Some issues about medical emergency situations

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COMITATO DI BOLOGNA

Dr. Luciano TRENTIN MD - Dr Stefano BADIALI MD

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Course Topics

- **Part one**
  - Forewords: Technical and Non-technical skills
- **Part two**
  - Some medical emergency situations
    - Anaphylaxis
    - Hypothermia and Hypertermia
  - Physical Trauma and Immobilization

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Why these forewords ?

What do you prefer ?

- A (perhaps) boring lecture focused **only** on notions, references and so on
- Some inputs aiming to trigger a method to deal with some medical emergency situations

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Why these forewords ?

Good choice!

During your professional education you will be given notions, data, protocols and so on.

Those are «technical skills» that you have to learn by lectures, books, journals, etc.

Unfortunately, medical profession is not only made by technical skills; you will have to think about «non-technical skills» as well!

Frequently, «non-technical skills» have to be learnt by yourself.

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Let's start our journey through some medical emergency problems

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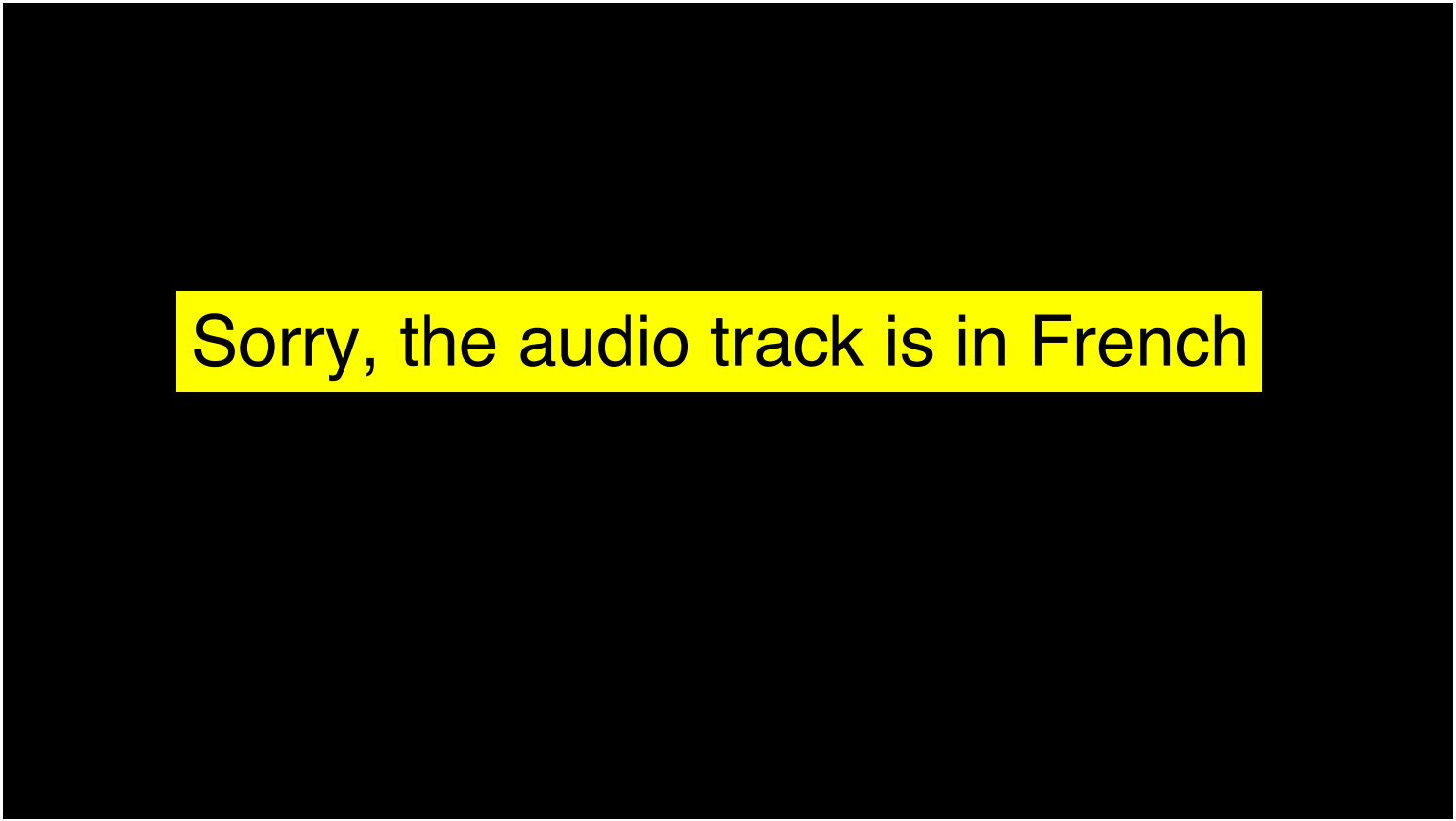
Fasten your seatbelts



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Fasten your seatbelts

Sorry, the audio track and subtitles are in French

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Something is wrong

Sorry, the audio track and subtitles are in French

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Are we attending to the wrong course ?

- You may asked yourself why we started this lecture by showing videos about flying an airliner, how the pilots act within the cockpit and commenting a potential air crash situation.
- Actually, medicine has a lot of similarities with the aeronautical world.
- Like a pilot, you will be asked to make decisions that, if the wrong ones, unfortunately could be catastrophic, either for the patient either for you.
- Furthermore, during the profession, you will perform both **technical skills** (ability to perform manoeuvres) and **non-technical skills** (communication, cross-checking assessment, decision making → remember in the video the go-around decision because an aircraft was crossing the runway).
- It is important that, especially in emergencies, you learn to understand well what you are about to do and to know how to choose.

Burke CS - Team task analysis in: Handbook of human factors and ergonomics methods - London, Taylor & Francis, 2004

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You will always have to decide

What contributes to effective decision-making?

- A good situational awareness;
- High levels of thought organization;
  - definitions of the problem;
  - drawing up a plan;
  - determining the decisions to be taken;
  - determination of the necessary information and resources;
  - determination of available info/resources;
- Shared mental models;
- Effective resource management.

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How to face emergency problems ?

- Priority Assessment
- Monitoring/Cross Checking
- Communication is Important
- Continual Reassessment is Required
- Use all Available Resources and Information
- Avoid Fixation of Goals and Ideas
- Problem Assessment

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How to face with emergency problems ?

Technical skills

- **Theoretical knowledge**
  - Anatomy
  - Phisiology
  - Pathology
  - Pharmacology
- **Ability to perform technical manoeuvres**
  - Surgical procedures
  - Fracture splinting

Usually, this is part of the academic education

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How to face with emergency problems ?

Non-technical skills

- **Communication**
- **Resources management**
  - time
  - available equipment
  - personnel
- **Methods**
  - cross-checking
  - reassessment
- **Situational awareness**

Usually, this is not included within the academic education

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What to look at
How to observe

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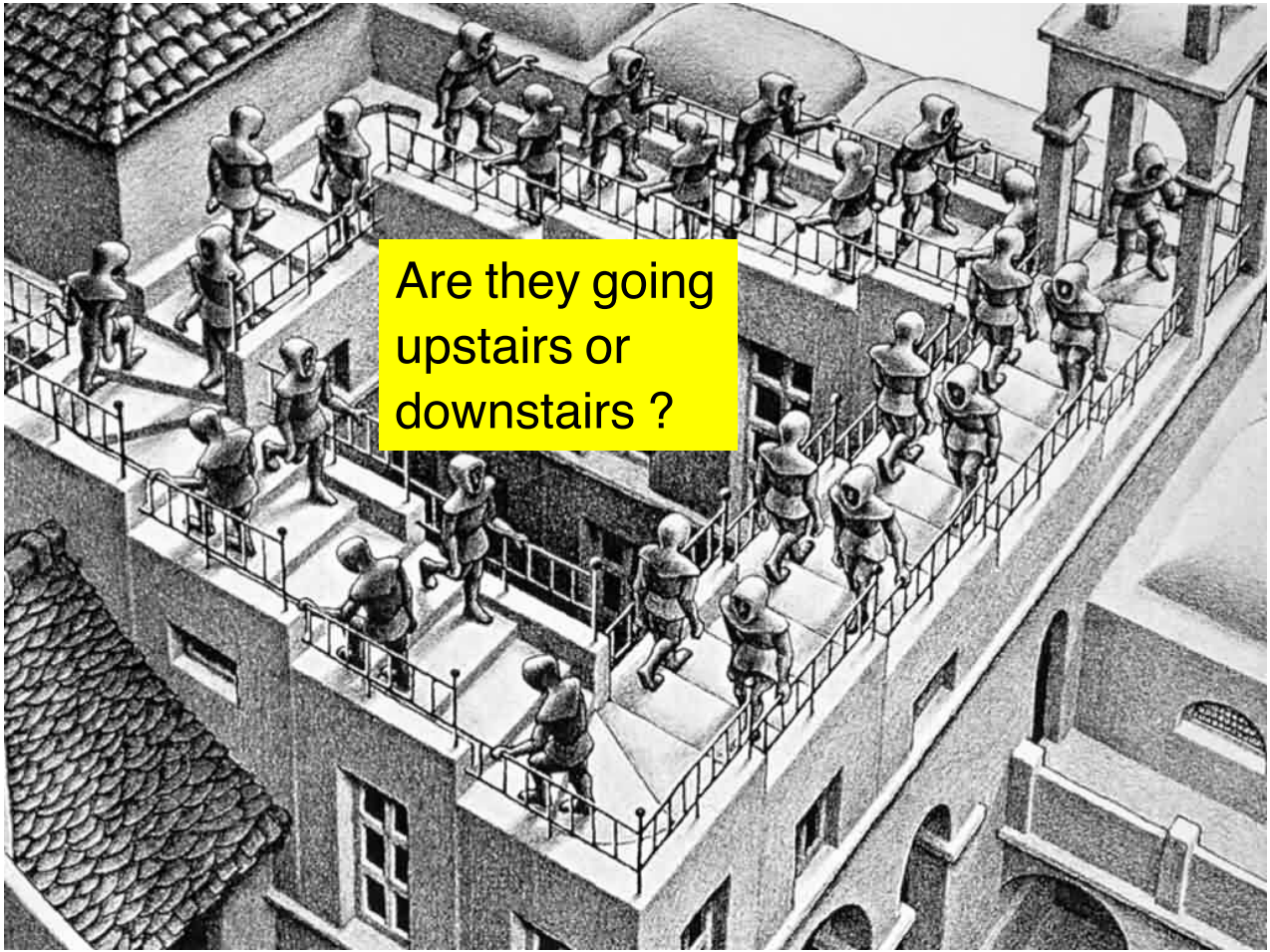
Perception ?



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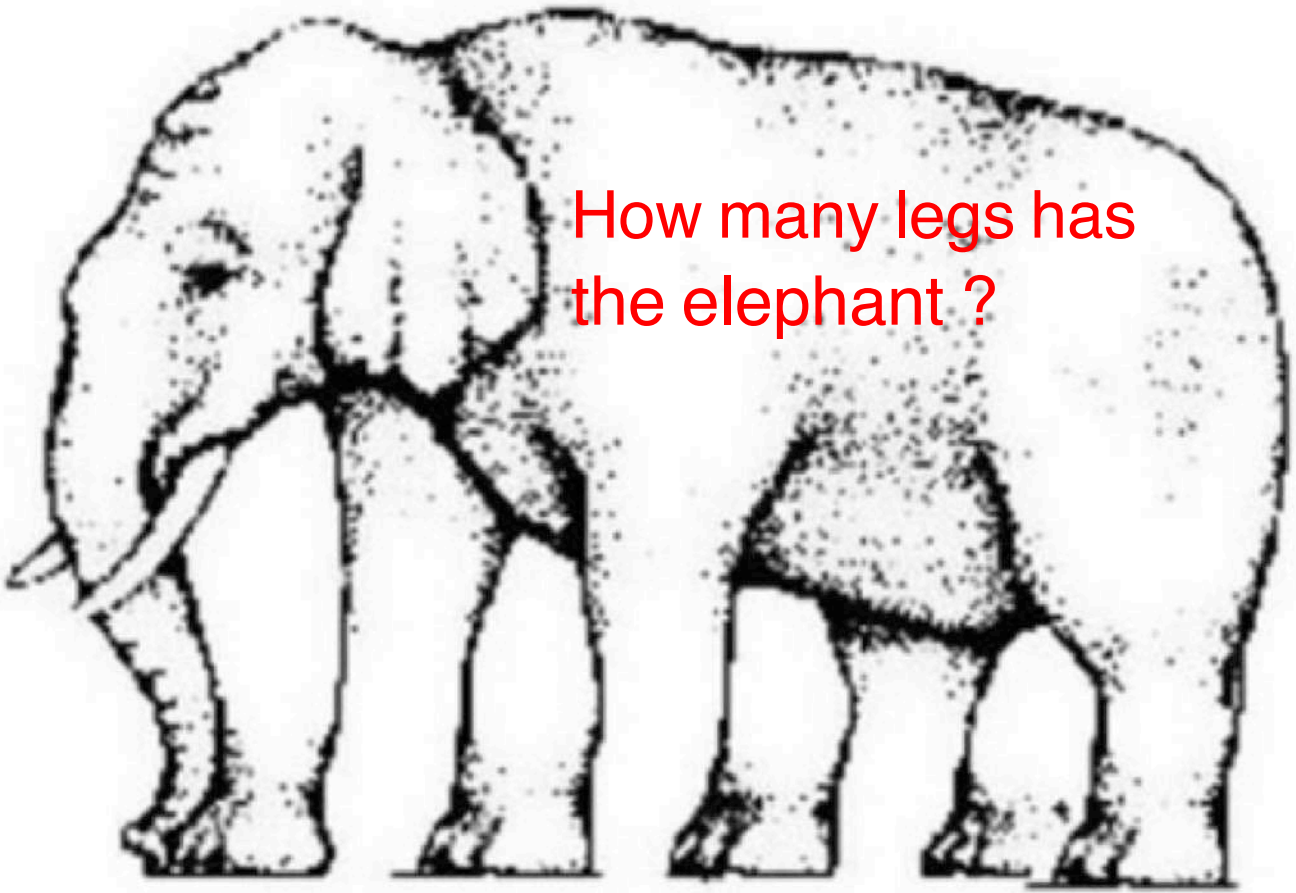
Perception ?



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Perception ?

- How many faces you see?
- How many saxophone players ?
- How many chalices ?

- Man believes more easily true what he prefers to be true.
  Francis Bacon

- What we know influences what we perceive.

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What do you see at a glance? A perception test

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Answer these questions in 30”

Total number of injured

Number of injured able to move

Number of injured laying down

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Answer these questions in 30”

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Answer these questions in 30”

Question	Answer
Total number of injured	10
Number of injured able to move	3
Number of injured laying down	5

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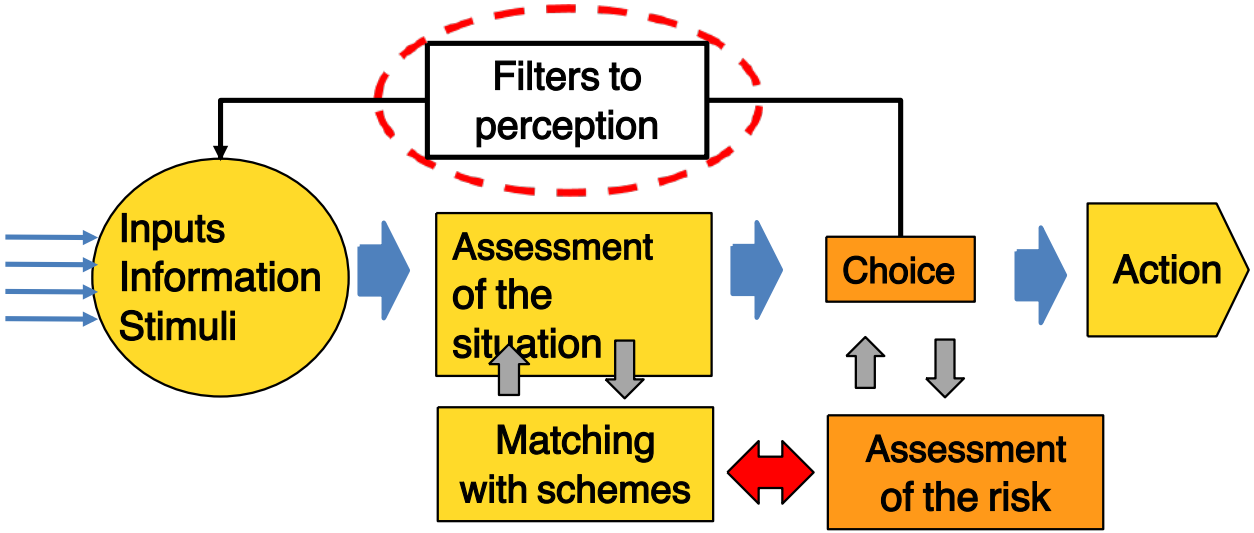
Perception and its filters



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Perception ?

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Eastern flight 401 syntesis

- On December 29, 1972, the flight Eastern 401 departed from JFK at 21:20 with 163+13 on board and was cleared to Miami in accordance with an instrument flight rules flight plan.
- By approaching Miami airport, the landing gear handle was placed in the "down" position during the preparation for landing, and the green light, which would have indicated that the nose landing gear was fully extended and locked, failed to illuminate. The captain recycled the landing gear, but the green light still failed to illuminate.
- Local weather at the time of the accident was clear, with unrestricted visibility. The accident occurred in darkness, and there was no Moon.

- At 23:36:04, the captain instructed the first officer, who was flying the aircraft, to engage the autopilot. The first officer acknowledged.
- At 23:36:27, In order to check the light that did not illuminate, the first officer removed the nose gear light lens assembly, but it jammed when he attempted to replace it.
- At 23:37:08, the captain instructed the second officer to enter the forward electronics bay to check visually the alignment of the nose gear indices.
- From 23:38:56 until 23:41:05, the captain and the first officer discussed the faulty nose gear position light lens assembly and how it might have ben reinserted incorrectly.

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Eastern flight 401 syntesis

- At 23:40:38, a half-second C-chord, indicating a deviation of >250 feet from the selected altitude, counded in the cockpit. No crewmember commented on the C-chord. No correction of altitude was done. The flightcrew and the maintenance specialist did go on discussing the operation of the nose wheelwell light.
- At 23:41:40, the Miami controller noted an altitude reading of 900 feet of the EAL 401 on his radar display. He had no doubt about the safety of the aircraft: momentary deviations in altitude information on the radar display were not uncommon.
- At 23:42:07, the first officer asked, "*We're still at two thousand, rlght?*" and the captain immediately exclaimed, "*Hey, what's happening here?*"
- At 23:42:10, the first of six radio altimeter warning "beep"' sounds began.
- At 23:42:12, the aircraft crashed into the Everglades.

The cause of this accident was the **failure of the flightcrew to monitor the flight instruments** during the final 4 minutes of flight, **and to detect an unexpected descent** soon enough to prevent impact with the ground.
Preoccupation with a malfunction of the nose landing gear position indicating system distracted the crew's attention from the instruments and allowed the descent to go unnoticed.

