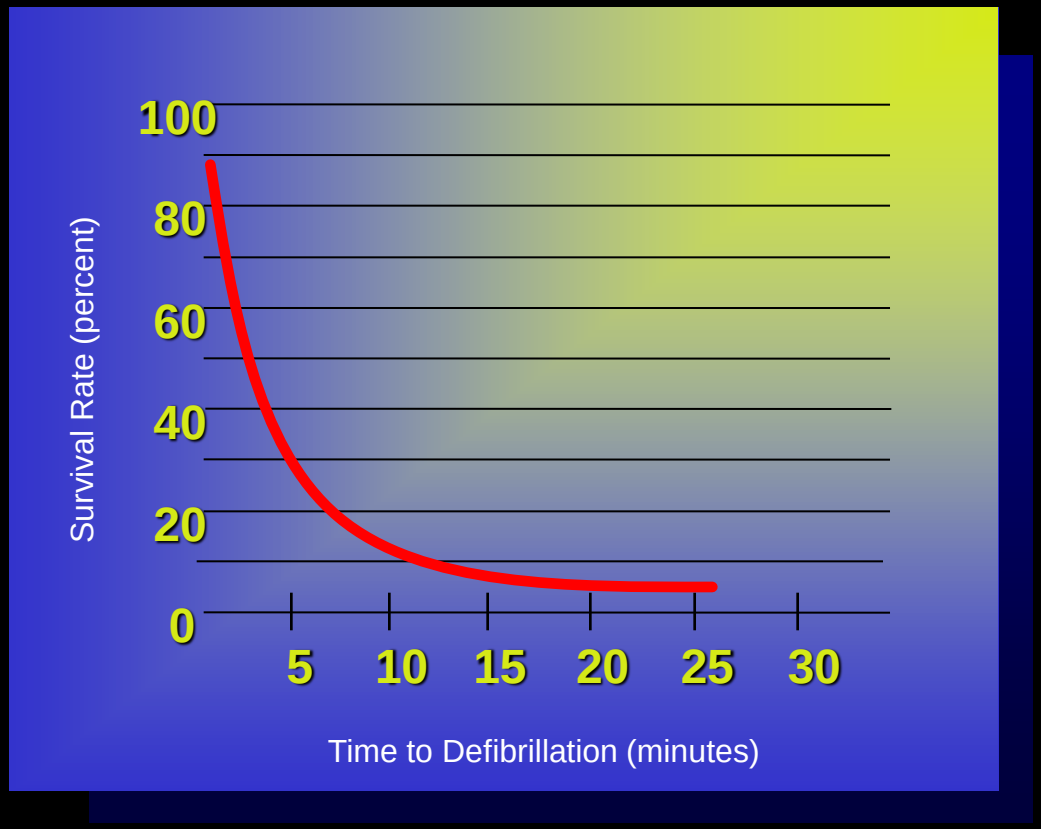
If victim starts to breathe normally place in recovery position

AED in children

- Age > 8 years
  - use adult AED
- Age 1-8 years
  - use paediatric pads / settings if available (otherwise use adult mode)
- Age < 1 year
  - use only if manufacturer instructions indicate it is safe



For each minute that defibrillation is delayed Survival is reduced by 10%



- **Adopt the SAFE approach**
  Shout for help
  Approach with care, avoiding any situation that poses a hazard to you, you can't help anyone if you end up injured in the process
  Free the person from any immediate danger
  Evaluate CAB (Circulation Airway, Breathing,)

Basic life support (BLS)

Key points

1. **30 chest compressions followed by two rescue breaths is recommended ratio for single rescuers resuscitating children and adult**

Basic life support (BLS)

Key points

2. **Chest compressions performed with minimal interruption are critically important in improving the chance of survival from sudden cardiac arrest**

Basic life support (BLS)

Key points

3. **Chest compressions should be performed at a rate >100/min for children and adults**

Basic life support (BLS)

Key points

4. a **single shock** be delivered when a shockable dysrhythmia exists, followed by resumption of chest compressions as soon as the shock is delivered.

Two minutes of chest compressions and ventilation should be performed before reassessing the underlying cardiac rhythm.

Basic life support (BLS)

Key points

- **5. Automated external defibrillators (AEDs) may follow an outdated defibrillation protocol (e.g., three defibrillation shocks before resumption of cardiopulmonary resuscitation [CPR]). In this circumstance, the rescuer should allow the AED to function as programmed until a manual defibrillator becomes available.**

Basic life support (BLS)

Key points

- **6. When a rescuer is unfamiliar with the type of manual defibrillator used during resuscitation, a default energy of 200 J is a reasonable energy level for defibrillation.**

Basic life support (BLS)

Key points

- **7. In an unwitnessed cardiac arrest or in situations in which initiation of CPR has been delayed, 2 minutes of CPR before the first defibrillation has been shown to have survival benefit.**

Basic life support (BLS)

Key points

- **8. Hyperventilation during resuscitation increases intrathoracic pressure, impairs venous return to the heart, and has a negative impact on survival from cardiac arrest.**

Basic life support (BLS)

Key points

- **9. Therapeutic hypothermia has demonstrated benefit**

Basic life support (BLS)

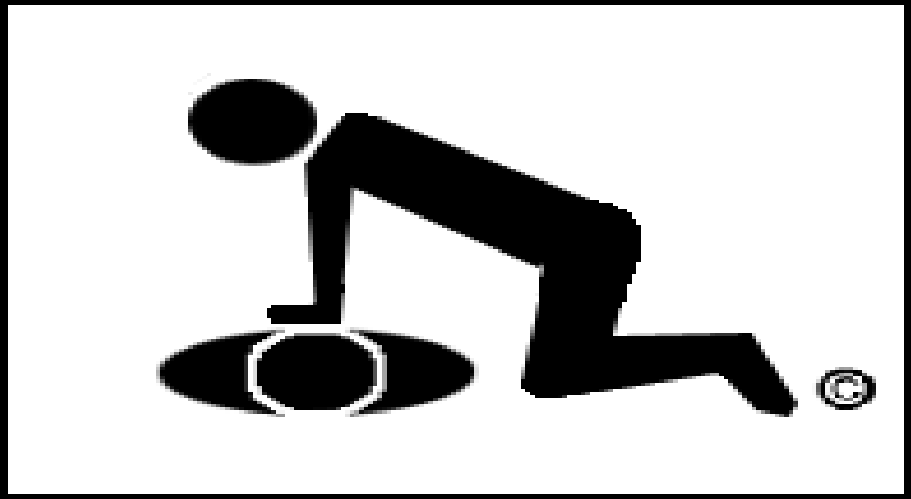
Key points

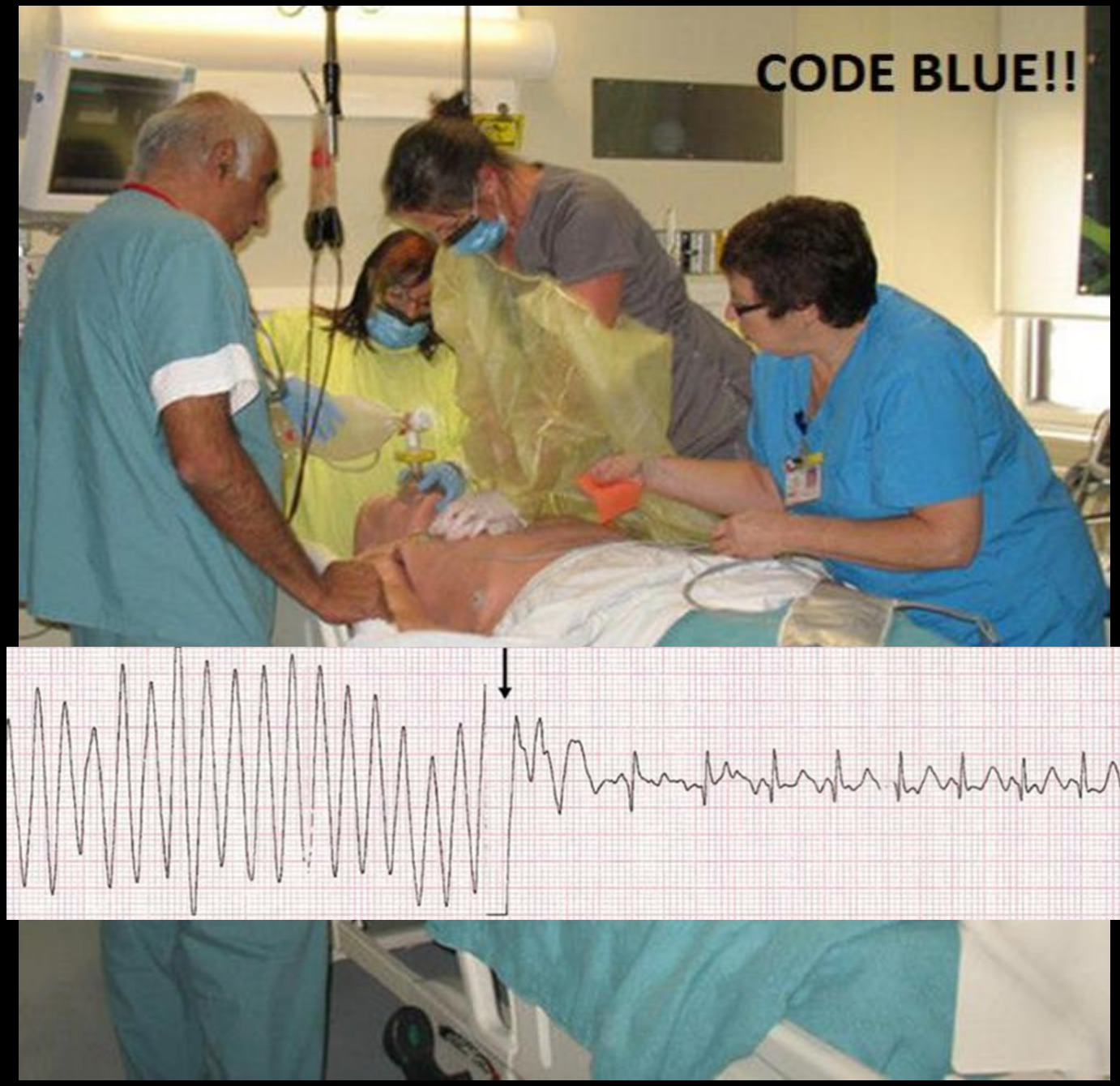
10. **Resuscitation knowledge declines rapidly, ACLS protocols should be made available on resuscitation carts.**