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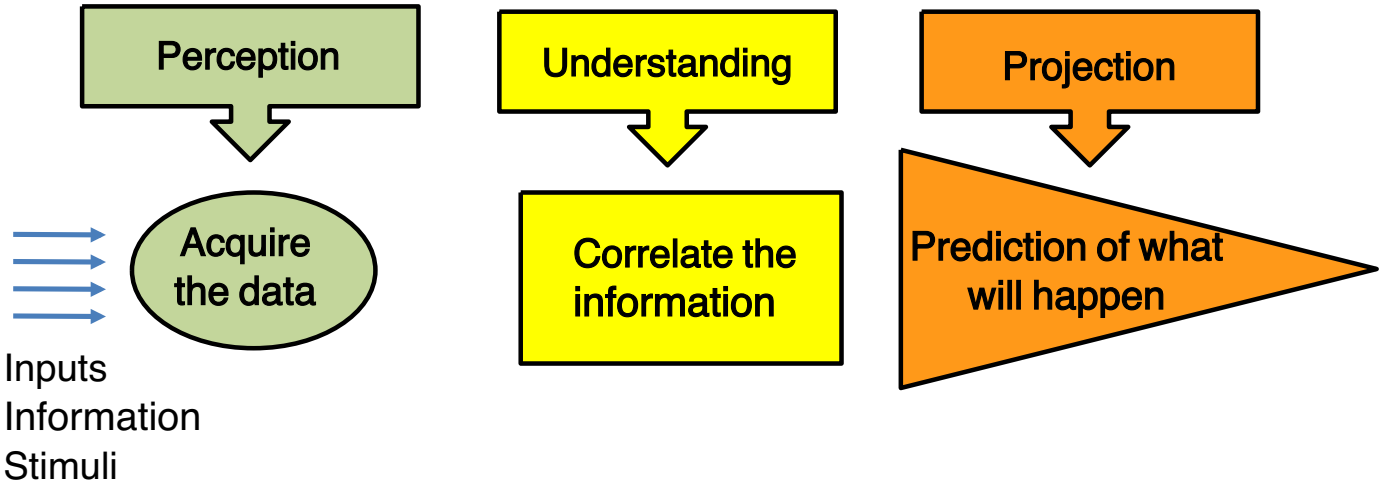
Awareness



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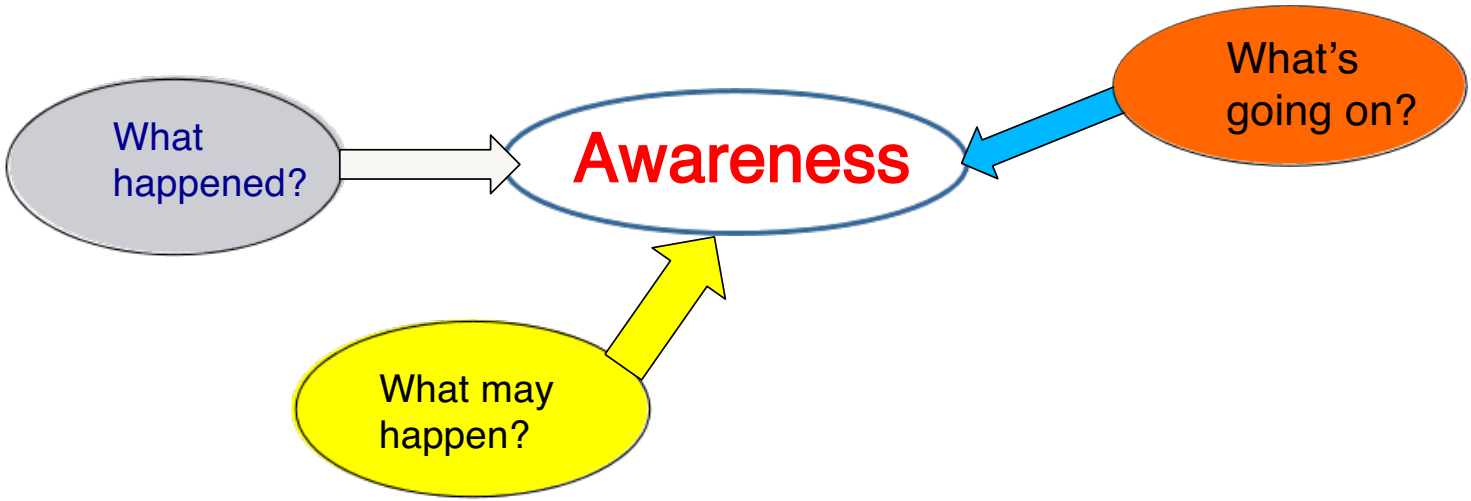
Situational awareness



Endsley MR. *Toward a theory of situation awareness in dynamic systems*. Hum Factors 1995;37:32–64

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Case study

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Case study

- Croatia; July, 24th.
- In order to prevent bush fires, some servicing trains regularly discharge an oily fire retardant along the railways.
- After a while, a passenger train derails in a stretch of railways in strong descent in the middle of a rocky gorge.

- The Rudine derailment was a train derailment that happened on 24 July 2009 at 10:08 GMT near the village of Rudine in southern Croatia, on the Zagreb-Split railway line. The derailment site is located on the slopes of Kozjak. The accident caused the deaths of 6 people, and 55 were injured.

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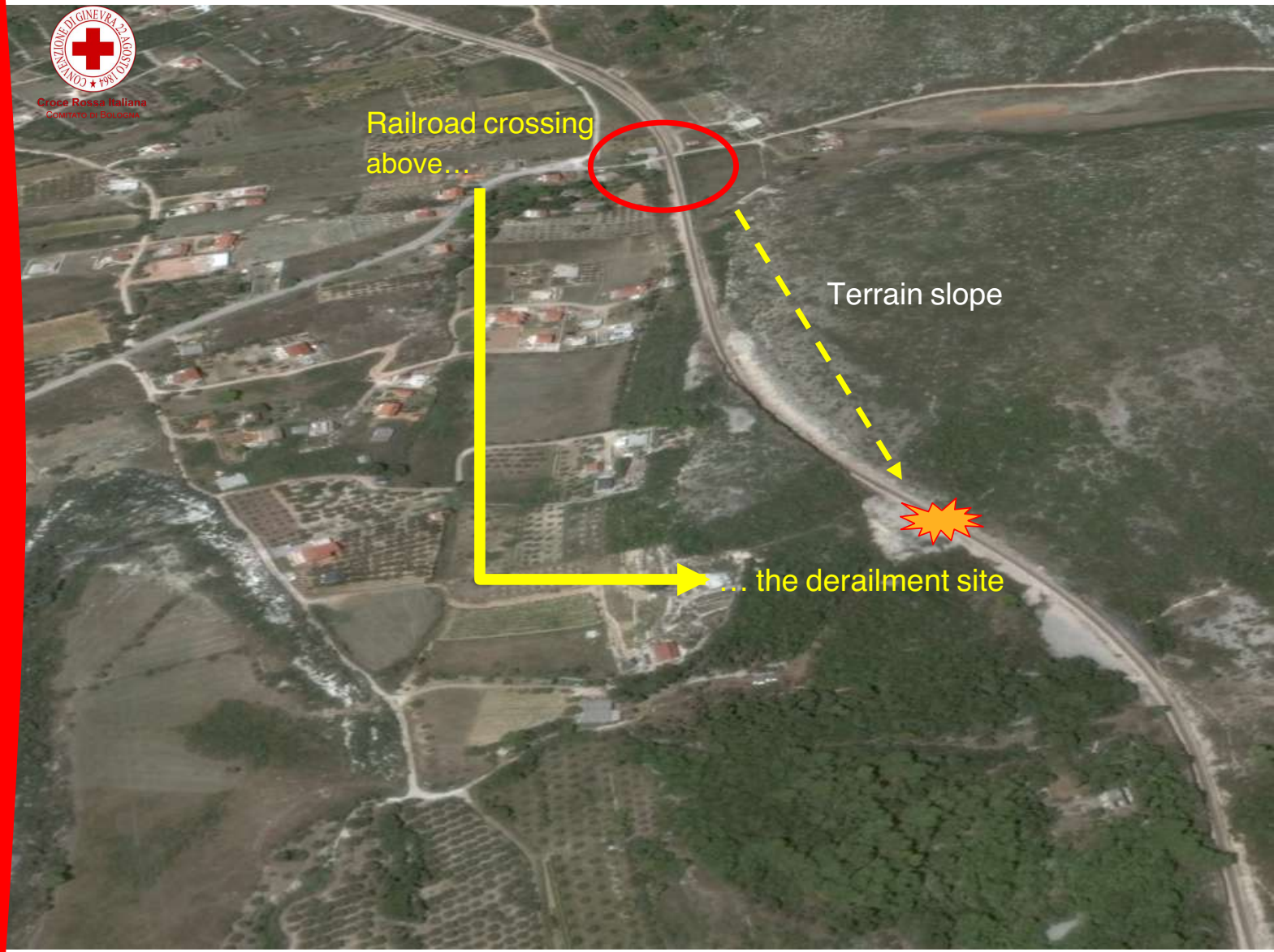
Case study

- Helicopters are unable to land because of the lay of the terrain
- Ambulances can only drop down the crews at a railroad crossing about 470 meters upstream from the accident where the descent begins.
- The same train which few minutes before discharged the fire retardant liquid is dispatched as a rescue train; it stops at the same railroad crossing where the ambulances are parked.


Railroad crossing above…
Terrain slope
… the derailment site

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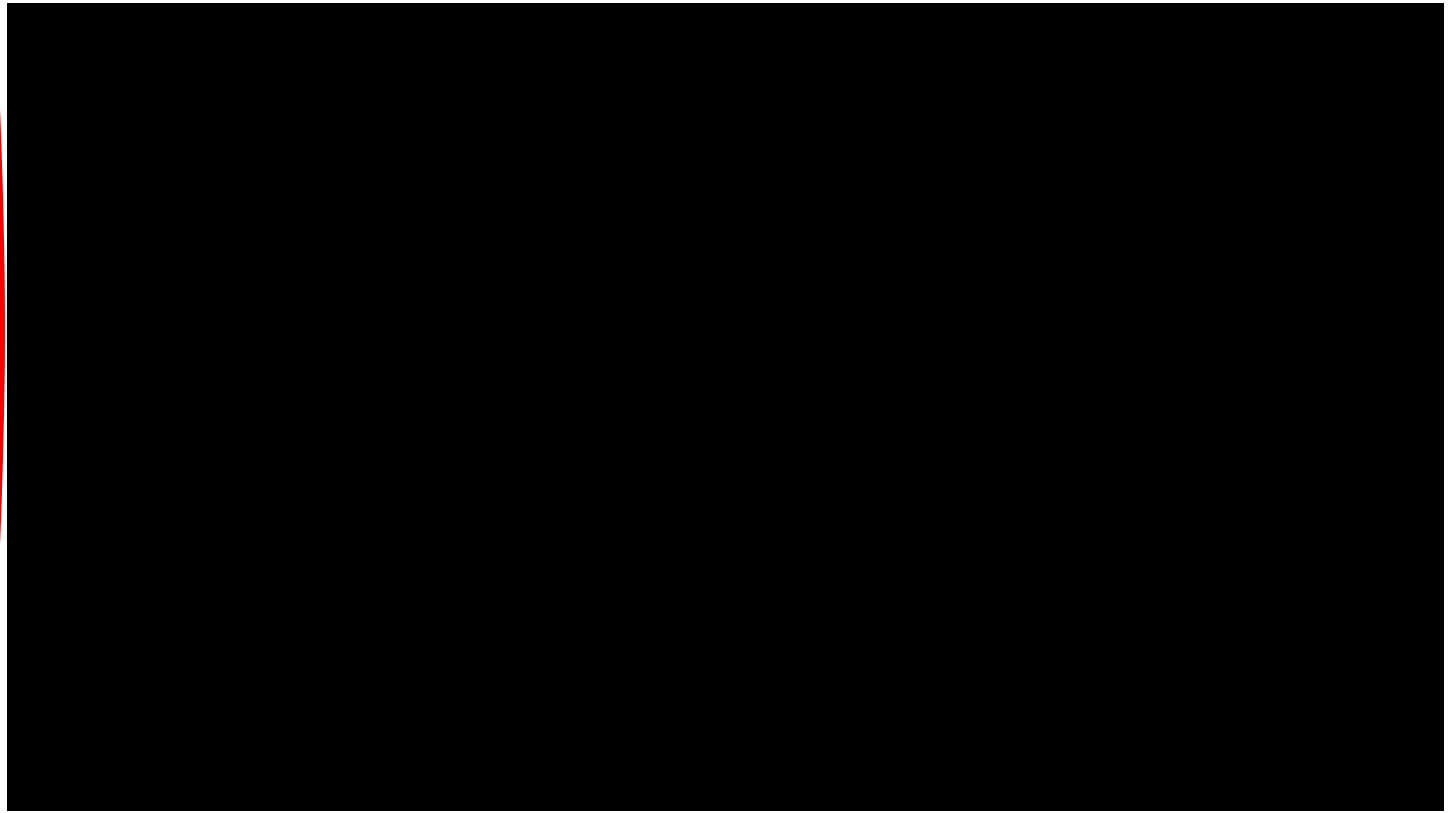
The accident setting



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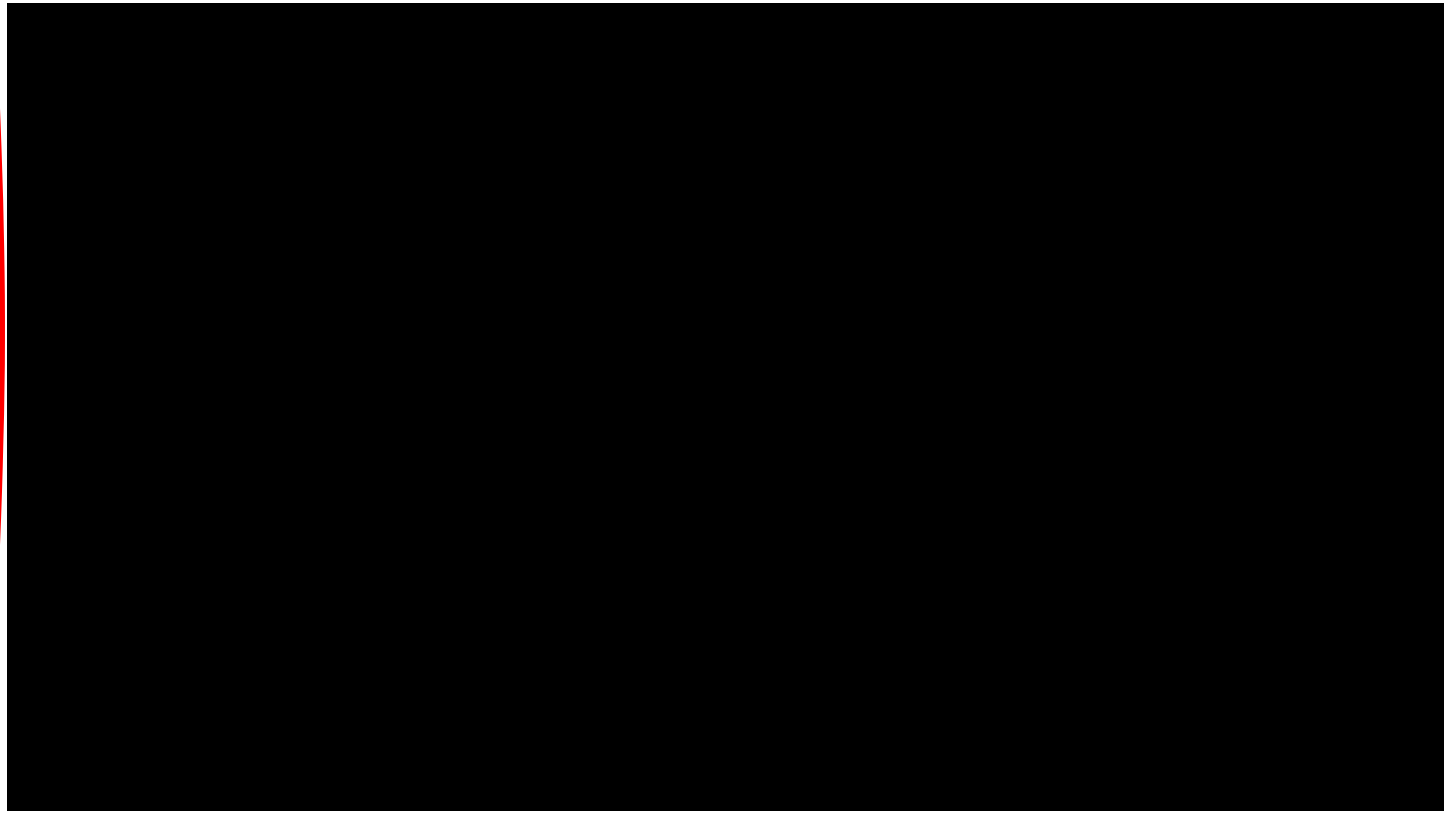
Situational awareness ?



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You will always have to D.E.C.I.D.E.

- **D**etect = realize that the operating framework has changed. What has changed? Why?
- **E**stimate = assess the impact of the change on the operating scenario
- **C**hoose = make a choice for the safety of operations
- **I**dentify = identify the appropriate action and monitor the implementation of the change
- **D**o = put in place the chosen procedure
- **E**valuate = assess the effects and consequences of the intervention

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Problems in maintaining a good Situational Awareness

PERCEPTION Errors in correct perception of what happened	• Data not available • Data difficult to detect or perceive • Data scanning/observation error (omission, distraction, high workload, taskload)
UNDERSTANDING Errors in correctly understanding what's going on	• Data seen but not acquired • Lack of mental models • Using the wrong mental model • Overevaluation of the "standard" mental model
ANTICIPATING Errors in anticipating or forecasting what could happen in the near future	• Poor correlation of perceived data • Lack of models • Use of the "standard" mental model

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Crew Resource Management

Crew resource management (**CRM**) is a set of training procedures for use in environments where human error can have devastating effects. Used primarily for improving aviation safety, given the many similarities with aeronautical world, CRM (now renamed «Crisis Resource Management») has been applied to the medical environment, with the same purposes: to reduce human errors that can have devastating effects.

CRM is mainly focused on «non-technical» skills !

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Crew Resource Management topics

- Situational awareness
  - Receiving, sending, confirming information about team members
  - Maintaining a correct perception of one's role in rapport to the external environment
  - Identifying the problem / problems
  - Early recognizing possible situations requiring reactions
- Decision making
  - Identifying possible solutions to the problem
  - Assessing the consequences for each alternative
  - Choosing the best alternative
  - Collecting the necessary information before deciding
  - Avoiding crystallisation of ideas and objectives

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Crew Resource Management topics

- Mission analysis
  - Monitoring, deploying and coordinating staff and resources team materials
  - Prioritising the tasks
  - Setting objectives
  - Developing plans to achieve them

- Leadership
  - Directing the activities of the team members
  - Monitoring and evaluating team members' performance
  - Motivating the team
  - Communicating mission requirements

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It’s all right ?

Good !

Let’s check.

Look at the next picture and answer a few questions


CONVENZIONE DI GINEVRA 22 AGOSTO 1864
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UD-682785

Look at the picture

Answer these questions

What's going on?

What happened?

Awareness

What may happen?

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Let's take a break!

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Now is the time to look more closely at the patient

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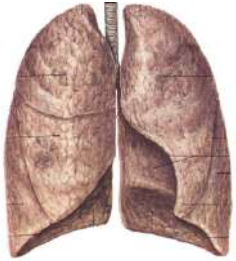
Looking at the patient

VITAL FUNCTIONS

- CONSCIOUSNESS



- BREATHING

- CIRCULATION

Are there any vital function impairment?

YES *NO*

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"ABCD" Method

A = Airway

B = Breathing

C = Circulation

D = Disability

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"A-B-C-D" METHOD IS SUITABLE FOR ALL KIND OF EMERGENCIES

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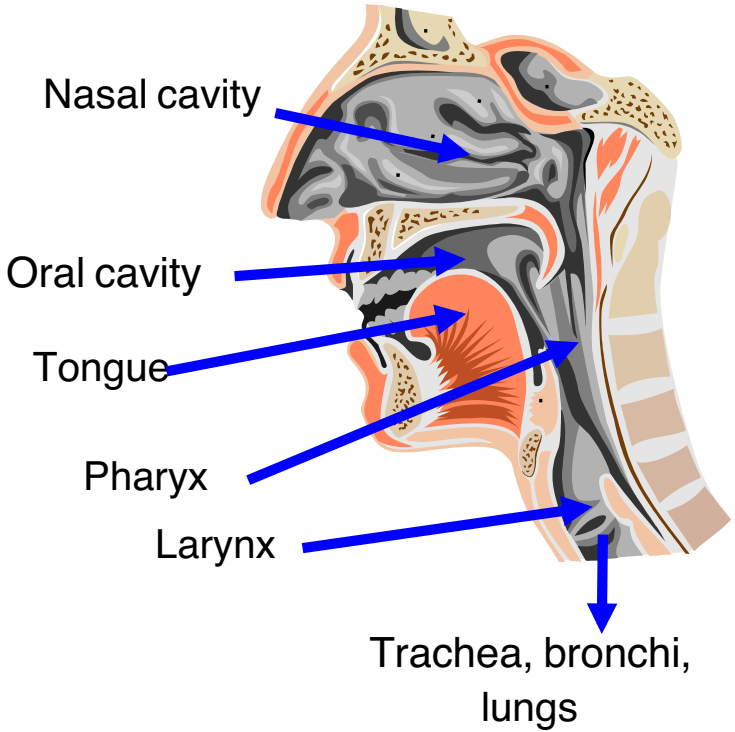
A = Airway patency



Airway patency is granted if the patient is able to speak normally

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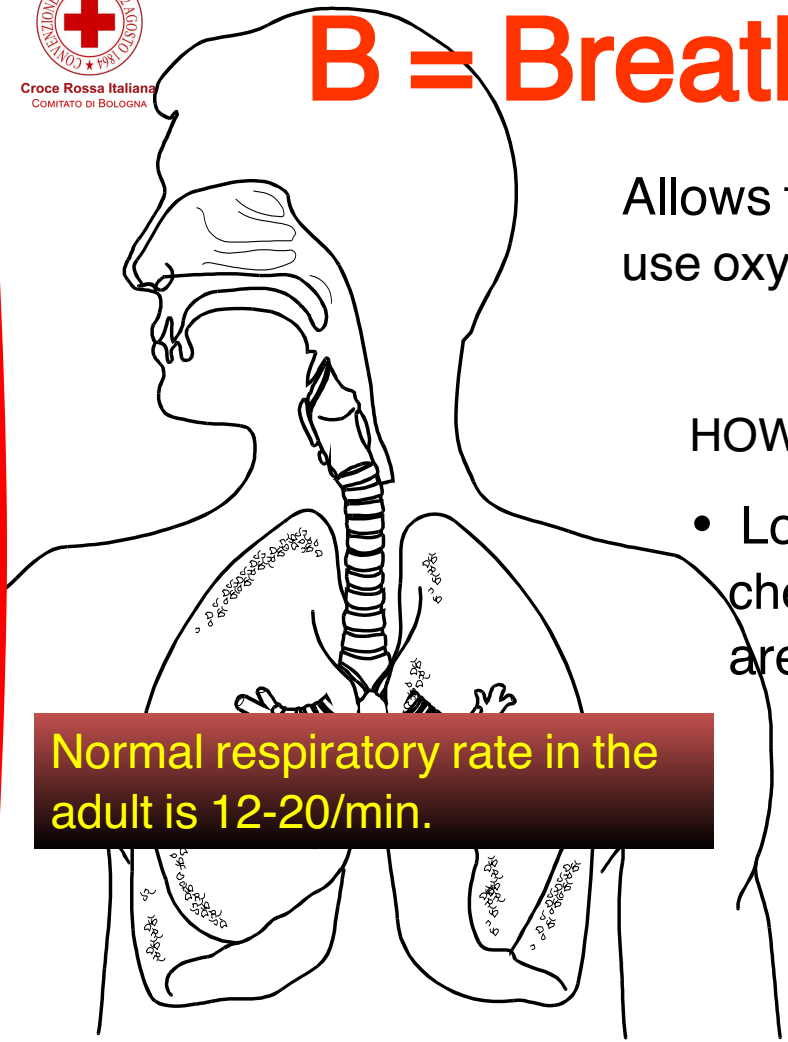
B = Breathing



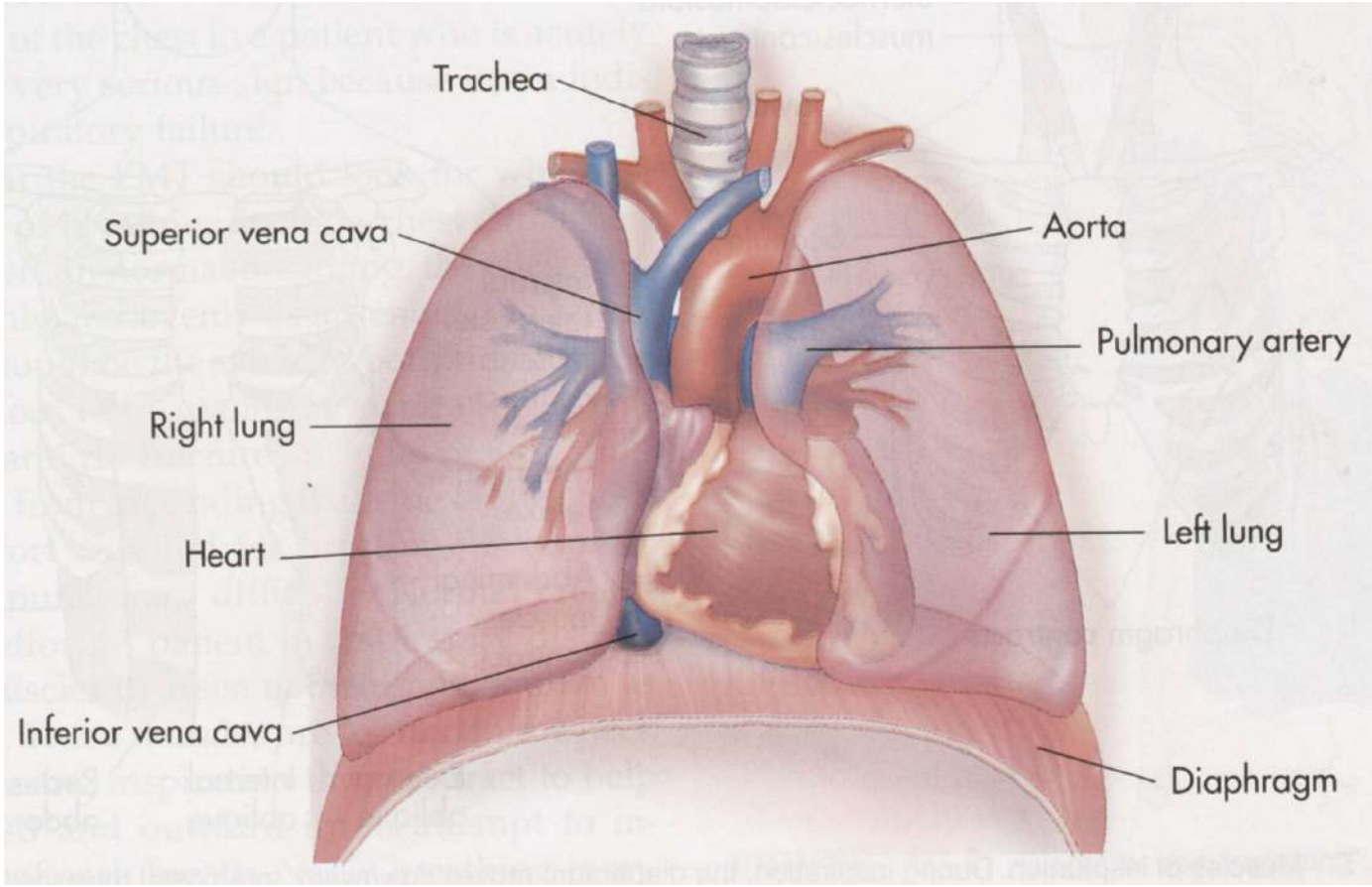
Allows the body either to introduce and use oxygen and dispose carbon dioxyde

HOW TO EVALUATE BREATHING?

- Look at the patient: look at the chest expansion; chest movements are normal or rapid, difficult?

Normal respiratory rate in the adult is 12-20/min.

- Which position did the patient take on?
- Is the patient cyanotic?


Trachea
Superior vena cava
Aorta
Pulmonary artery
Right lung
Heart
Left lung
Inferior vena cava
Diaphragm

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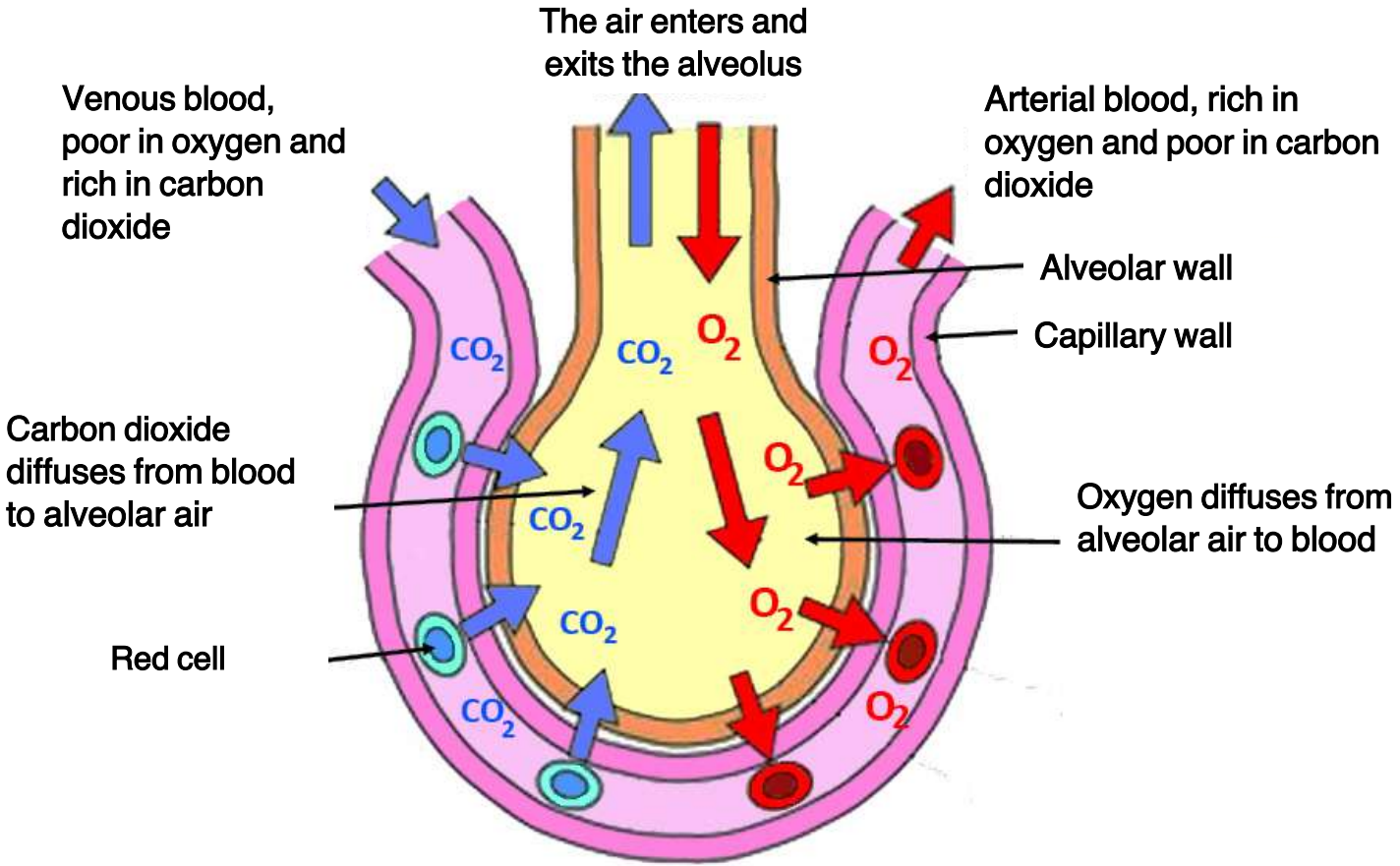
This is the «Respiration»



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This is the «Respiration»

Red blood cells give up carbon dioxide (CO2) in the pulmonary alveoli mainly due to a passive diffusion mechanism, driven by the partial pressure difference of the gases and facilitated by the arrival of oxygen (O2) in the lungs (Haldane effect).
Here are the details of the process:

Pressure gradient (Difference of pCO2): The partial pressure of the (CO2) is higher in venous blood reaching the alveolar capillaries than in air in the alveoli.
The CO2 then naturally diffuses from the blood (high pressure) to the socket (low pressure) to be exhaled.

Haldane Effect (Oxygen Binding): When blood rich in O2 reaches the lungs, hemoglobin binds to the newly inspired oxygen. Oxygenated hemoglobin (oxyhemoglobin) has a lower affinity for the CO2 and tends to release it. Furthermore, binding to oxygen promotes the release of hydrogen ions (H+), which help convert bicarbonates into CO2

.

Carbonic Anhydrase Conversion: Most of the CO2 travels in the blood in the form of bicarbonate ions (HCO3-). In the alveoli, bicarbonates re-enter red blood cells, bind to ions H+ freed from hemoglobin and, thanks to the enzyme carbonic anhydrase, are converted back into CO2 and H2O. This free CO2, then spreads into the alveolus.

In short, blood "discharges" the CO2 because in the alveoli its pressure is lower and because the inhaled oxygen "hunts" away the CO2 from hemoglobin

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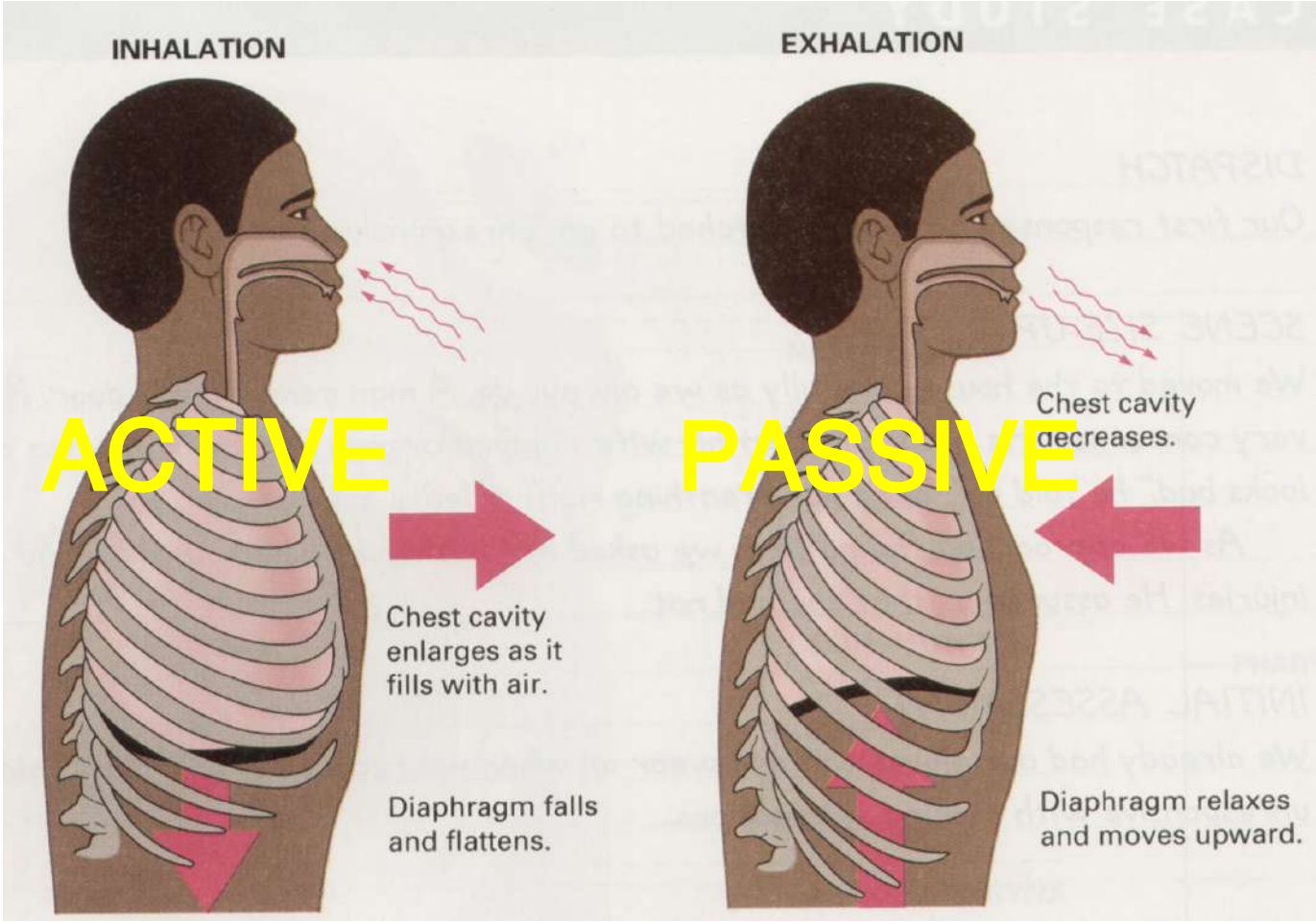
This is the «Ventilation»



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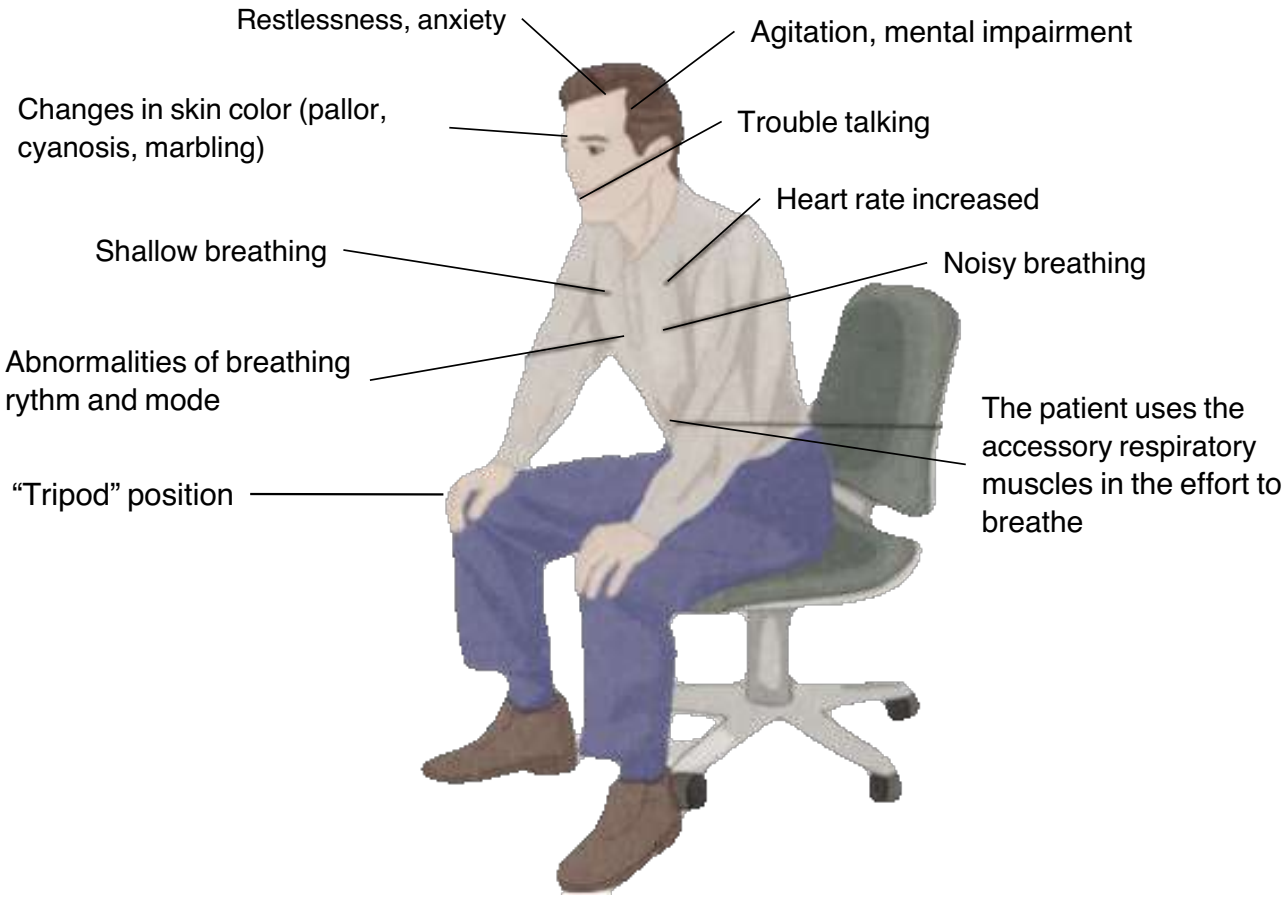
Dyspnea signs

Dyspnea (= laboured breathing)



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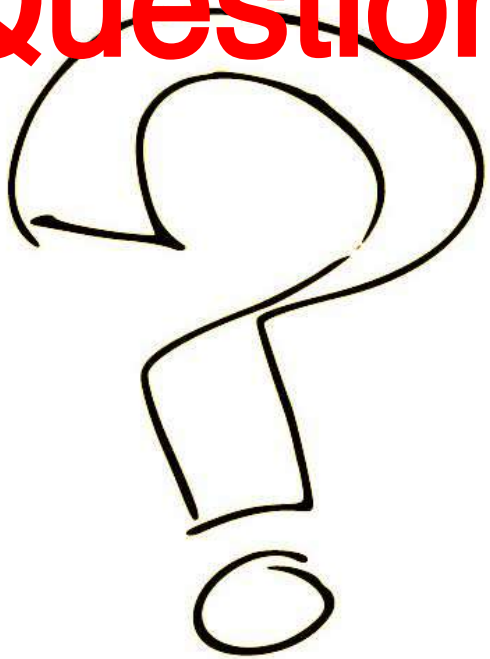
Questions



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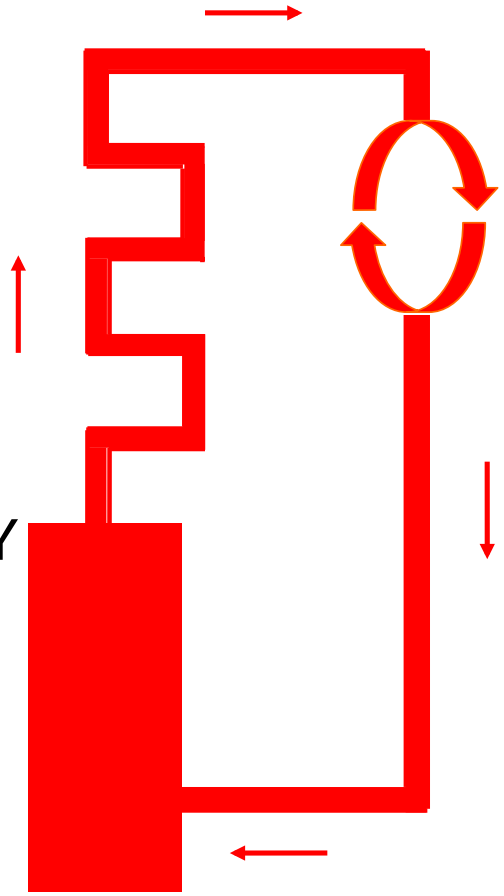
C = Circulation

Think to the heart-vessels-blood system as a heating/cooling plant made by:

- a pump, this is to say the HEART
- a pipeline (ARTERIES/VEINS) connected to radiators (CAPILLARY BED)
- a liquid carrier, this is to say the BLOOD



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C = Circulation

HOW TO CHECK IT ?