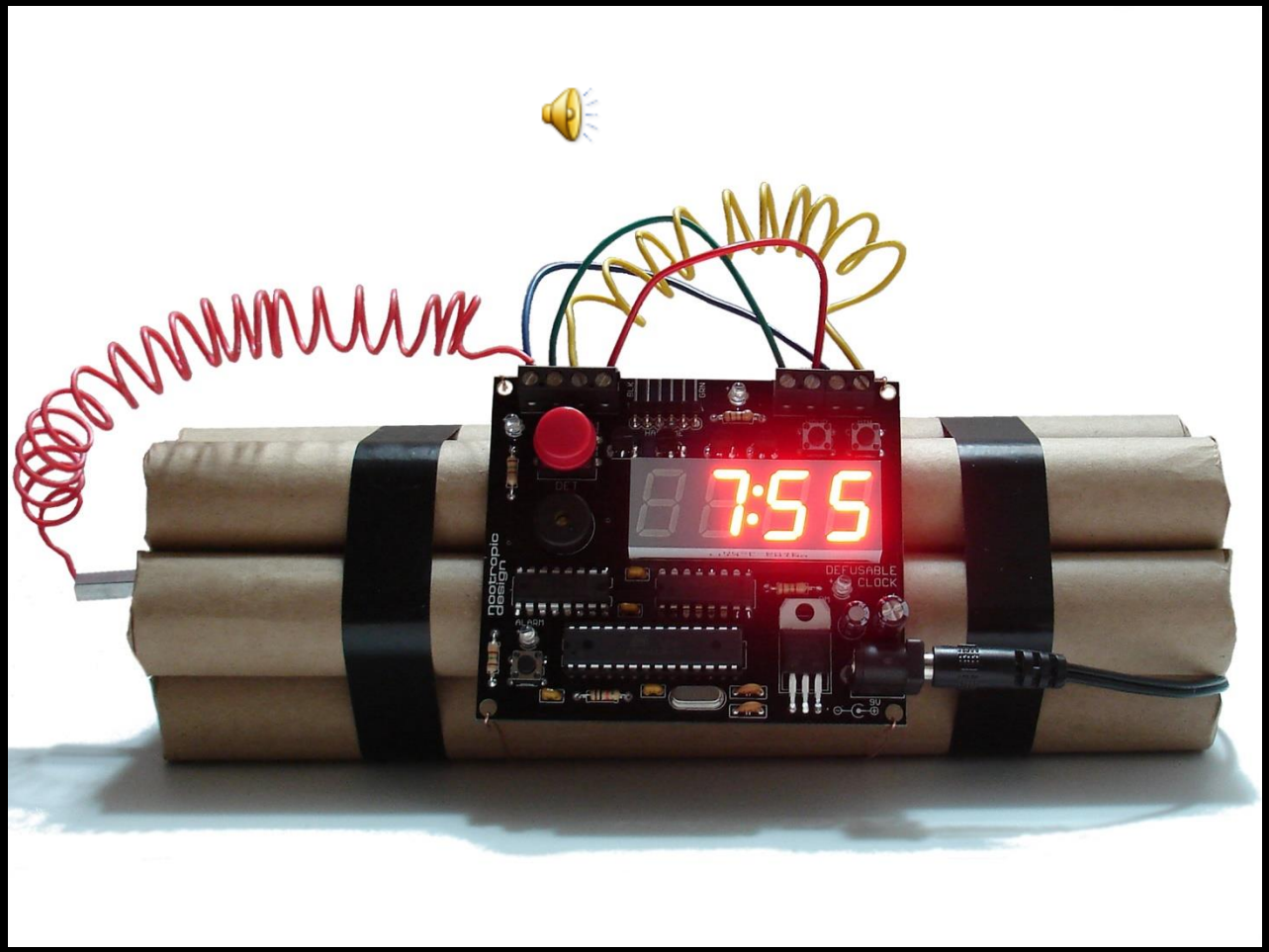
Sequence Change from ABC to CAB

- The most dramatic change in the 2010 AHA CPR guidelines for ACLS and BLS is a change in the basic life support sequence of steps from “**A-B-C**” (Airway, Breathing, Chest compressions) to “**C-A-B**” (Chest compressions, Airway, Breathing) for adult and pediatric patients (excluding newborns).

Post-resuscitation care of the cardiac arrest survivor




CODE BLUE!!

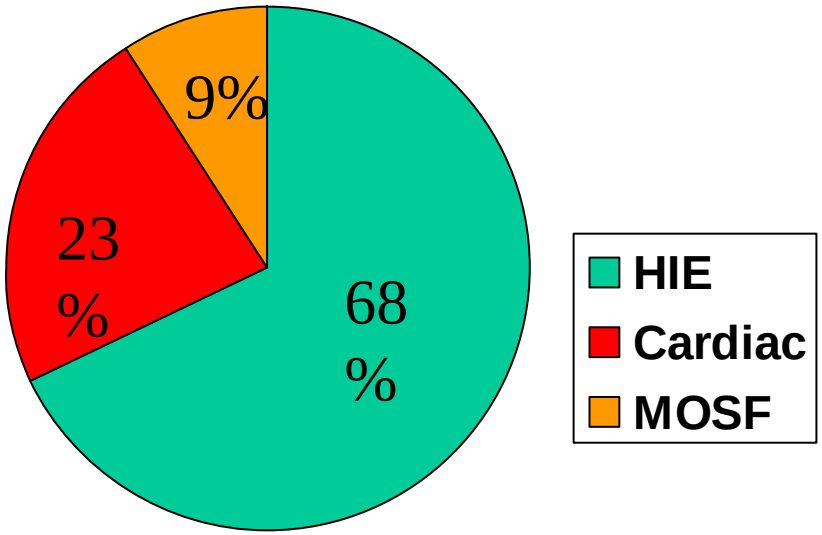

7:55
DEFUSABLE
CLOCK
ALARM

Improving Postresuscitation Outcomes

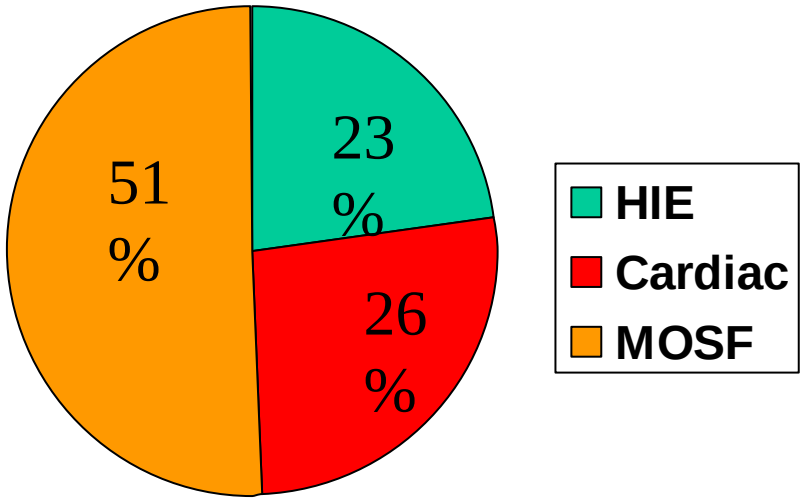
- Postresuscitation care is a critical component
- Patient mortality remains high
- Ultimate prognosis in the first 72 hours may be difficult to determine
- survivors of cardiac arrest have the potential to lead normal lives

From what do they die…?