In a conscious patient

RADIAL PULSE

- use fingertips of 2nd, 3rd and 4th fingers
- if present, SBP > 80 mmHg

In a unconscious patient

CAROTIDEAL PULSE

- if present, SBP > 50 mmHg

SBP = Systolic Blood Pressure

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Normal values

AGE RELATED VITAL PARAMETERS

	Heart Rate (bpm)	Systolic Blood Pressure (mmHg)	Respiratory Rate (bpm)
Newborn, baby	160	70-80	40
Child until 6 years	120	80-90	30
Teenager	100	100	20
Adult	60-100	100-150	12-20

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Shock
(bare bones)

Stefano Badiali

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Shock mechanism

Remember:

Think to the heart-vessels-blood system as a heating/cooling plant made by:

- a pump, this is to say the HEART
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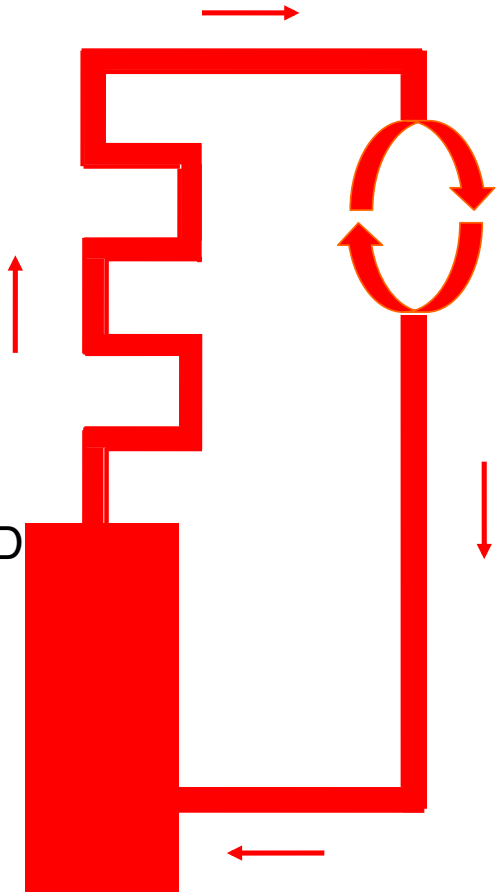

A sudden, unbalanced failure of one of such parts leads to a SHOCK

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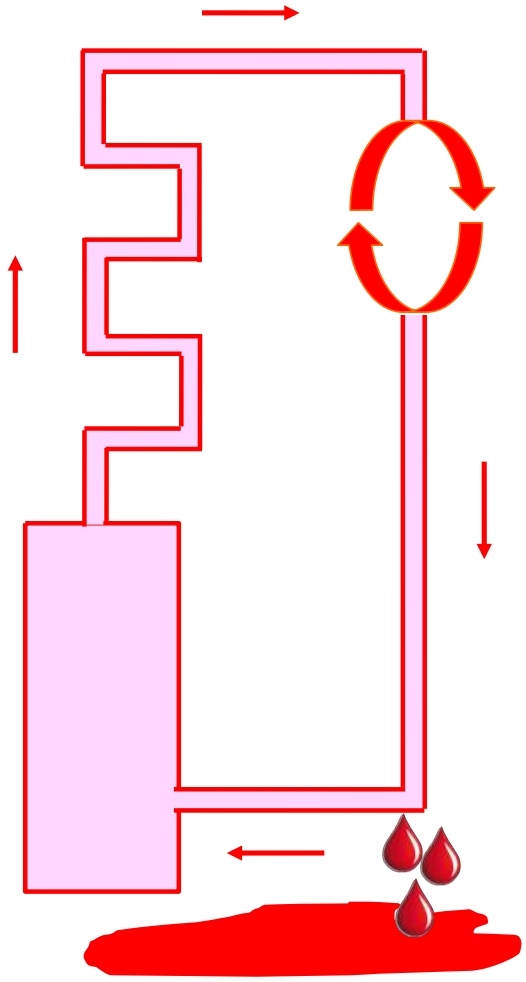
Hypovolemic Shock

Loss of liquids (not only blood !)

- Massive hemorrage
- Wide burns
- Persistent vomiting
- Profuse diarrhoea
- Heavy sweating
- Diuretic drugs abuse



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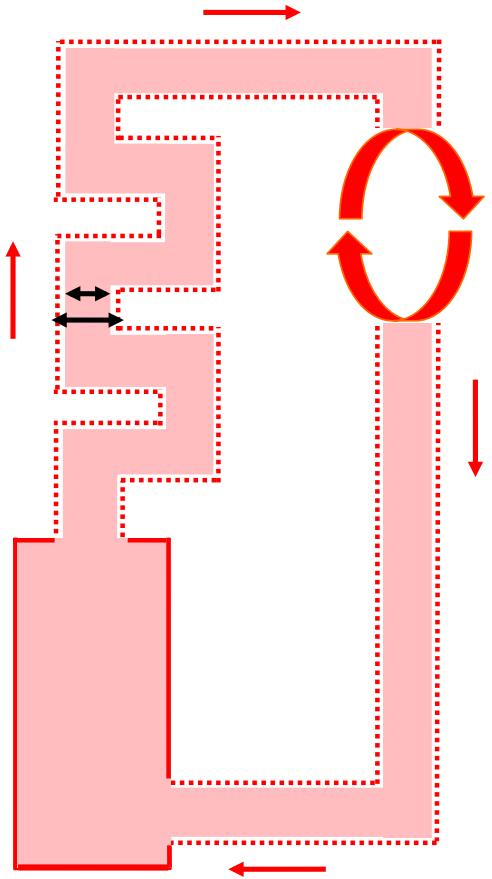
Vasoplegic Shock

Rise of blood vessels diameter

- Spinal cord injuries
- Poisoning
- Allergic reactions
- Serious infections



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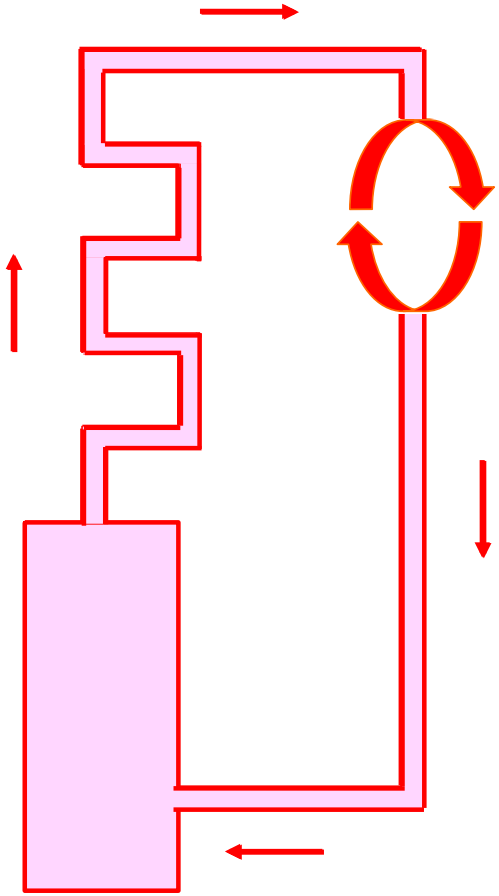
Cardiogenic Shock

Decrease of the heart's
contractile energy

- Myocardial infarction
- Acute vessel obstruction (embolism)
- Severe arrythmias
- Poisoning



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Signs of Shock

- Blood pressure fall
- Rapid and shallow breathing
- Pallor, sweating
- Radial pulse rapid and shallow
- Agitation first, then drowsiness
- Chill
- Severe, persistent thirst

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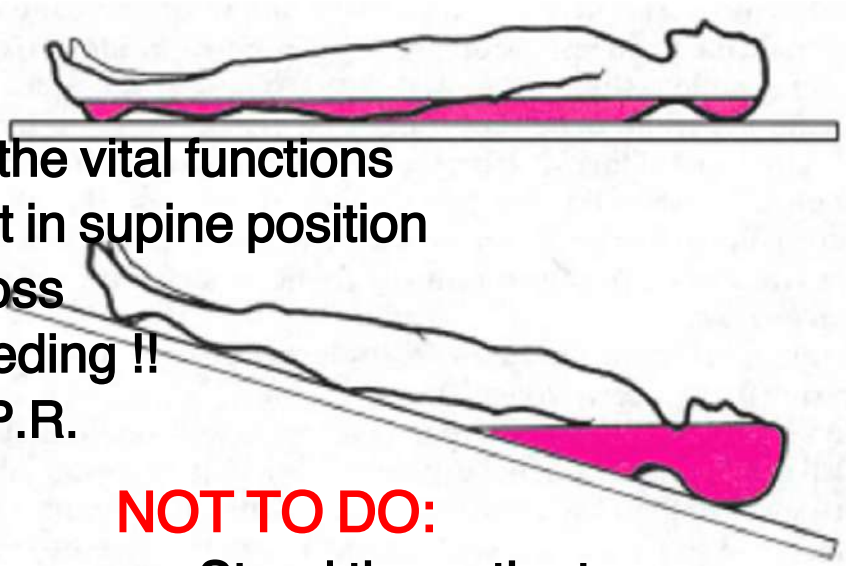
Dealing with Shock (all kinds)

The essentials, even without equipment or drugs



TO DO:

- Continuously check the vital functions
- Lay down the patient in supine position
- Protect from warm loss
- Stop/reduce the bleeding !!
- Get ready to start C.P.R.

NOT TO DO:

- Stand the patient
- Give drinks

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The management of airway patency, breathing and bleeding control problems **MUST** be done as soon the problem arises !!!

Find the killer in A – B - C

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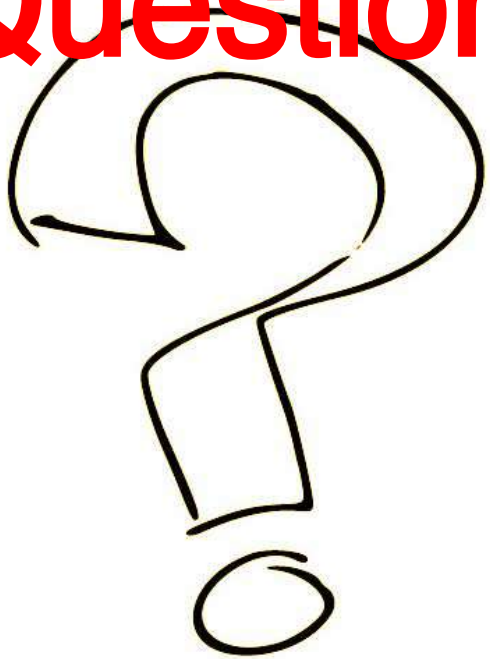
Questions



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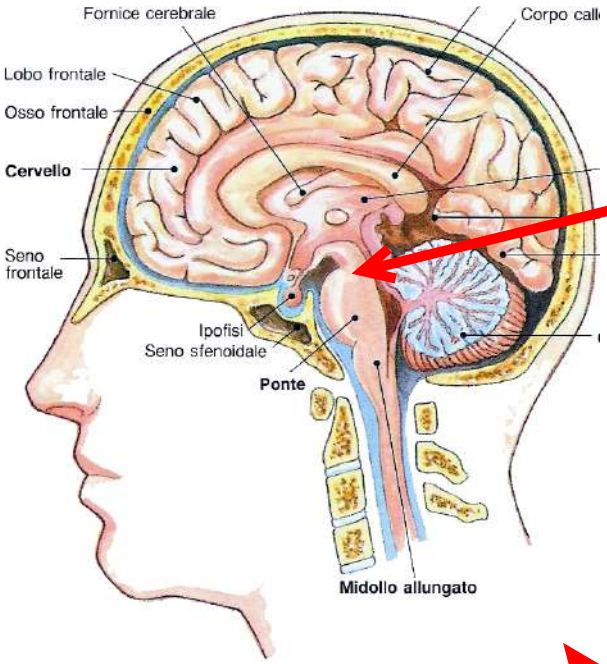
D = Disability



The brain regulates all the body activities, including metabolism

Deep in the brain there is the brainstem regolulating the automatic activity of breathing and circulation

Unfortunately, the brain is enclosed within a rigid skull that serves to protect him but can turn into a fatal prison if:

- inside it a bleeding happens
- the brain tissue "swells" because blood arrives with little pressure and/or poor in oxygen

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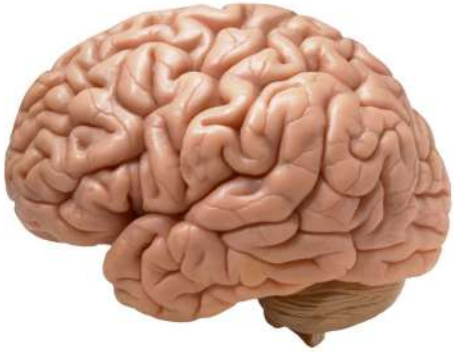
D = Disability



If the brain is so important,
why «D = Disability» is at the fourth step
within the «A-B-C-D» method ?

REMEMBER !

Unfortunately, the brain is enclosed within a rigid skull that serves to protect him but can turn into a fatal prison if:

- inside it a bleeding happens
- the brain tissue "swells" because blood arrives with little pressure and/or poor in oxygen

In order to protect the brain, you MUST first warrant a good oxygenation (steps «A+B») AND a good blood pressure (step «C») !!

Otherwise your efforts in resuscitating a patient are likely to produce only an organ donor

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Evaluating consciousness

Alert

- Awake, answers your questions and speaks normally

Verbal

- Drowsy, but able to react if called

Pain

- Drowsy, reacts ONLY if given a standard painful stimulus

Unresponsive

- Does not react to any kind of stimulus

Notice: This is a simplified scale, mainly used by rescuers. Professionals use the Glasgow Coma Scale (GCS)

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Evaluating consciousness

Pain

Key Pain Stimulus

Methods

- Sternal Rub: Rubbing knuckles firmly on the patient's sternum (center chest).
- Trapezius Squeeze: Gripping and squeezing the trapezius muscle at the shoulder.
- Supraorbital Pressure: Applying pressure with a thumb to the ridge below the eyebrow.
- Nail Bed Pressure: Applying pressure to the fingernail bed with a pen or similar object

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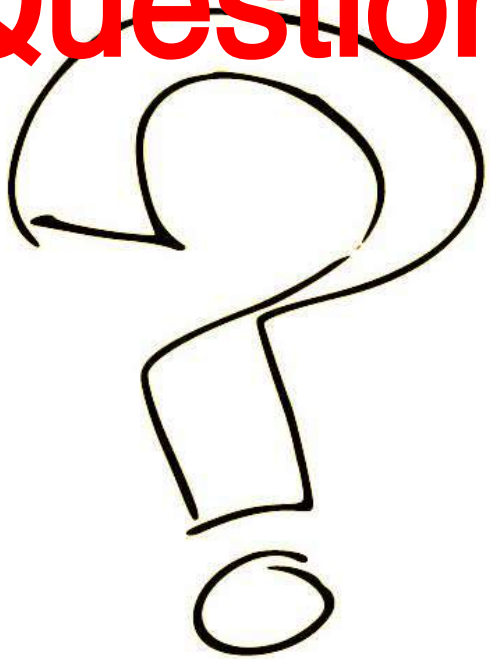
Questions



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In the previous episode…

You will always have to decide

What contributes to effective decision-making?

- A good situational awareness;
- High levels of thought organization;
  - definitions of the problem;
  - drawing up a plan;
  - determining the decisions to be taken;
  - determination of the necessary information and resources;
  - determination of available info/resources;
- Shared mental models;
- Effective resource management.

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In the previous episode…

How to face emergency problems ?

- Priority Assessment
- Monitoring/Cross Checking
- Communication Is Important
- Continual Reassessment Is Required
- Use All Available Resources and Information
- Avoid Fixation Of Goals And Ideas
- Problem Assessment

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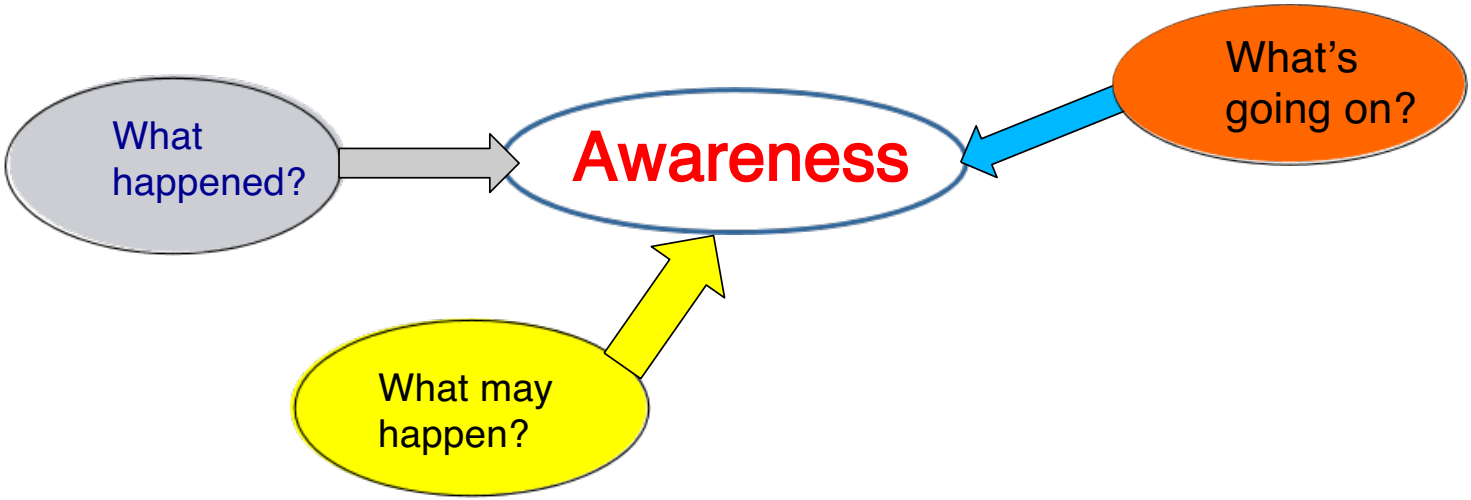
In the previous episode…

Situational awareness



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In the previous episode…

"A-B-C-D" METHOD IS SUITABLE FOR ALL KIND OF EMERGENCIES

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Some emergency problems

- Clinical features
- Case study, focused on situational awareness:
  - What happened (according to A-B-C-D check list)
  - What's going on (again, according to A-B-C-D check list)
  - What may happen (even according to A-B-C-D check list)

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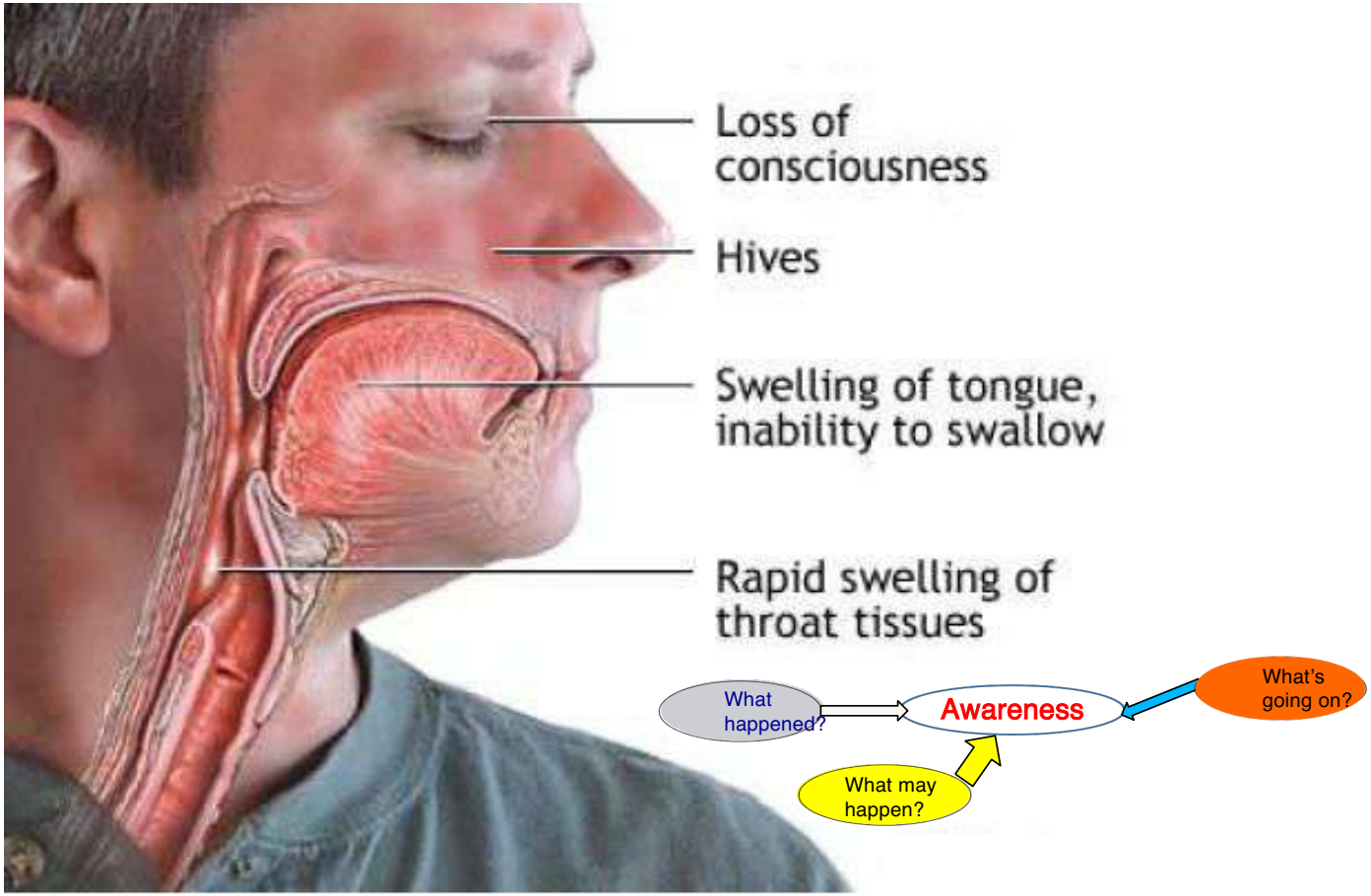
Anaphyilaxis



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Anaphyilaxis

Anaphylaxis is an **acute**, potentially **fatal**, **multiorgan** system reaction caused by the release of chemical mediators from mast cells and basophils. The classic form involves prior sensitization to an allergen with later re-exposure, producing symptoms via an immunologic mechanism.