Cause of Death in OHCA



Cause of death in IHCA

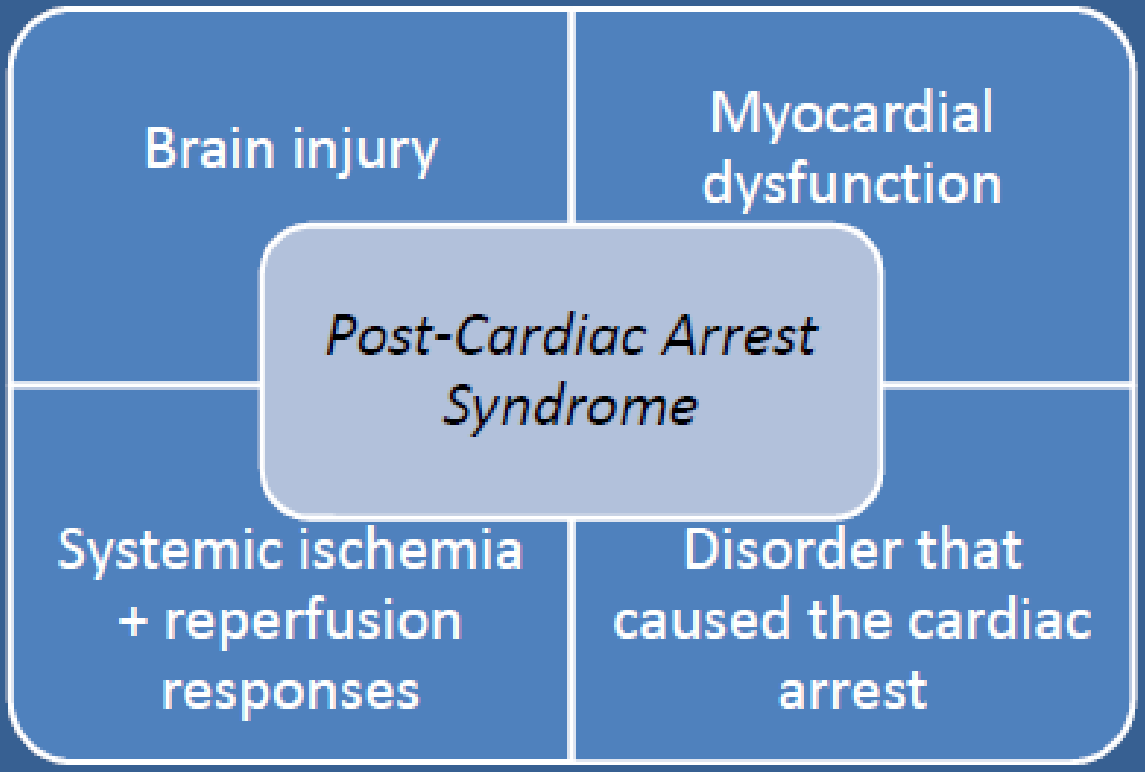


Laver. Intensive Care Med 2004;30:2126

Post-arrest care is as important as intra-arrest care

- Once we've achieved ROSC our job is not over
- maintaining blood pressure
- cerebral perfusion
- adequate sedation,
- cooling and preventing hyperthermia
- Antiarrhythmic medications,
- Oxygen delivery & avoiding hyperoxia
- PCI who need it
- Treating the underlying cause.

Consequences From Cardiac Arrest

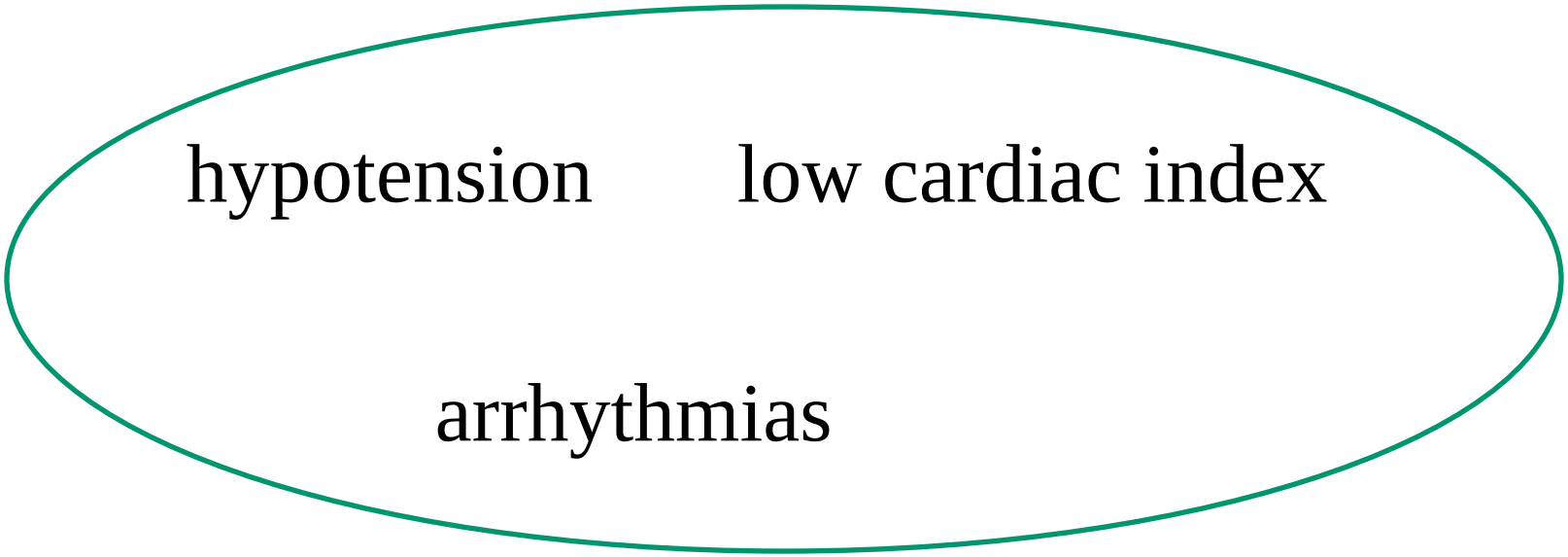


The post-cardiac arrest syndrome

- post-cardiac arrest brain injury

Haemodynamic management

- Post-resuscitation myocardial dysfunction causes haemodynamic instability,



Haemodynamic management

- early echocardiography in all patients
- Post-resuscitation myocardial dysfunction
- inotropic support
- vasoplegia
- severe vasodilation

Haemodynamic management

- Noradrenaline, with or without Dobutamine, and
- Fluid

most effective treatments

BP Goals after CA

- **Cerebral perfusion concerns balanced against risks to the heart**
- favor empiric MAP 80-90

Control of ventilation

- Hypocarbia ⇨ cerebral vasoconstriction, it
- adjust ventilation to achieve normocarbia

- end-tidal CO_2 arterial blood gas

Circulation, Coronary reperfusion

- Acute coronary syndrome (ACS) is a frequent cause of out-of-hospital cardiac arrest (OHCA)
- Early percutaneous coronary intervention (PCI), is feasible in patients with ROSC after cardiac arrest.

PCI following ROSC with ST-elevation

- post-ROSC electrocardiogram (ECG) more than 80% will have an acute coronary lesion
- ST segment elevation (STE)
- Left bundle branch block (LBBB)
- Early invasive management is beneficial in STE patients.

Control of seizures

- Seizures are common after cardiac arrest
- approximately one-third of patients who remain comatose after ROSC
- Myoclonus is most common and occurs in 18–25%
- focal or generalised tonic-clonic seizures or a combination of seizure types.

Glucose control

- There is a strong association between high blood glucose after resuscitation from cardiac arrest and poor neurological outcome.
- Do not implement strict glucose control in adult patients with ROSC after cardiac arrest because it increases the risk of hypoglycaemia.

The post-cardiac arrest syndrome

- restoration of blood pressure and improvement in gas exchange do not ensure survival and functional recovery

optimising neurological recovery

Mechanisms of brain injury in circulatory arrest

- Primary Injury:
  - "Energy failure" due to ATP depletion
- Secondary injury:
  - Loss of transcellular electrolyte gradients
    - Ca^{+}, Na^{+}, Cl^{-} enter, K^{+} exits cell
    - Water follows Na^{+} into cells causing cytotoxic edema
  - Lipid peroxidases damage membranes
  - Neurotransmitter release causes excitotoxicity
  - Activation of apoptotic pathways
  - Microvascular thrombosis
  - Reperfusion injury

6-72h

Cerebral perfusion

- immediately after ROSC there is a short period of multifocal cerebral no-reflow followed by transient global cerebral hyperaemia lasting 15–30 min.
- This is followed by up to 24 h of cerebral hypoperfusion while the cerebral metabolic rate of oxygen gradually recovers

After asphyxial cardiac arrest

- brain oedema may occur transiently after ROSC but it is rarely associated with clinically relevant increases in intracranial pressure.
- after ROSC, maintain mean arterial pressure near the patient's normal level.

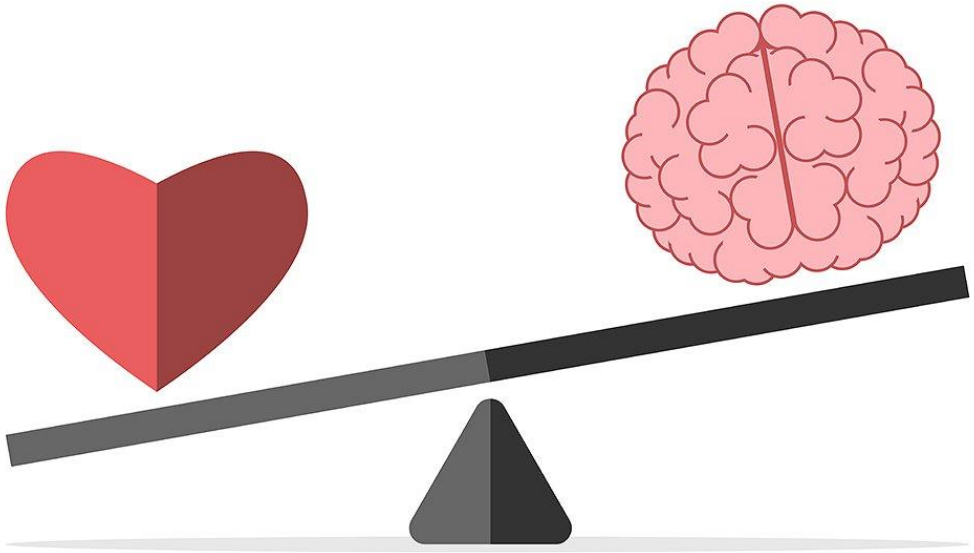
THE USE OF HYPOTHERMIA AFTER CARDIAC ARREST

DONALD W. BENSON, M.D.
G. RAINEY WILLIAMS, JR., M.D.
FRANK C. SPENCER, M.D.
ADOLPH J. YATES, M.D.
Baltimore, Maryland*

Anesthesia and Analgesia 1959;38 (6): 423

History

- 1803 "Russian Method of Resuscitation" consisted of burying the victim of a cardiac arrest in snow hoping for ROSC