Symptoms and findings :

- Patients are commonly restless and anxious, agitated and/or combative Why ?
- **Dermatologic/ocular:** Flushing, urticaria (ie: hives), angioedema, cutaneous and/or conjunctival injection or pruritus, warmth, and swelling
- **Respiratory:** Nasal congestion, rhinorrhea, sneezing, throat tightness, wheezing, shortness of breath, cough, hoarseness, dyspnea, severe angioedema of the tongue and lips, tachypnea, stridor or severe air hunger, loss of voice, hoarseness, and/or dysphonia
- **Cardiovascular:** Dizziness, weakness, chest pain, palpitations, tachycardia, hypotension; cardiovascular collapse and shock can occur immediately, without any other findings
- **Gastrointestinal:** Dysphagia, nausea, vomiting, diarrhea, bloating, cramps
- **Neurologic:** Headache, dizziness, blurred vision, and seizure; altered mentation
- **Other:** Metallic taste, feeling of impending doom

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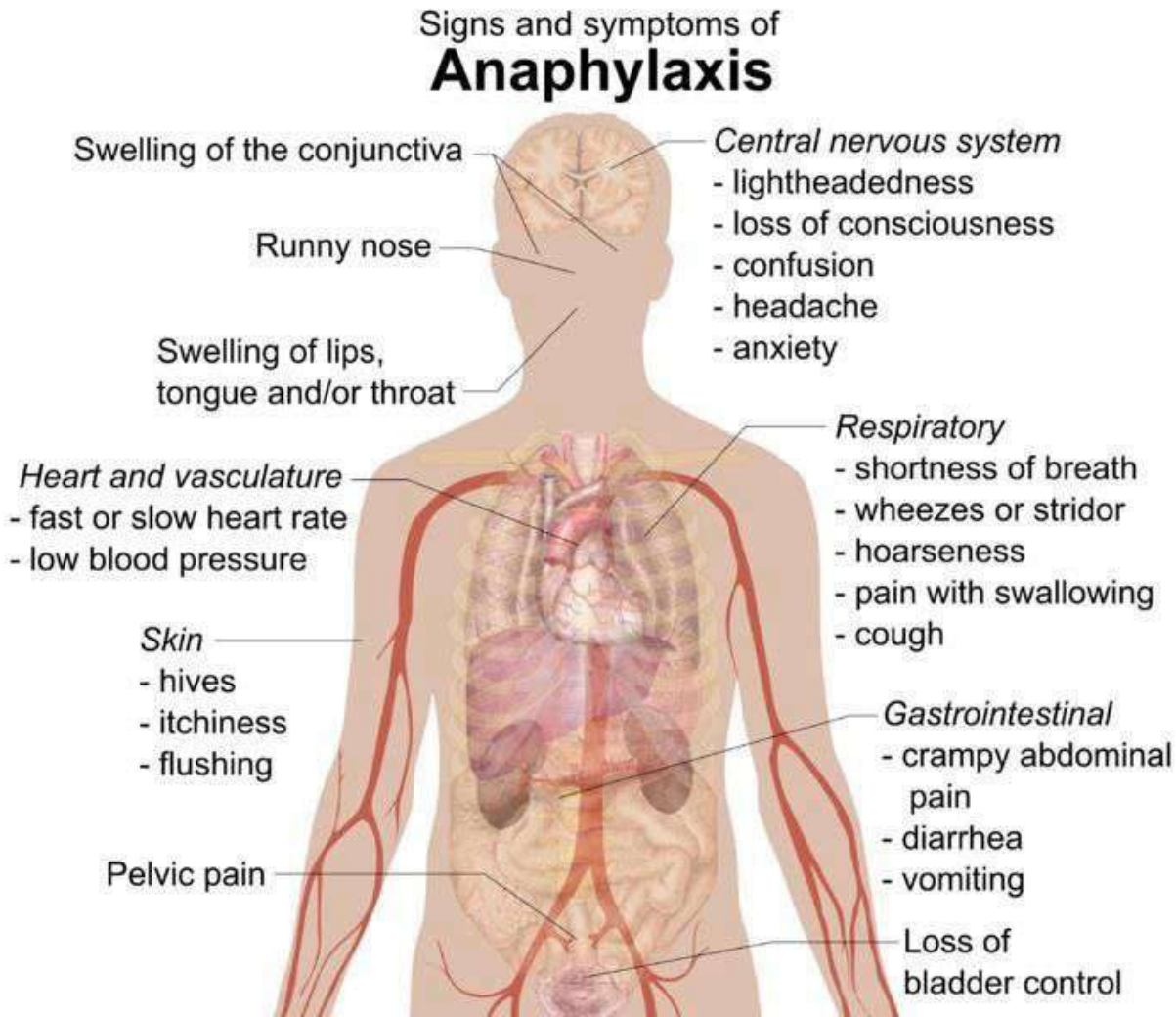
Anaphyilaxis



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Anaphyilaxis

Anaphylaxis is a medical emergency that requires immediate recognition and intervention.

Prehospital patients with symptoms of severe anaphylaxis should first receive standard interventions including high-flow oxygen, cardiac monitoring, and intravenous (IV) access.

Supportive care for patients with suspected anaphylaxis includes :

- Airway management (e.g. ventilator support with bag/valve/mask, endotracheal intubation, Supraglottic Airway Devices as I-Gel or Laryngeal Mask; in extreme circumstances, cricothyrotomy or catheter jet ventilation may be lifesaving when orotracheal intubation or bag/valve/mask ventilation is not effective)

Remember: A-B-C-D !!

- High-flow oxygen
- Cardiac monitoring and/or pulse oximetry
- Intravenous access (large bore)
- Fluid resuscitation with isotonic crystalloid solution
- Supine position (or position of comfort if dyspneic or vomiting) with legs elevated

Why ?

Posture. In a retrospective review of prehospital anaphylactic fatalities in the United Kingdom, the postural history was known for 10 individuals. Four of the 10 fatalities were associated with the assumption of an upright or sitting posture during anaphylaxis. Postmortem findings were consistent with an “empty heart” attributed to reduced venous return from vasodilation and redistribution of intravascular volume from the central to the peripheral compartment.

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Anaphyilaxis

The physiologic responses to the release of anaphylaxis mediators include smooth muscle spasm in the respiratory and gastrointestinal (GI) tracts, vasodilation, increased vascular permeability, and stimulation of sensory nerve endings.
Cardiovascular effects result from **decreased vascular tone and capillary leakage**. Hypotension, cardiac arrhythmias, syncope, and shock can result from intravascular volume loss, vasodilation, and myocardial dysfunction. Increased vascular permeability can produce a shift of 35% of vascular volume to the extravascular space within 10 minutes.

Does it remind you something ?

The primary drug treatments for acute anaphylactic reactions are epinephrine and H1 antihistamines

- **Epinephrine is the drug of choice** for treating anaphylaxis
- Antihistamines have a much slower onset of action than epinephrine, they exert minimal effect on blood pressure, and they should not be administered alone as treatment
- Corticosteroids have no immediate effect on anaphylaxis. Corticosteroids have a delayed onset of action and do not reverse the cardiovascular effects of anaphylaxis

Because hypotension in anaphylaxis is due to a dramatic shift of intravascular volume, the fundamental treatment intervention **after epinephrine** is aggressive IV fluid administration

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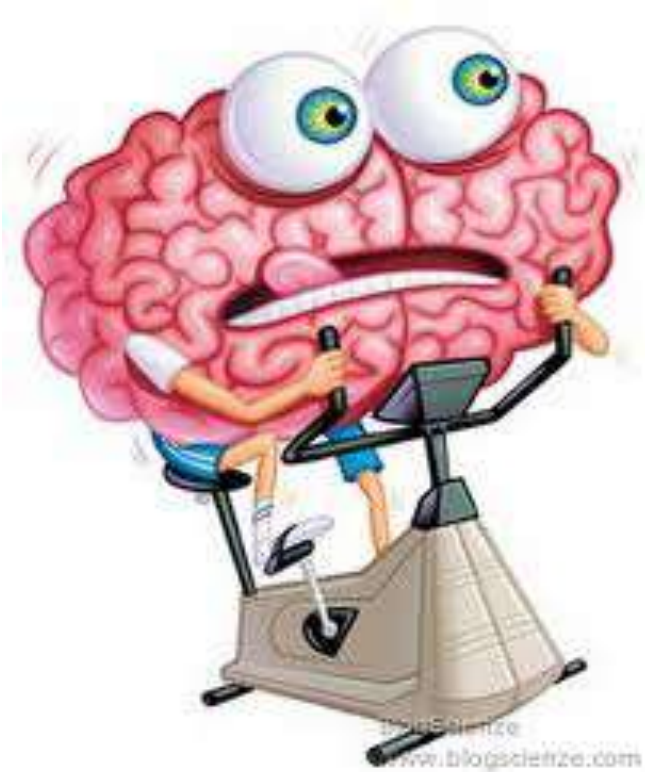

Some mental training …

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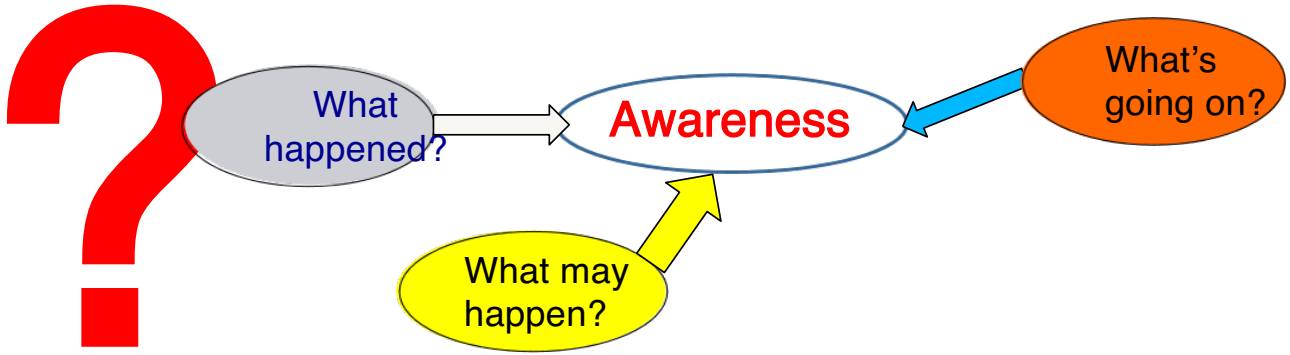
John, 25 years old, farmer; has been stung by several bees some 10 minutes ago. He complains of pruritus, swollen lips and mild dyspnea. He has troubles in speaking. Radial pulse is very weak and rapid. He is pale.



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John, anaphylactic shock

What happened?

Young farmer stung by several bees few minutes ago

What's going on?

ABCD check-list

A. Airways: partially obstructed
B. Breathing: mild (for the moment!) dyspnea
C. Circulation: radial pulse weak, rapid
D. Disability: alert (until now!)

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John, anaphylactic shock

What may happen?

ABCD check-list

A. Airways:
B. Breathing:
C. Circulation:
D. Disability:

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John, anaphylactic shock

What may happen?

ABCD check-list

A. Airways: complete obstruction
B. Breathing: respiratory arrest
C. Circulation: SHOCK, cardiac arrest
D. Disability: deep coma

- What to do ? (unfortunately, you have no equipment or drugs)
  - Supine position
  - DON'T give drinks
  - Continuously check the vital functions
  - If **he gets unconsciuos,** IMMEDIATELY start C.P.R.

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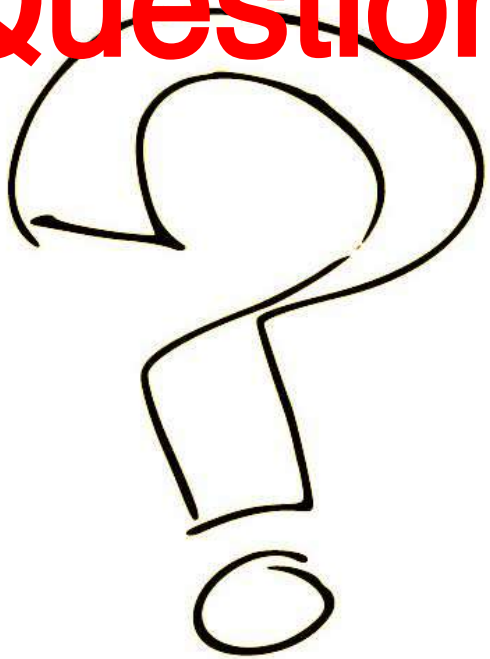
Questions



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Thermal injuries

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Burns

A systemic injury

- Tissue burn involves direct coagulation and microvascular reactions that may result in extension of the injury.
- Large injuries are associated with a systemic response caused by:
  - a loss of the skin barrier,
  - the release of vasoactive mediators from the wound,
  - subsequent infection,
  - loss of fluids.
- This results clinically in an initial decrease in cardiac output.
- A hypermetabolic response occurs, with near doubling of cardiac output and resting energy expenditure.

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Burns

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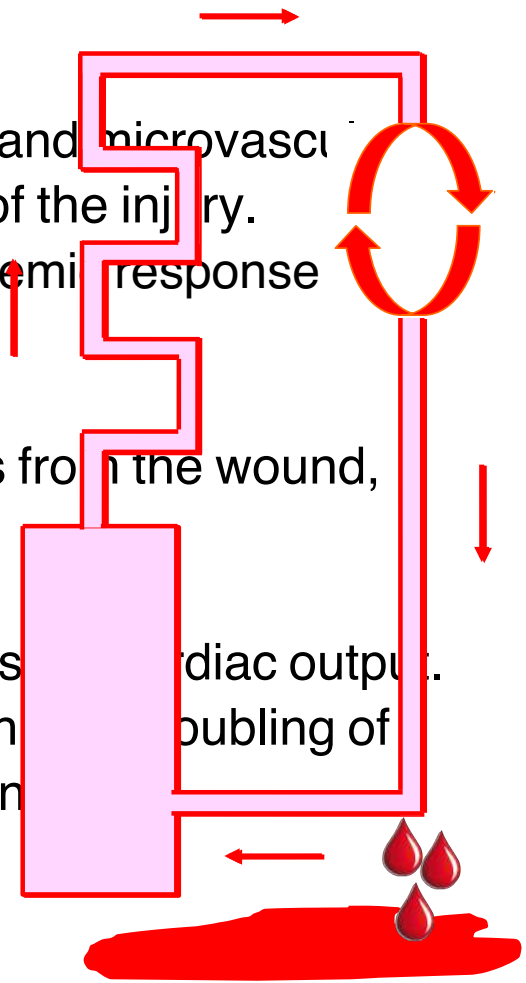

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Burns

A systemic injury

Release of vasoactive mediators: 1) local and systemic inflammatory response; 2) rapid edema formation;3) increased vascular permeability, and "4) burn shock". This response, in burns covering more than 20–30% of TBSA, involves the massive release of mediators = local vasoconstriction and systemic vasodilation.

Key Vasoactive Mediators Released

Histamine & Serotonin: from mast cells, initiate rapid edema formation and increase capillary permeability.

Prostaglandins & Leukotrienes:(arachidonic acid metabolism) contribute to severe edema and local tissue ischemia.

Cytokines (TNF-α, IL-1, IL-6, IL-8): Promote widespread inflammation, systemic capillary leak, and myocardial depression.

Bradykinin & Kinins: Act via the kallikrein–bradykinin system, leading to further vasodilation and increased permeability.

Reactive Oxygen Species (ROS):(by neutrophils), damage to vascular endothelium and exacerbating edema.

Other Mediators:Thromboxanes (platelet activation), **Catecholamines** (epinephrine/norepinephrine), and **Complement components** (C3a, C5a).

Pathophysiological Impact

Burn Shock: Combined effect of these mediators creates a "distributive shock," i.e. systemic vasodilation, significant intravascular fluid loss, and reduced cardiac output, (often requiring aggressive fluid resuscitation).

Wound Progression: Mediators in the "zone of stasis" (area surrounding the maximum damage) can lead to ischemia and progression to deeper necrosis.

Systemic Capillary Leak:The mediators break down the endothelial barrier, causing plasma to leak into the interstitial tissue.

Immediate vs. Delayed Effects: While early responses (0-24h) are dominated by profound fluid shifts and shock, the later phase (24-72h) involves a shift to a hyperdynamic and hypermetabolic state.

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Burns

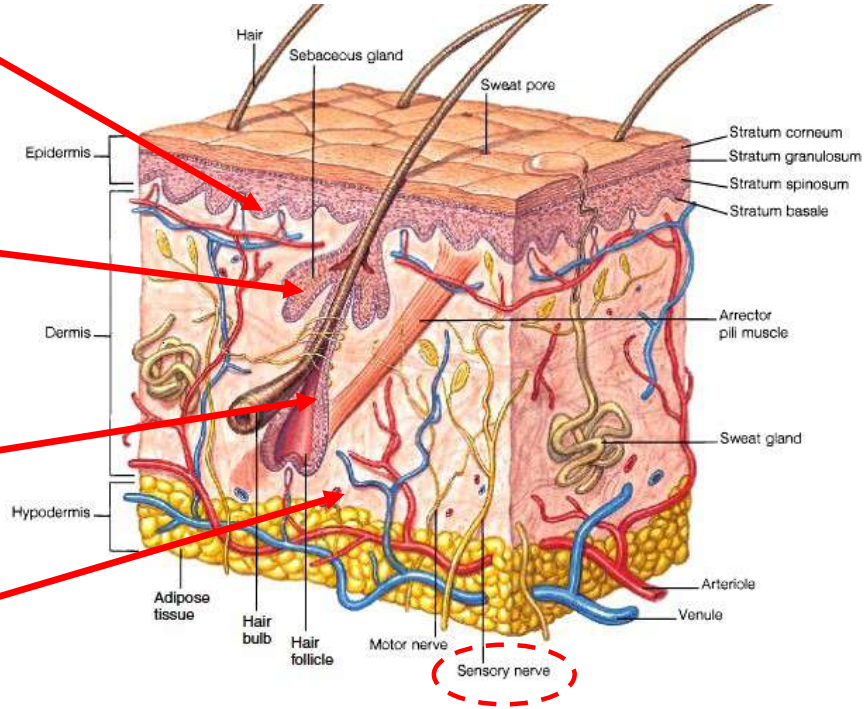
Depth of burns

First degree

Second degree
Superficial partial-thickness

Second degree
Deep partial-thickness

Third degree
Full-thickness



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Burns

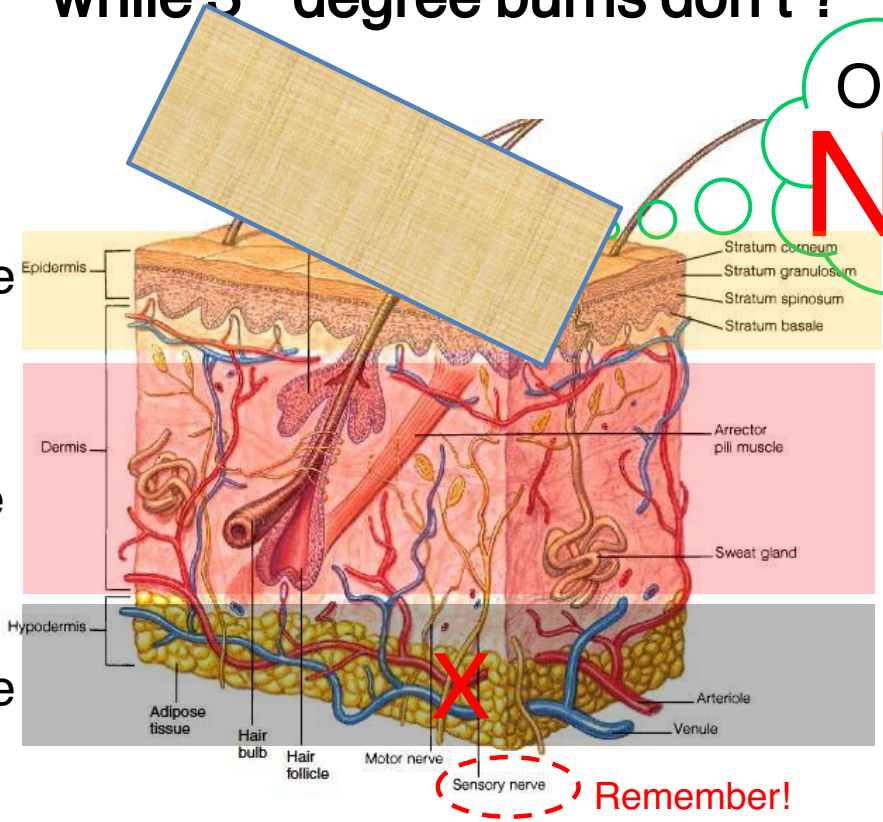
Why 1st and 2nd degree burns do hurt, while 3rd degree burns don't ?