Risks

- Infections
- Bleeding
- Need for sedation

Benefits

- Strongly neuroprotective
- Decreased mortality
- Better neurological outcome

N Engl J Med
2002;346:549-56

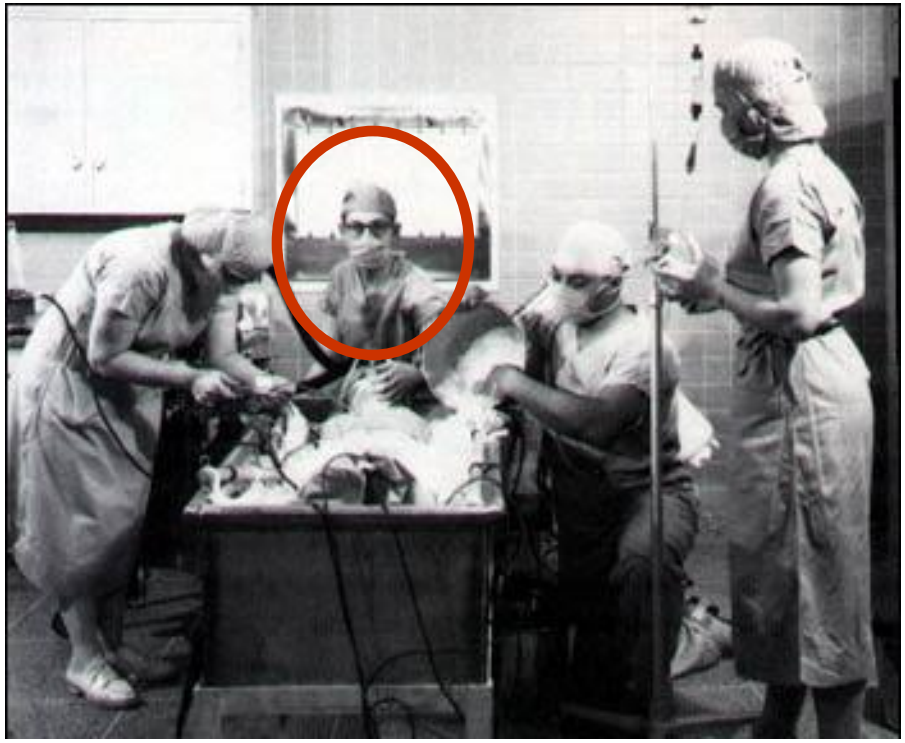
Basics of Therapeutic Hypothermia

- There are 3 phases of treatment:
  - **Induction**
  - **Maintenance**
  - **Decooling**

Induction

- Rapidly bring the temperature to 32-36C
- Sedate with propofol or midazolam during TH
- Paralyze to suppress heat production

How to cool…



Baltimore,
1955

Portland, Maine,
2006

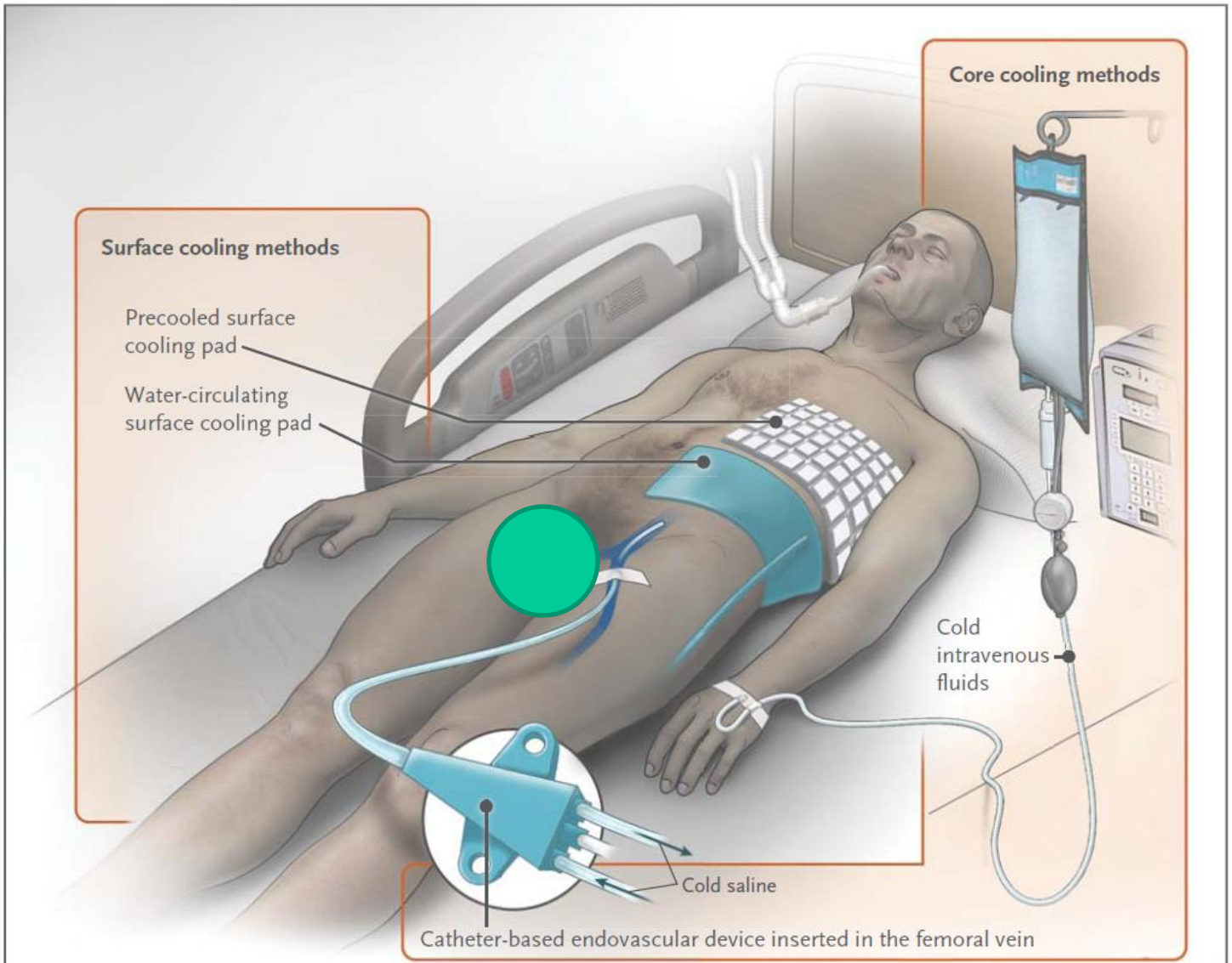


Figure 1. Cooling Methods Used in Clinical Practice.

Surface cooling methods include the use of precooled (refrigerated) surface cooling pads and water-circulating surface cooling pads. Core cooling methods include the infusion of cold intravenous fluids and the use of catheter-based endovascular devices.

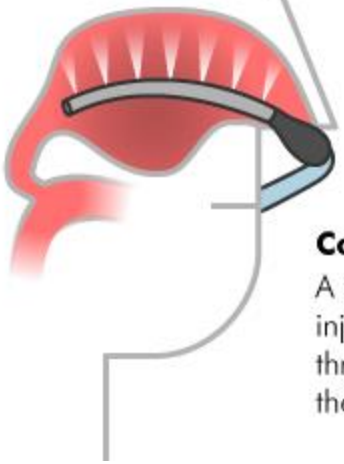
Holzer. New Engl J Med 2010;363:1256-

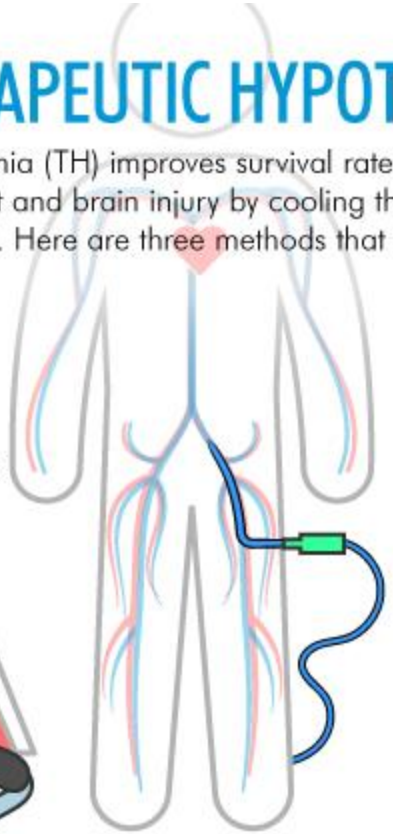
HOW THERAPEUTIC HYPOTHERMIA WORKS

Therapeutic hypothermia (TH) improves survival rates and brain function typically in cases of cardiac arrest and brain injury by cooling the body to be between 89.6 and 93.2 F (32 and 34 C). Here are three methods that hospitals use to induce TH.

Transnasal Evaporative Cooling

A tube inserted into the nasal cavity sprays a coolant mist, cooling the brain and bloodstream.



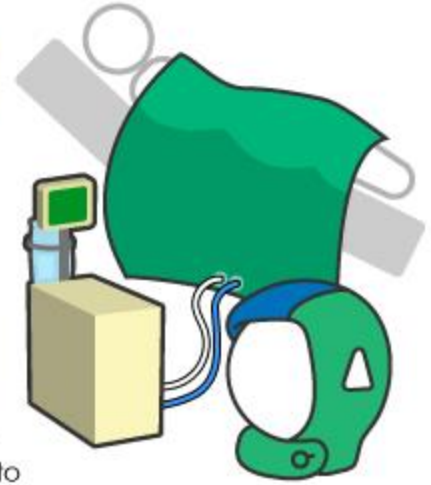


Cooling Catheter

A cooled saline solution is injected into the bloodstream through a catheter inserted into the femoral vein.

Water Blankets and Cooling Caps

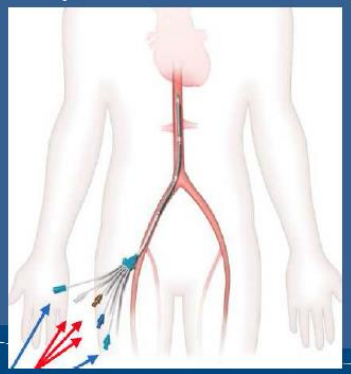
Cooled water is circulated through specialized blankets and/or caps.

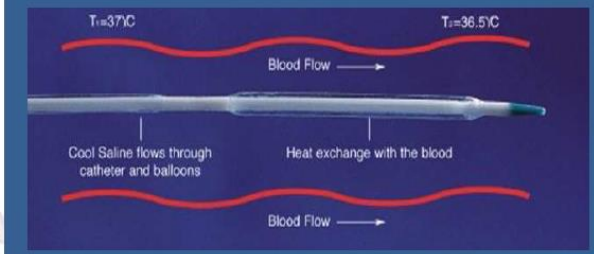


howstuffworks

Intravascular Cooling Systems

- Percutaneously placed central venous catheters
- Circulating cool or warm saline in a closed loop through the catheter's balloon
- Less shivering compared to surface devices
- Complication: Thrombosis





art | science | healing

Critical Care (2015) 19:103

UKHealthCare
Gill Heart Institute

Hypothermia Protocol

- External cooling device (TheraKool)
- Sedation with Midazolam and Fentanyl
- Pancuronium to prevent shivering
- Target temperature of 32°C to 34°C for 24h
- Passive rewarming over 8h

De-cooling (rewarming)

- Most dangerous period:
- hypotension, cerebral edema, seizures
- Goal is to reach normal body temperature over 12-24h
- Stop sedation when normal body temperature is achieved

De-cooling

- Vasodilation causes hypotension
  - May require several liters IVF
- More shivering during this phase
- Inflammation increases at higher temperature
  - “post-resuscitation” syndrome
- Increased ICP
- Watch for hyperkalemia
  - Primarily problematic in renal failure
- SEIZURES

Rewarming

- At 28 hours after cardiac arrest,
- passive rewarming will commence
- cessation of active cooling and covering the patient with a blanket (warming blankets are NOT to be used for patients at 35°C-36°C).
- Rewarming should take place at a rate of approximately 0.25°C/hour,
- no greater than 0.5°C/hour to a target of 37.0°C over the next 8 hours (i.e. until 36 hours post cardiac arrest)

a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA
Faculty of Medicine

Vancouver CoastalHealth
Promoting wellness. Ensuring care

Rewarming and fever

- Prevalence up to 42% post CA[1]
- Rebound pyrexia seen in pts treated with TTM and those who were not[1]
- Post CA pyrexia associated with worse neurological outcomes[2]