Ointments ?!
NO !!!

1st degree

2nd degree

3rd degree



They prevent heat in excess to be dispersed; it will be reflected to deeper skin lays intstead and will worse the burn.

Remember!

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Burns Evaluation

BURNS ARE CLASSIFIED BY THE DEPTH OF THE WOUND.

SUPERFICIAL

1ST DEGREE BURNS
are just like a sunburn, with a reddened appearance of the skin

PARTIALTHICKNESS

2ND DEGREE BURNS
will also have blisters

FULL THICKNESS

3RD DEGREE BURNS
may appear dry, stiff, and leathery, and/or it can also be white, brown, or black

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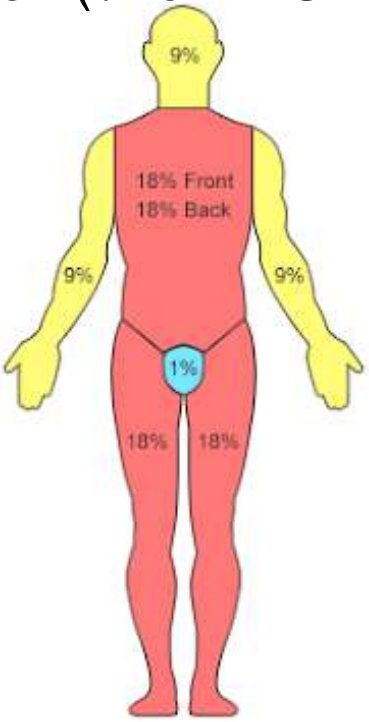
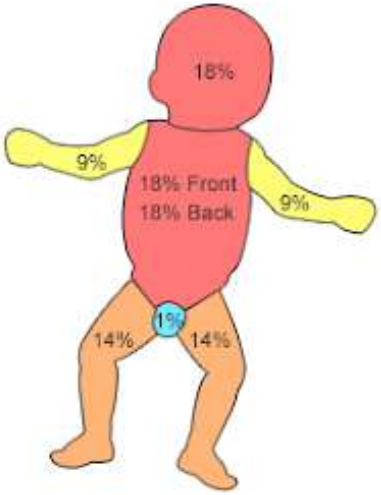
Burns Evaluation

How to estimate the burn size (Rule of 9s):

- Extension (% of TBSA =Total Body Surface Area):





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Burns Evaluation

Severity of burn injury depends on:

- Extent: rule of 9s
- Depth: 2nd – 3rd
- Location of burn injury:face, crotch, hands, feet,etc
- Age of patient:children <10 yrs, or adults >50 yrs
- Etiologic agents involved:caustic, electrical
- Presence of inhalation injury;
- Coexisting injuries or preexisting illnesses.

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Major Burns

- 2nd degree burns >25% of TBSA (Total Body Surface Area) in adults, or 20% of TBSA in children <10 years, or adults > 50 years;
- 3rd degree burns >10% of TBSA;
- 2nd and 3rd degree burns of face, crotch, hands, feet and main joints;
- Burns caused by caustic chemical agents, high-voltage electrical injury;
- Burns complicated by inhalation injury;
- Burns sustained by high-risk patients (those with underlying debilitating diseases)
- Circumferential full-thickness burns

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Burns management

Early management

First step

- Cool down the burned area of body with running water for at least 10 minutes
  - Extinguish flames on clothing
  - Remove outer layers of clothing (in case of boiling liquid)

Second step

- Protect the body from heat loss
  - Cover with wet gauze or damp blanket
  - Over this, wrap a thermal blanket (Metalline or Domopack-like)

Additional care

- Don't give drinks
- Supine position
- Continuously check the vital functions

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Burns management

The modified **Brooke or Parkland formulas** are reasonable consensus formulas and are used to help determine the initial volume of infusion.

- The Parkland formula for fluid resuscitation of burn patients is used as follows: **Lactated Ringer solution** (4 mL/kg/% TBSA burned) is administered intravenously in the first 24 hours, one half given in the first 8 hours, and the other half administered over the next 16 hours.
- Calculate fluid loss **from the time of injury**
- **Adequate resuscitation is evidenced by a normal urinary output** (1,5 mL/kg/h in children <2 years, 1 mL/kg/h in older children, at least 30-40 mL/h in adults), a normal sensorium, and stable vital signs.

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Burns management

List of example formulae for fluid calculation

Formula name	Formula
Parkland formula (Baxter formula)	4 mL/kg/%TBSA 50% given in first 8 hours 50% given in next 16 hours
Modified Parkland formula	2 mL/kg/%TBSA
Brooke Formula	1.5 mL/kg/%TBSA crystalloid and 0.5 mL/kg per %TBSA burn + 2 L free water
Cincinnati Formula	4 mL/kg/%TBSA + 1500 mL/m2 BSA
Galverston Formula	5000 mL/m2 TBSA + 2000 mL/m2 BSA
USA ISR Burn Centre	Estimate the burn size to the nearest 10; %TBSA × 10 = initial rate for fluid resuscitation. Every 10 kg above 80 kg the fluid rate should be increased by 100 mL/hr
Evans Formula	In the first 24 hours gives 1 mL/kg/% burn plus colloids at 1 mL/kg/% burn plus 2000 mL glucose in water. Next 24 hours gives crystalloids at 0.5 mL/kg/% burn, colloidal at 0.5 mL/kg/% burn and the same amount of glucose in water as in first 24 hours

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Burns management

Tips and mistakes to avoid

Assess the respiratory tract and prepare for early intubation if patients have respiratory symptoms, carbonaceous sputum, perioral burns, bruised nasal hair, or have been confined in a fire.

Assessment of the posterior pharynx is useful for assessing airway injury. If there is no evidence of edema or posterior pharyngeal erythema, airway involvement is unlikely.

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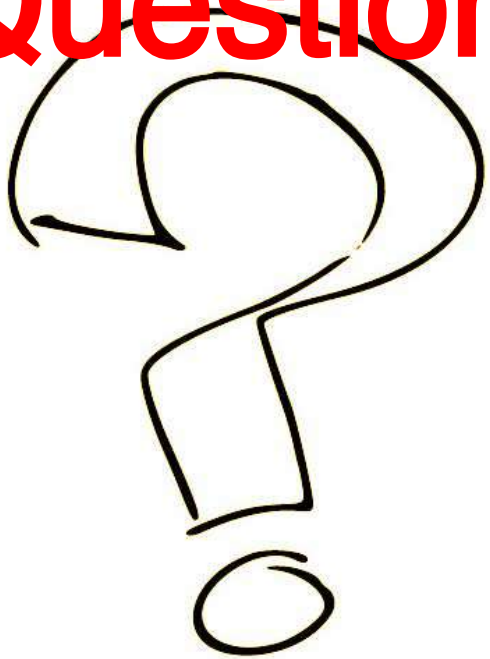
Questions



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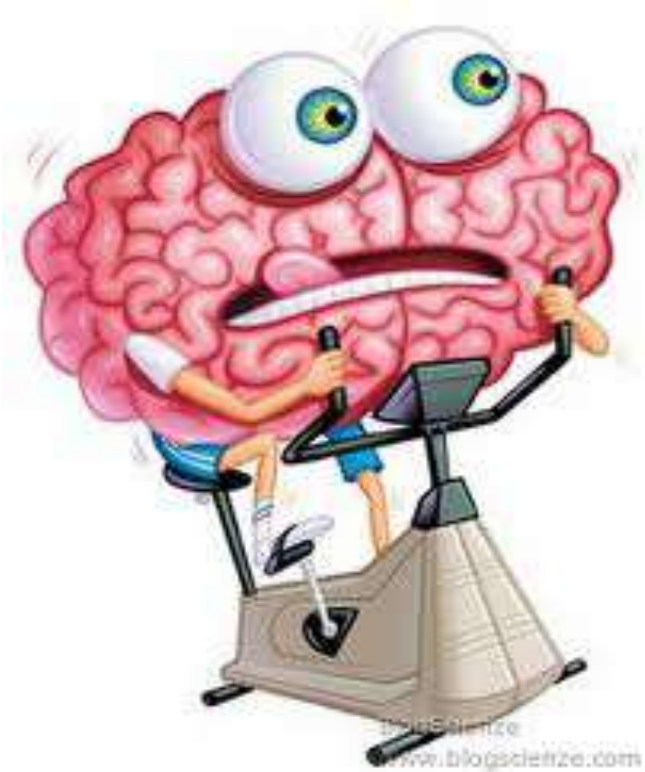

Some mental training …

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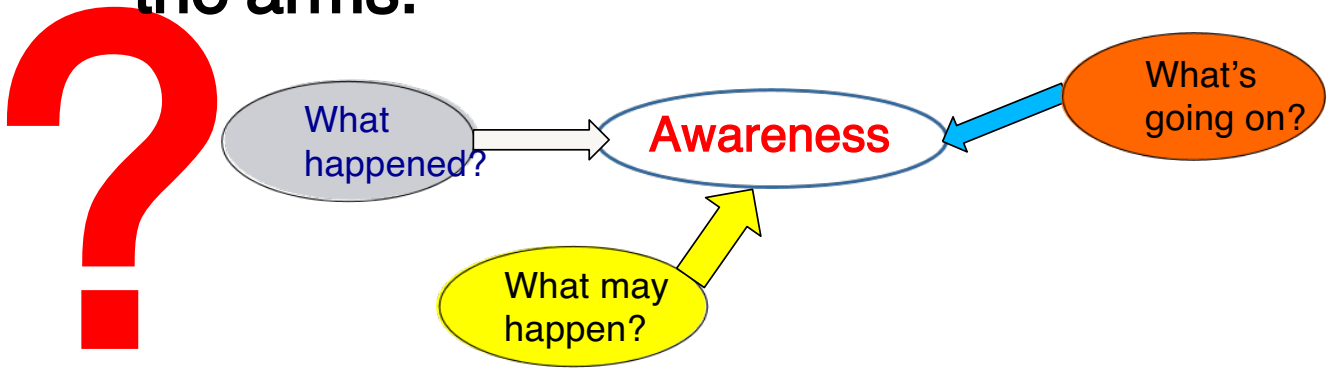
Sam, 47 years old, electrician; is electrocuted at 380 Volts. There are severe burns on both hands. His mouth is locked. Heart rate and respiratory rate are rapid. He is unconscious even though he reacts to the standard pain stimulus by waving the arms.



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Sam, electrical burns

What happened? Electrocuted electricician showing electrical burns to the hands

What's going on?

ABCD check-list

A. Airways:
B. Breathing:
C. Circulation:
D. Disability:

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Sam, electrical burns

What happened? Electrocuted electricician showing electrical burns to the hands

What's going on?

ABCD check-list

A. Airways: partially obstructed (the mouth is locked)
B. Breathing: rapid
C. Circulation: radial pulse rapid
D. Disability: unconscious (level P as «Pain» on the A-V-P-U scale)

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Sam, electrical burns

What may happen?

ABCD check-list

A. Airways:
B. Breathing:
C. Circulation:
D. Disability:

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Sam, electrical burns

What may happen?

ABCD check-list

A. Airways: complete obstruction
B. Breathing: respiratory arrest
C. Circulation: severe arrythmia, cardiac arrest
D. Disability: deeper coma

- Are the burns the main problem ? NO !
  - First support the vital functions
  - THEN care for the burns

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Sam, electrical burns

IN CASE OF ELECTRICAL INJURY

Secure the power, if possible. Otherwise, remove the casualty from the electrical source using a nonconductive object such as a wooden stick. Move the casualty to a safe place.

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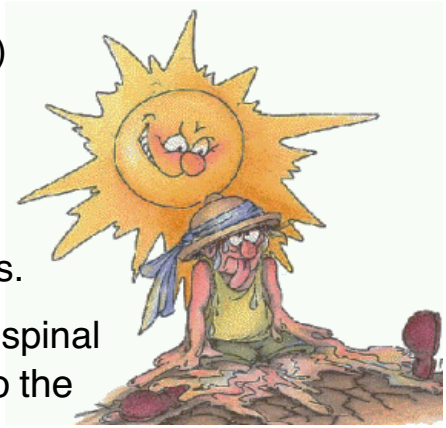
Heat stroke

- Heat stroke is defined as a body temperature >40°C (104°F) associated with neurologic dysfunction.
- With the influence of global warming, incidence of heat stroke cases and fatalities will become more prevalent.



When heat gain exceeds heat loss, the body temperature rises.

In a simplified model, thermosensors in the skin, muscles, and spinal cord send information regarding the core body temperature to the anterior hypothalamus.

Heat production

- Basal metabolic processes produce 1 kcal/kg/h. This can raise the body temperature by 1.1°C/h if the heat-dissipating mechanisms are nonfunctional.
- Strenuous physical activity can increase heat production to >1000 kcal/h.
- Fever, shivering, tremors, convulsions, thyrotoxicosis, sepsis, sympathomimetic drugs.

Heat loss

- Increased cardiac output and blood flow to the skin (as much as 8 L/min), which is the major heat-dissipating organ.
- Dilatation of the peripheral venous system.
- Stimulation of the eccrine sweat glands to produce more sweat.

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Heat Stroke - Etiology

- **Increased heat production**
  - Infections
  - Sepsis
  - Encephalitis
  - Stimulant drugs
  - Thyroid storm
  - Drug withdrawal
  - Increased muscular activity
    - Exercise
    - Convulsions
    - Tetanus
    - Strychnine poisoning
    - Sympathomimetics
    - Drug withdrawal
    - Thyroid storm
- **Decreased heat loss**
  - Reduced sweating
    - Dermatologic diseases
    - Drugs
    - Burns
  - Reduced central nervous system responses
    - Advanced age
    - Young age (toddlers and infants)
    - Alcohol
    - Barbiturates and other sedatives
  - Reduced cardiovascular reserve
    - Advanced age
    - Diuretics
    - Cardiovascular drugs
- **Reduced behavioral responsiveness**
  - Infants, bedridden / chronically ill patients are unable to control their environment and water intake.

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Heat Loss

As the major heat-dissipating organ, the skin transfers heat to the environment through:

- **Convection**; the transfer of heat between the body's surface and a gas or fluid with a differing tempera
- **Conduction**; the tra ratures that are in direct co
- **Radiation**; the trans een the body and its surrounding.

  The most important mechanism of heat transfer at rest in temperate climates.
- **Evaporation**; the conversion of a liquid to a gaseous phase.

  The most effective mechanism of heat loss at high ambient temperatures.
  - Evaporation does not occur when the ambient humidity >75%
  - Nonacclimated individuals can only produce 1 L/h of sweat, which only dispers 580 kcal/h of heat
  - Acclimated individuals can produce 2-3 L/h of sweat and can dissipate as much as 1740 kcal/h of heat

Think about all this in all situations where the heat loss is a jeopardizing factor for the patient

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Heat Stroke - assessment

- Excessive heat denatures proteins, leading to cardiovascular collapse, multiorgan failure, and death.
- Temperatures > 106°F or 41.1°C require immediate aggressive therapy
- Additionally, the redistribution of blood flow to the periphery, coupled with the loss of fluids and electrolytes in sweat, place a tremendous burden on the heart, which ultimately may fail to maintain an adequate cardiac output

Indicators of poor prognosis during acute episodes:

- Initial temperature >41°C (106°F) or a temperature >42°C (108°F) or a temperature persisting >39°C (102°F) despite aggressive cooling measures
- Coma duration longer than 2 hours
- Severe pulmonary edema
- Delayed or prolonged hypotension
- Lactic acidosis in patients with classic heat stroke
- Acute kidney injury and hyperkalemia
- Aminotransferase levels greater than 1000 IU/L during the first 24 hours

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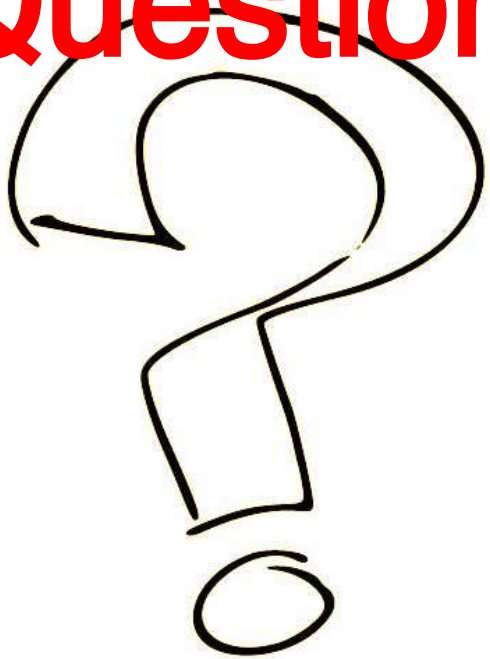
Questions



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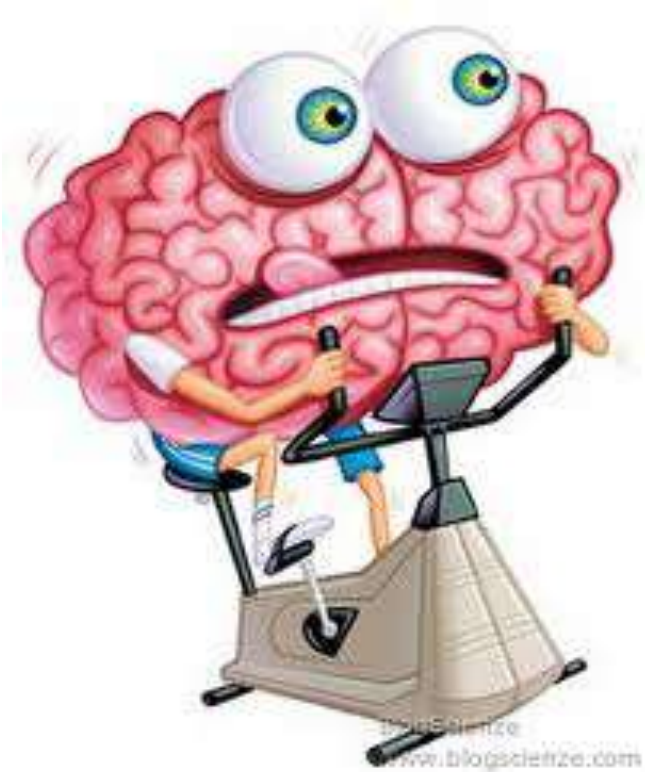

Some mental training …

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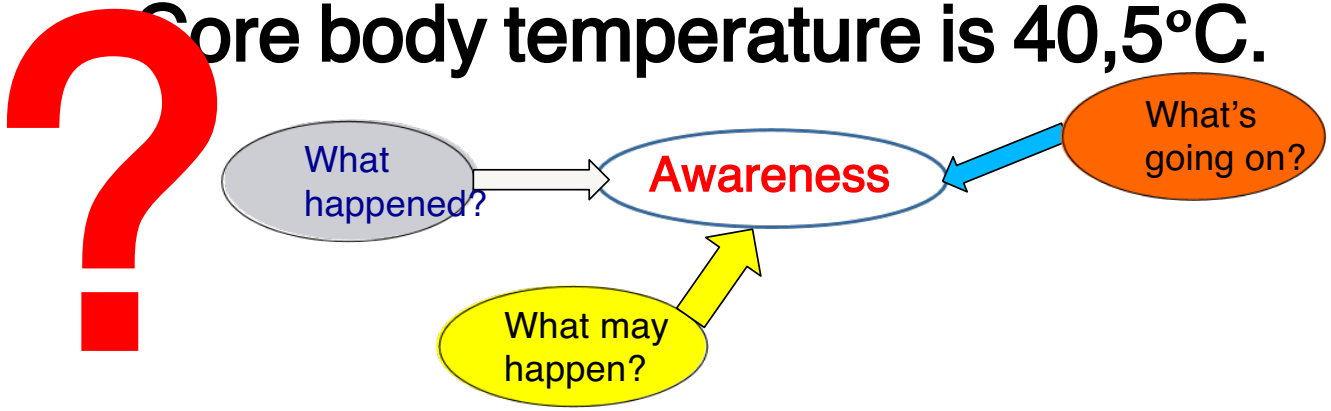
Jack, 50 years old, farmer. For 8 hours he has been working in the fields under the scorching sun. He feels more and more tired, headache, dizziness, is red and warm in the face. Pulse and breath are accelerated. He speaks in a somewhat confused way. Core body temperature is 40,5°C.



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Jack, heat stroke

What happened? Mild-severe heat stroke

What's going on?

ABCD check-list

A. Airways:
B. Breathing:
C. Circulation:
D. Disability:

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Jack, heat stroke

What happened? Mild-severe heat stroke

What's going on?

ABCD check-list

A. Airways: patent
B. Breathing: rapid
C. Circulation: radial pulse rapid
D. Disability: conscious but confused (level A as «Alert» on the A-V-P-U scale)

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Jack, heat stroke

What may happen?

ABCD check-list

A. Airways:
B. Breathing:
C. Circulation:
D. Disability:

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Jack, heat stroke

What may happen?

ABCD check-list

A. Airways: Patent, until alert
B. Breathing: Pulmonary edema — Why ?
C. Circulation: Shock/collapse — What kind of shock ?
D. Disability: Worsening of consciousness — Why ?

- B= pulmonary edema:
- Excessive heat denatures proteins, leading to multiorgan failure (see also “C” step)
- C= impending shock/collapse
- All kind of shock !
- D= worsening consciousnes
- Brain edema (see «B» step)

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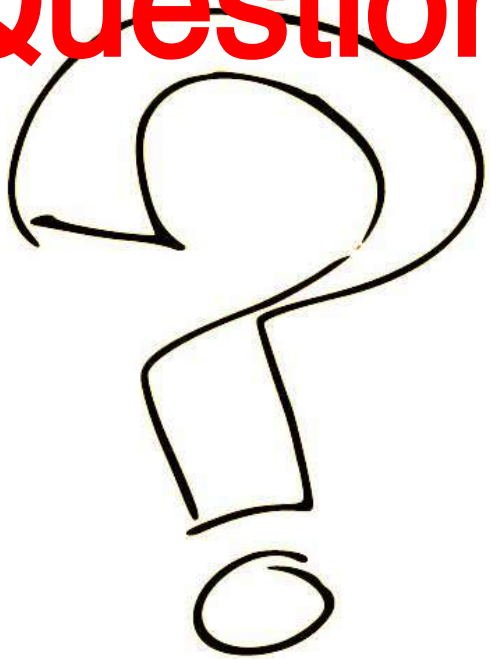
Questions



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Hypothermia

A systemic cold injury in which the core body temperature has decreased to 35°C (95°F) or less.

- Hypothermia affects multiple organs.
- Initially, the metabolic rate increases, with tachycardia, tachypnea, increased muscle tone, and peripheral vascular resistance to generate maximal shivering.
- Once hypothermia sets in, the body loses the ability to cope.
- With continued hypothermia, the metabolism progressively declines, with bradycardia and hypoventilation and subsequent carbon dioxide retention.
- Cerebral metabolism is decreased 6-7% per every 1°C drop in temperature, which results in worsening of the consciousness.
- Autoregulation of cerebral blood flow is impaired at temperatures below 25°C (77°F).

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Heat Loss

As previously seen, the skin transfers heat to the environment through:

- **Convection**; the transfer of heat between the body's surface and a gas or fluid with a differing temperature.
  The thermal conductivity of water (or wet clothing) is approximately 30 times that of air
  Convection becomes more significant in a windy environment
- **Conduction**; the transfer of heat between 2 surfaces with differing temperatures that are in direct contact.
- **Radiation**; the transfer of heat in the form of electromagnetic waves between the body and its surrounding.
  Evaporation; the conversion of a liquid to a gaseous phase.

Alcohol seems to be a predominant cause of cutaneous vasodilation, loss of shivering, hypothalamic dysfunction, and lack of concern regarding the environment

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Hypothermia

- Thermosensors in the skin, muscles, and spinal cord send information regarding the core body temperature to the anterior hypothalamus, you know.
- When the hypothalamus is stimulated by the above mechanisms, various heat conservation and production mechanisms become activated. When the sympathetic nerves are excited, they cause the blood vessels in the skin to markedly constrict.
- This reduction of blood flow in the skin is the prime physiologic regulator of heat loss from the body.
- This is protective in terms of safeguarding the more vital organs of the body from hypothermia, but it places the extremities at particular risk for peripheral cold injury.
- Stimulation of the sympathetic nerves also causes secretion of epinephrine and norepinephrine, that increase the metabolic rate of all cells, thereby enhancing heat production.

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Hypothermia

°F 95 86 80,6 < 80,6

°C 35 30 27 < 27

Hypothermia ≥ 35°C

- shivering

Mild hypothermia ≥33°C (91°F)

- shivering mechanism of thermoregulation stops

Severe hypothermia < 28°C (82.4°F)

- heart rate drops to half its normal rate
- ventricular contractility decreases
- risk of ventricular fibrillation
- coma

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Hypothermia

If a patient presents with severe frostbite, the obvious damage to the involved areas, especially the extremities, can be quite distracting. Although it is important for these injuries to be addressed in a timely manner, **never forget that the most imminent threat to life and limb is systemic hypothermia**.
This must be treated and corrected prior to focusing on peripheral cold injury.

For a person with mild hypothermia (≥33°C [91°F]) found in a cold environment, the first priority is to search for other injuries in that person.

In severe hypothermia the patient may appear clinically dead, with nonpalpable peripheral pulses, fixed and dilated pupils, loss of ocular reflexes, and stiff extensor posturing. Cardiac standstill usually occurs at 20°C (68°F),

Patients with severe hypothermia are never dead until they are **warm and dead**

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Hypothermia

The general principles of prehospital management are:

1) prevent further heat loss,
2) rewarm the body core temperature in advance of the shell
3) avoid precipitating ventricular fibrillation.

The patient should:

- be moved out of the cold environment and out of the wind,
- provided with warm shelter,
- given warmed fluids,
- Keep off the ground (increases loss of body heat).

Rubbing affected parts of the body is not recommended because this potentially can worsen tissue injury.

Rapid changes in temperature can affect the cardiovascular status, and these rapid changes are often the cause of complications associated with active rewarming methods.

Hypothermia could worsened by a massive blood loss.

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Hypothermia

Active rewarming

The increase in core temperature is much faster.

Active external rewarming may precipitate hypovolemic rewarming shock by decreasing the circulating blood volume secondary to peripheral vasodilation in an already hypovolemic patient.

Passive rewarming

The increase in core temperature varies from 0.5-2°C/h; 24 hours may be required to achieve a normal temperature

The **safest** method of **active** rewarming of patients with severe hypothermia is **internal** rewarming.

- heated, humidified inhalation
- peritoneal dialysis with warmed fluids
- mediastinal irrigation (ie, through chest tubes)
- gastrointestinal tract irrigation
- arterial venous shunting including hemodialysis
- extracorporeal bypass
- warm irrigation through a Foley catheter inserted into the bladder.

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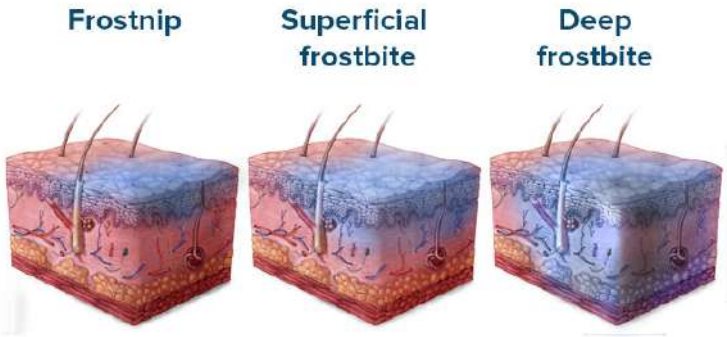
Frostbite



Localized cool injuries staging recalls burns staging

Principles of frostbite treatment universally accepted.

- The patient must be removed from the cold environment.
- Treatment should not be attempted in the field if a hospital is available within a short distance.
- Once the rewarming process has begun, weight-bearing on the affected result in additional injury.
- Rubbing the frostbitten part with snow or exercising it is absolutely contraindicated.
- Contrary to popular belief, walking some distance on frostbitten feet can result in tissue fracture.

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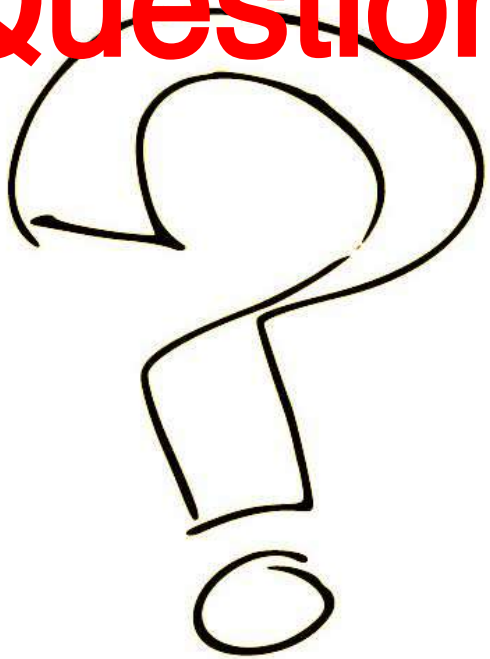
Questions



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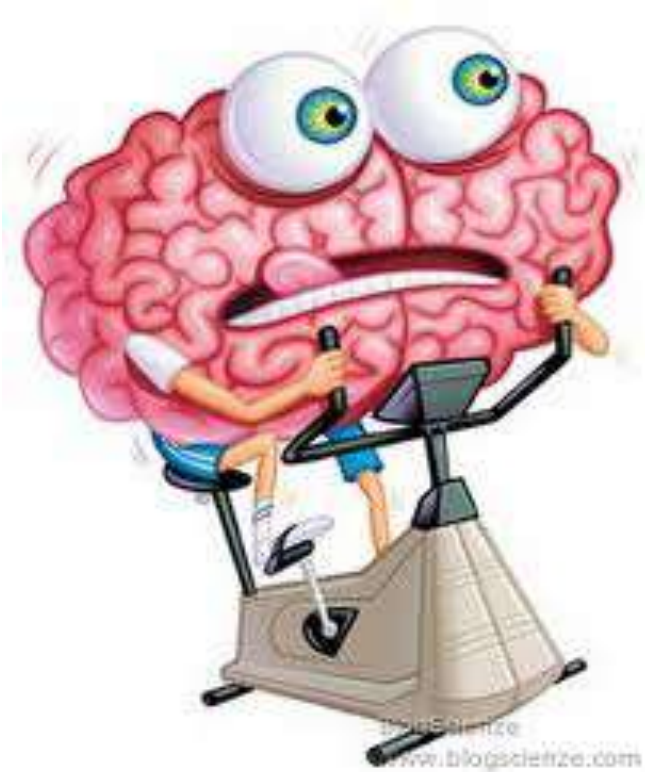

Some mental training …

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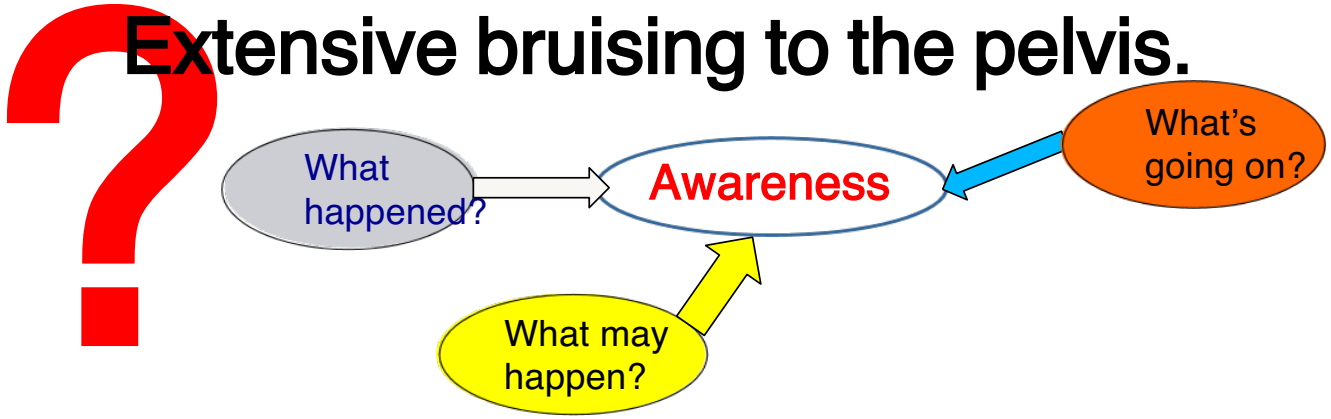
Bill, 27 years old, homeless. Found drunk in a street, early in a rainy and windy winter morning. Slow respiratory rate, radial pulse weak and rapid. He responds only by moaning to pain stimuli. Body temperature is 28°C (82,4°F). Extensive bruising to the pelvis.



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Bill, hypothermia

What happened?

Person unable to protect himself from cold;
prolonged exposure to wind and rain;
vasodilation due to alchol consumption.
High suspicion of pelvic fracture (bruising)

What's going on?

ABCD check-list

A. Airways:
B. Breathing:
C. Circulation:
D. Disability:

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Bill, hypothermia

What happened?

Person unable to protect himself from cold;
prolonged exposure to wind and rain;
vasodilation due to alchol consumption.
High suspicion of pelvic fracture (bruising)

What's going on?

ABCD check-list

A. Airways: Patent (until now!)
B. Breathing: Slow respiratory rate
C. Circulation: Radial pulse weak and rapid
D. Disability: Impaired consciousness (level P as «Pain» on the A-V-P-U scale)

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Bill, hypothermia

What may happen?

ABCD check-list

A. Airways:
B. Breathing:
C. Circulation:
D. Disability:

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Bill, hypothermia

What may happen?

ABCD check-list

A. Airways: Patent, until now
B. Breathing: Respiratory arrest
C. Circulation: Ventricular fibrillation
D. Disability: Worsening of consciousness

Why ?

- D= worsening consciousnes
- Brain edema (see «B» and «C» steps)

Notice!
Hypothermia protects brain tissue impairment, **PROVIDED** that oxygen delivery **AND** blood pressure are guaranteed

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Let’s take a break!

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Trauma

(The very essentials)

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Myth: Don't move a trauma patient !

Obviously, someone have to move her from the wreckages at some point !

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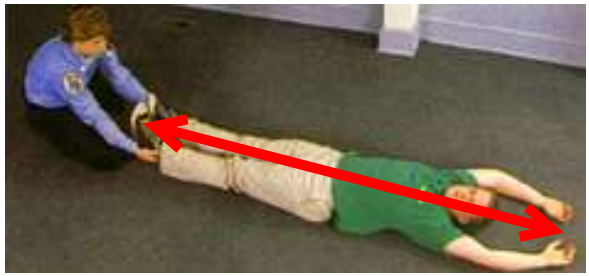
Myth: Don't move a trauma patient !

IN CASE OF IMPENDING DANGER !
(Fire, wall collapse, etc.)



Keep the main axis of the body aligned!

Obviously, you can't take the patient to the hospital this way!
This is only to go away from an impending danger

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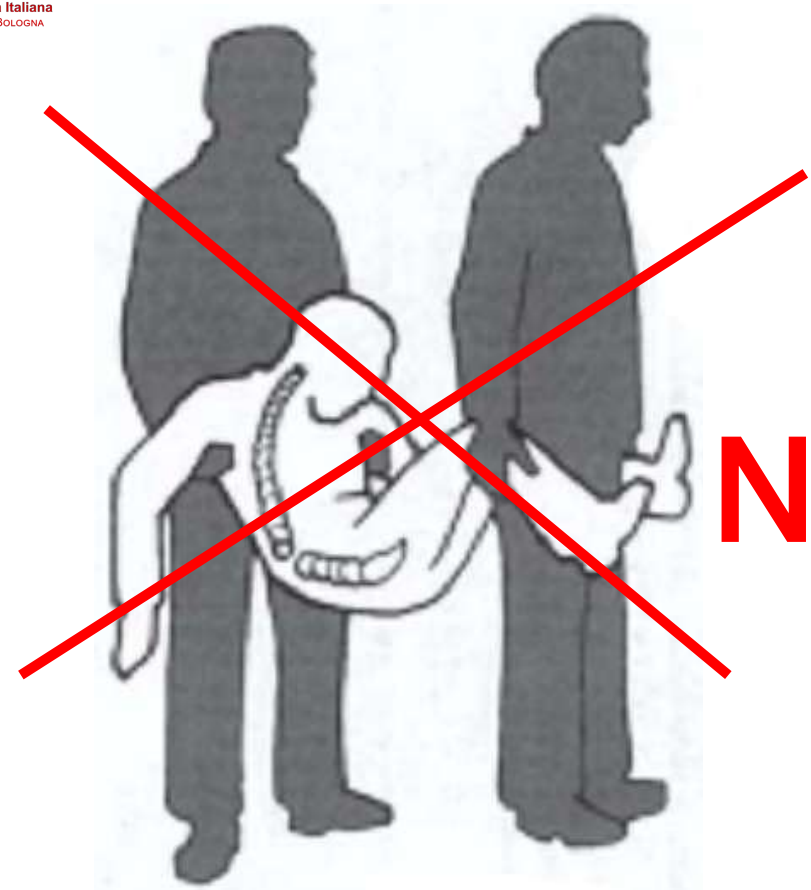

Keep the main axis of the body aligned!

NO !

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"A-B-C-D" METHOD IS SUITABLE FOR ALL KIND OF EMERGENCIES

Remember !

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High suspicion criteria for a MAJOR trauma

Mechanism of injury

- Trapped patient
- Ejection from a vehicle
- Fall from more than 3 metres
- Penetrating wounds
- Pedestrian or biker projected
- Cockpit intrusion ≥ 30 cm.
- Other patients killed in the same vehicle

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Trauma

Spine injuries

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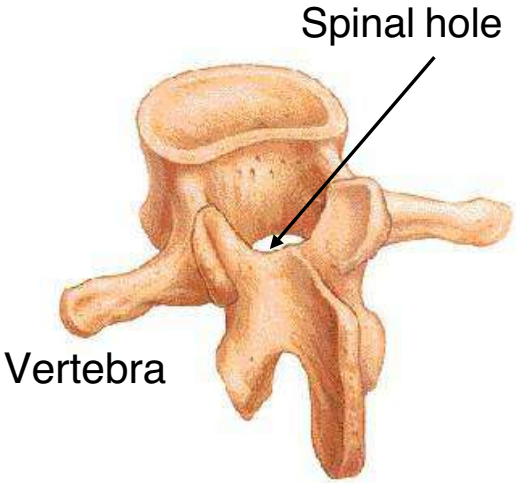
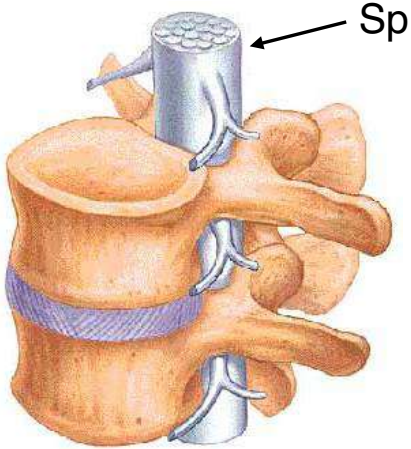
The spinal column

Like to the brain, spinal cord is protected by bones but has a very narrow space around itself. Emerging nerve rooths too !





Spinal column

Nerves come out of the spinal cord that go to all structures of our organism

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Spinal cord injuries

Features and symptoms

- possible pain in the spine area where trauma occurred
- possible tingling, numbness of limbs
- possible loss of limb sensitivity
- possible functional impotence
- possible loss of urine and faeces
- none of the foregoing

Early management

- assess the mechanism of injury
- check the vital functions (A-B-C-D)
- avoid unecessary movements

Cross check !