1.Gebhardt et al Resuscitation 2013; 84: 1062-67

2.Leary et al Resuscitation 2013; 84: 1056-61

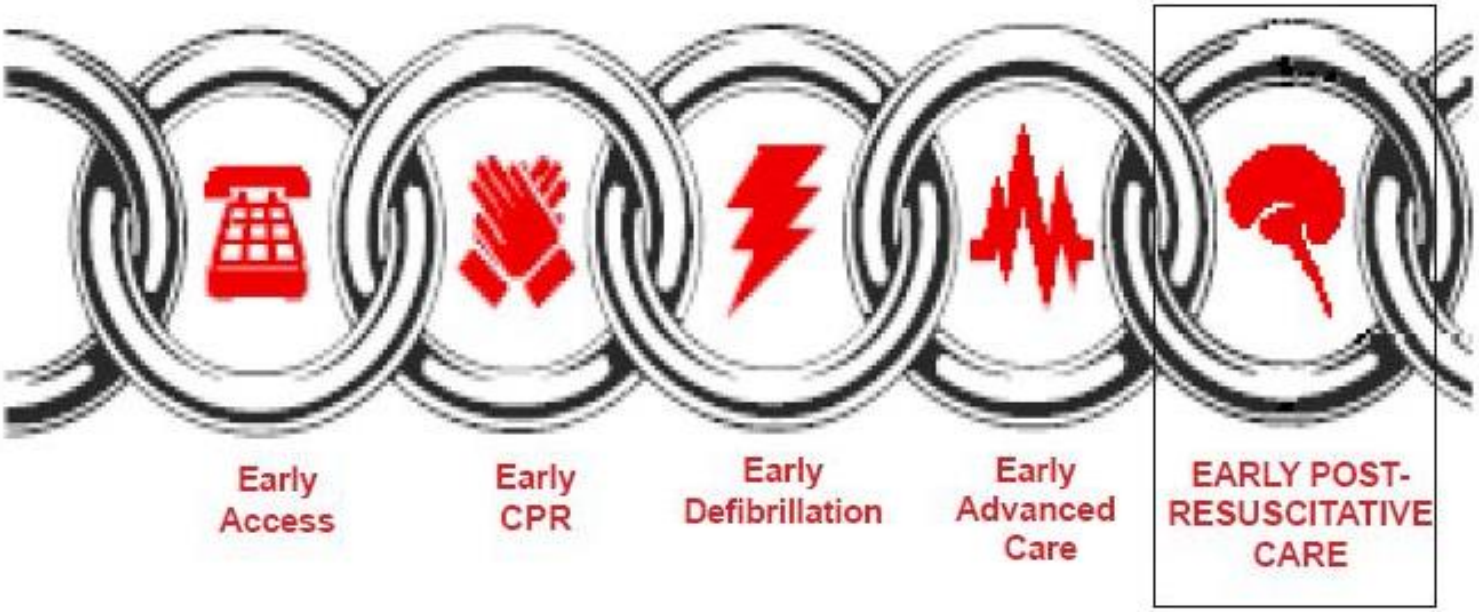
We recommend

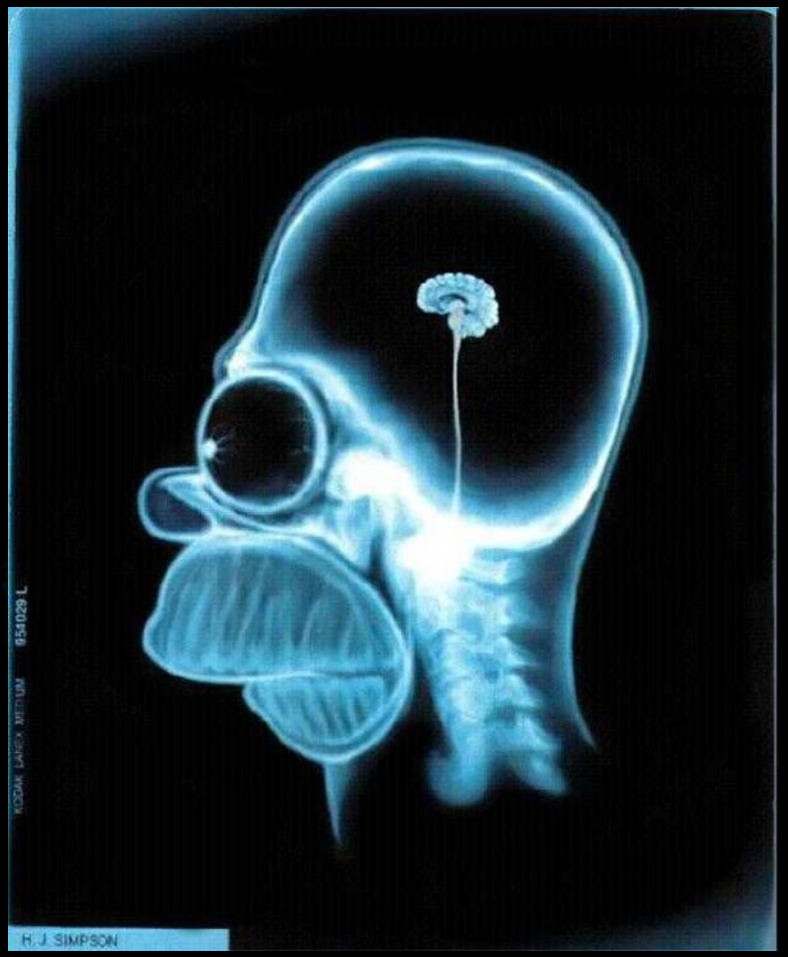
- begin 32-36C for 24 hours by using a cooling device with feedback loop.
- TTM for adult who do not follow commands after ROSC from OHCA with any initial rhythm.
- TTM for adult who do not follow commands after ROSC from IHCA with initial nonshockable rhythm.
- TTM for adult who do not follow commands after ROSC from IHCA with initial shockable rhythm.

Conclusions

- Provide TTM for patients not following commands after cardiac arrest
- Pick a target temperature and stick to it Consider a ‘cushion’ (ie, 35C) to avoid overshooting beyond 36C
- Don’t actively warm patients who are already cooled to within target range
- 4.Once rewarmed, avoid fever unless neurologic recovery has been achieved


Early Access
Early CPR
Early Defibrillation
Early ALS
Early Post Resuscitation Care


Early Access
Early CPR
Early Defibrillation
Early Advanced Care
EARLY POST-RESUSCITATIVE CARE



can expect better OHCA outcomes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به دو عالم ندهم لذت بیماری را

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