Keep the patient's head still,
in NEUTRAL POSITION
(HEAD-NECK AXIS)

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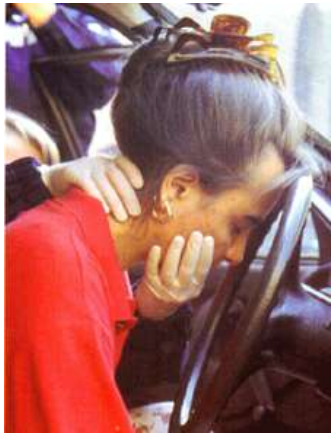
Stabilizing the cervical spine



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Trauma

Chest trauma

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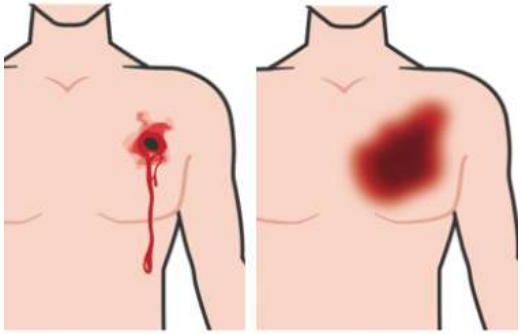
Assess for potential life-threatening chest injuries

TYPES OF CHEST INJURY



Penetrating Wounds

Blast Injury

IMPORTANT

DO NOT ***pack chest wounds*** with a hemostatic (or other) dressing

REPORT ***a severe CHEST INJURY*** to medical personnel immediately

ROLL TO EXAMINE FRONT AND BACK FOR SIGNIFICANT TORSO TRAUMA

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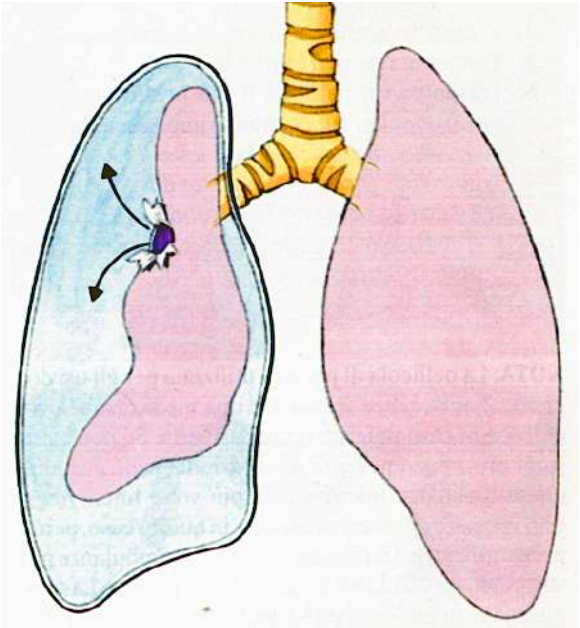
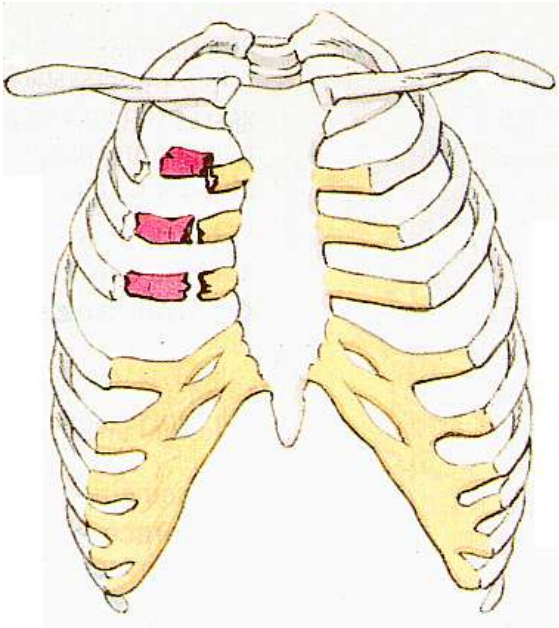
Chest trauma

The two most lethal chest injuries

- Pneumotorax



- Flail chest



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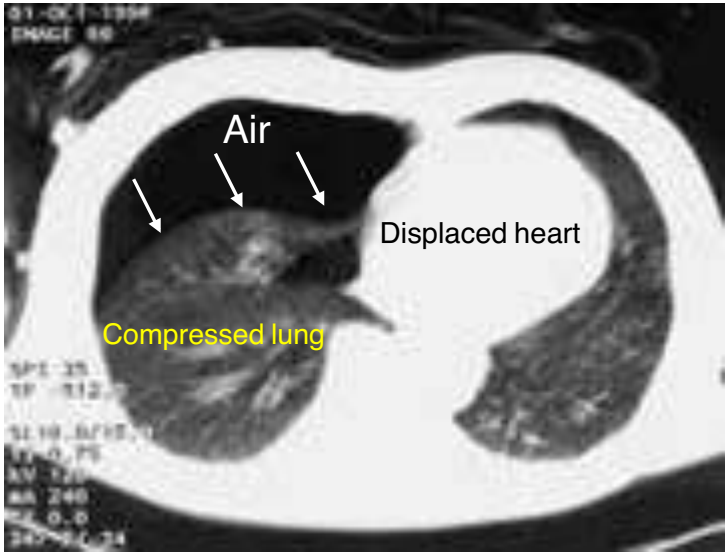
Pneumotorax

Signs of pneumothorax

- Respiratory difficulty
- Cough with possible foamy blood emission
- Abnormal movements of the rib cage
- Swelling of the neck and/or face
- Cyanosis



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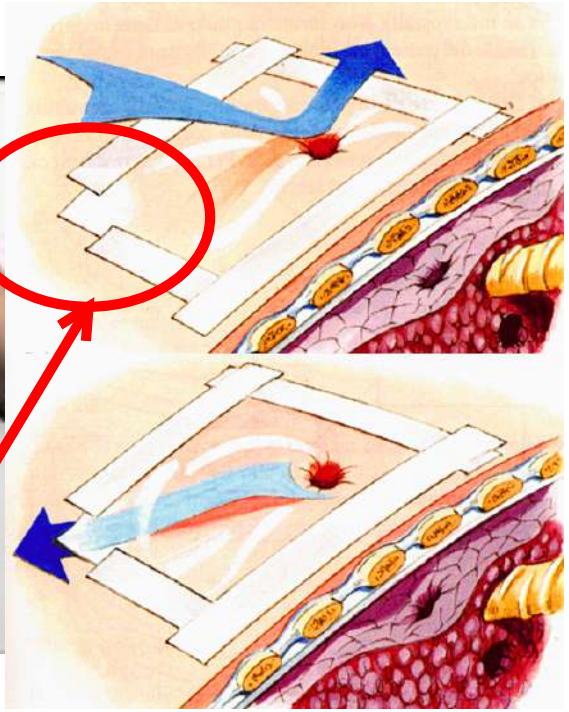
“Blowing” Wounds

Unsealed edge



«Valve» dressing

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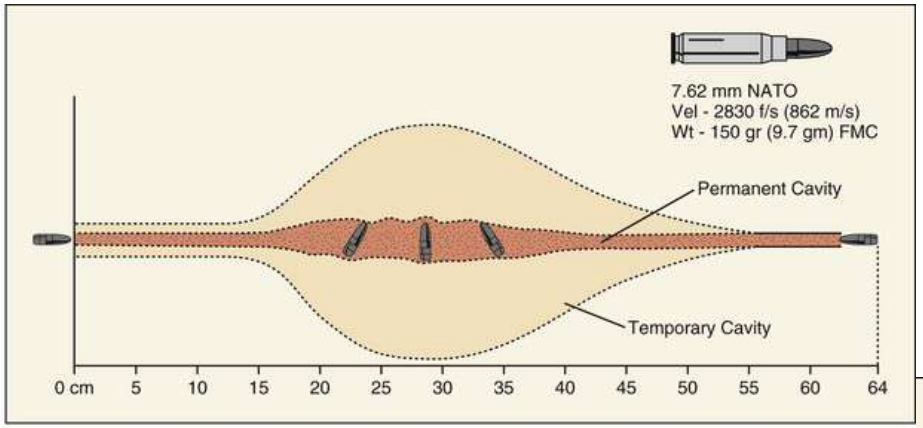
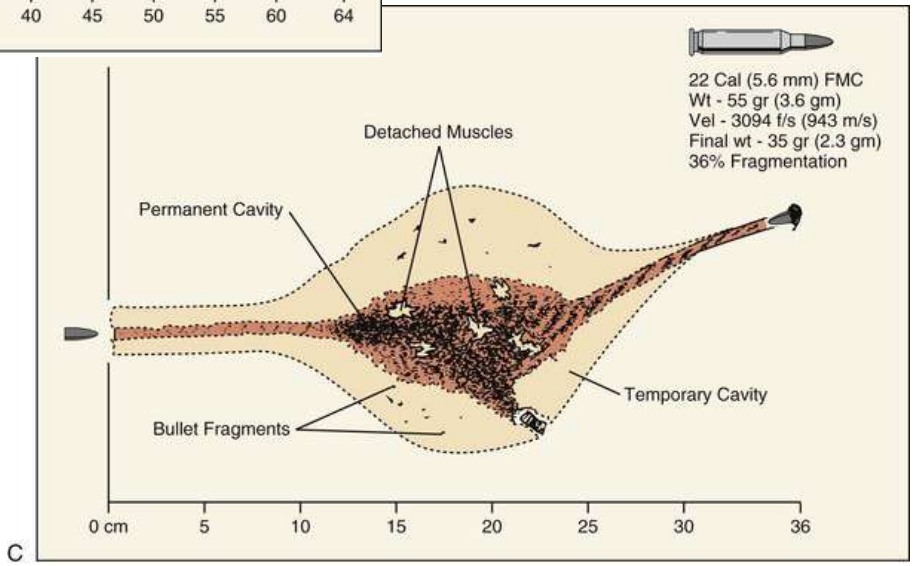
Firearms wounds



Bullett weight = 9,7 g.
Speed = 862 m/sec.

Bullett weight = 3,6 g.
Speed = 943 m/sec.



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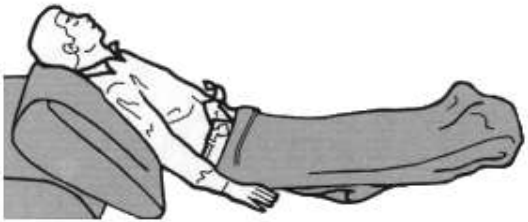
Chest Trauma

Early management (without equipment!)

- **If** «Blowing» wound : «valve» dressing
- **If** penetrating object: DO NOT remove it; try to make it fixed
- Loosen what holds
- Semi-sitting or semi-reclining position on the injured side
- Continuosly check the vital functions («A-B-C-D»)



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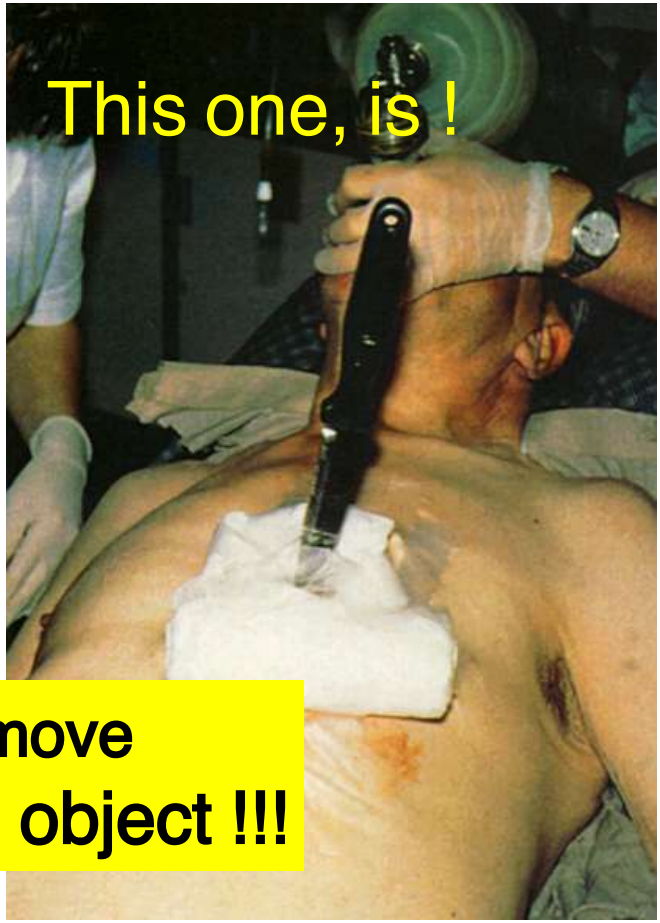
Penetrating wounds



NEVER remove the penetrating object !!!

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Trauma

Bleedings

(see also the specific module later)

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How to recognize massive life-threatening bleeding

BRIGHT RED BLOOD
is pulsing, spurting or steady bleeding from the wound

Overlying clothing or ineffective bandaging is becoming **SOAKED WITH BLOOD**

IMPORTANT! Casualties with severe injuries can bleed to death in ***as little as 3 minutes***

3 MIN

BRIGHT RED BLOOD
is pooling on the ground

AMPUTATION of the arm or leg

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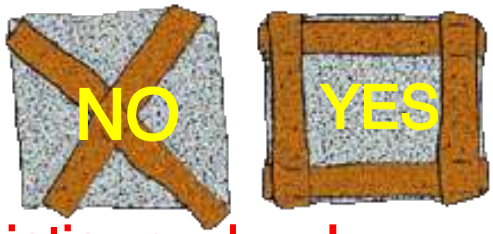
Simple external bleedings

Early management (without equipment)

PROTECT YOURSELF !

- To sit or lie the wounded
- Lift the injured limb
- Wash the wound under cold running water
- DIRECT compression on the wound
- Compressive bandage



NO cotton wool !

NO alcohol !

NO ointments and antibiotic powders !

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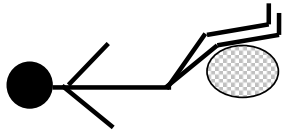
Severe external bleedings

Early management (without equipment)

- Lie on the ground with raised lower limbs (antishock position)



- COMPRESSION AT DISTANCE
- Thermal protection
- EXCEPTIONALLY, tourniquet (obvious bleedings!!)
- DO NOT give alcohol to drink !
- Keep vital functions under control

PROTECT YOURSELF !

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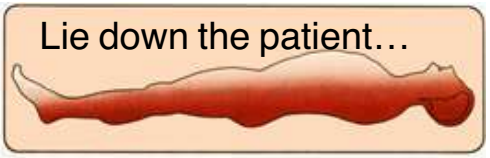
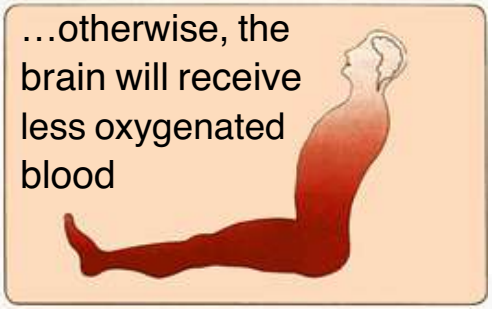
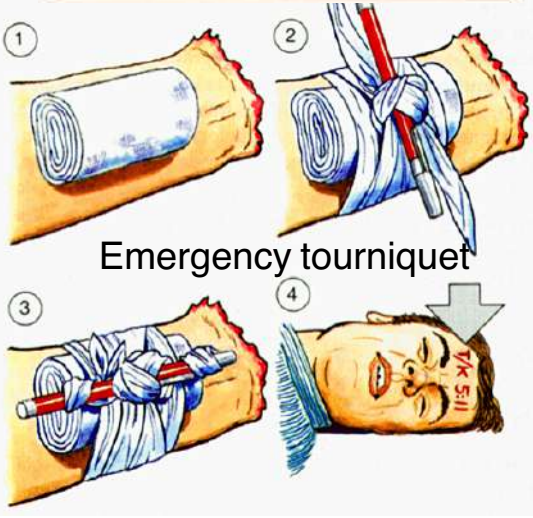
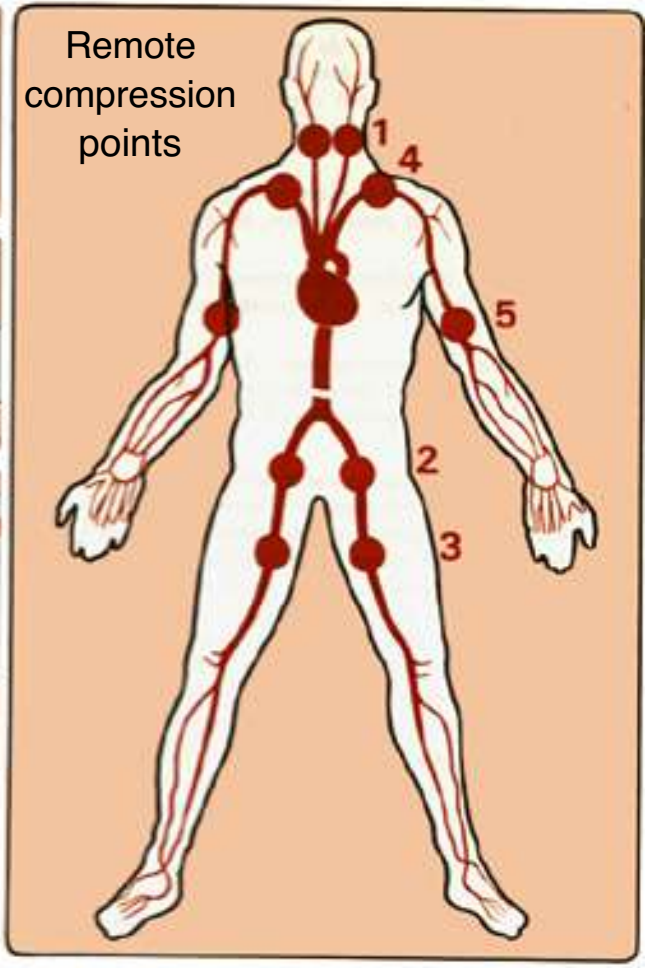
Bleeding control









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Arterial tourniquet

ONLY IN CASE OF EXTREME NEED

WHAT SHOULD BE USED?

- Strip or belt of cloth
- Tie
- Scarf
- NO twine, NO cord, NO iron wire, NO nylon stockings

WHERE IT HAS TO BE PLACED?

- Upstream of the wound, between the wound and the heart
- Always ABOVE the elbow and ABOVE the knee

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Tourniquet: some myths

This is NOT a tourniquet for bleeding control !

THIS is a tourniquet for bleeding control !

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Tourniquet: not improvised

RISKS ASSOCIATED WITH IMPROVISED TOURNIQUETS:

- **DAMAGE** may occur to skin if the band is too narrow
- Bleeding may **WORSEN**
- Bleeding **MAY NOT BE COMPLETELY CONTROLLED**
- An improvised tourniquet may likely **LOOSEN** over time from not being properly secured

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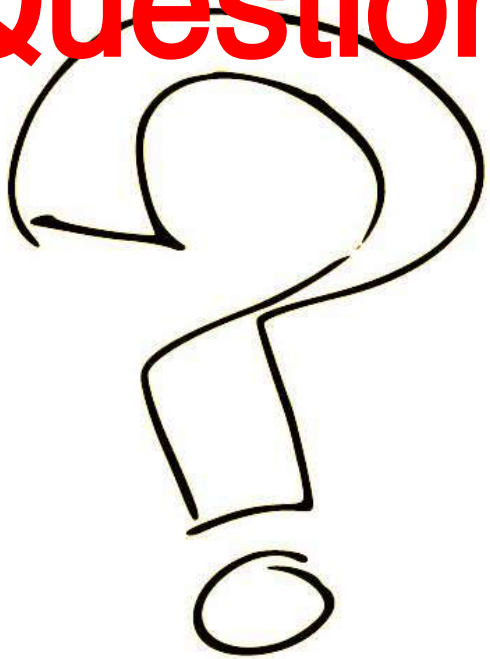
Questions



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Head Trauma

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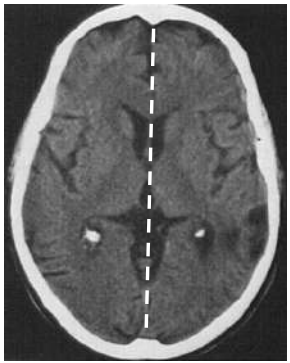
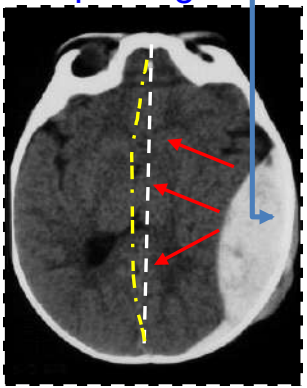
Mechanism of brain trauma

CT scan of a normal brain



Extradural hematoma compressing and displacing the brain



Brain edema, due to poor ventilation and/or hypotension

Primary damage

- Due to the direct impact of the trauma

Secondary damage

- Due to poor oxygenation of the blood
- Due to poor blood pressure
- Due to both the above listed causes

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Signs of severe head trauma

Racoon eyes

Battle sign

W.H.Battle

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Warning signs in head trauma

- Worsening level of consciousness
- Onset of drowsiness, disorientation, amnesia
- Onset of headache, nausea, sudden vomiting
- Onset of seizures
- Functional impairment

IT IS NOT ALWAYS TRUE THAT:

- no **external** injury = no **internal** injury
- conscious **at once** = conscious **always**

IT IS ALWAYS TRUE THAT:

- head trauma = suspected cervical trauma

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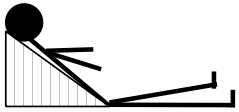
Head trauma

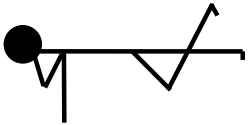
Early management (without equipment)

- assess the state of consciousness and its variations over time :

if **conscious**: - semi-sitting position



if **unconscious**: - Keep vital functions under control



- Lateral position if he vomits
- Where necessary, C.P.R. (obviously supine)

- ensure the immobility of the axis head-neck-trunk !!

- NO antishock position (the head should always be a little more in high above the heart)
- DO NOT obstruct leakage of fluids from ear/nose
- DO NOT give beverages

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Bones Trauma

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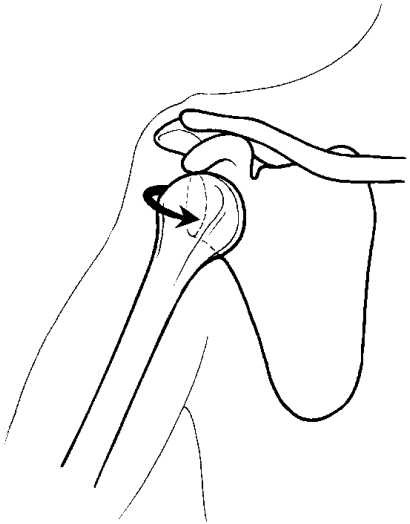
Joints trauma

DISLOCATIONS

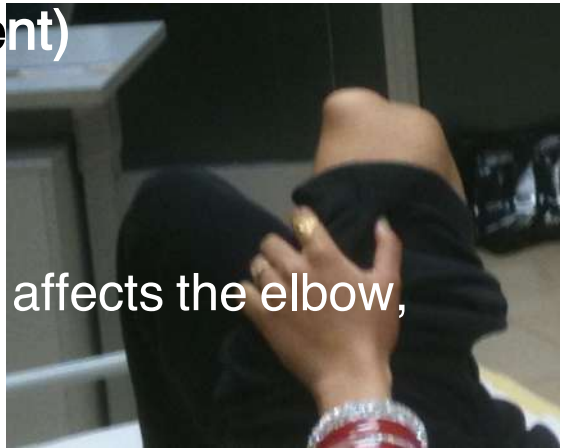


Signs and symptoms

- acute pain
- swelling
- absolute and immediate functional impotence
- possible tingling
- joint deformity

Early management (without equipment)

- DO NOT attempt to "fix" the joint
- immobilize it in its position
- apply ice
- rapid hospitalization, especially if it affects the elbow, knee or if it is tingling



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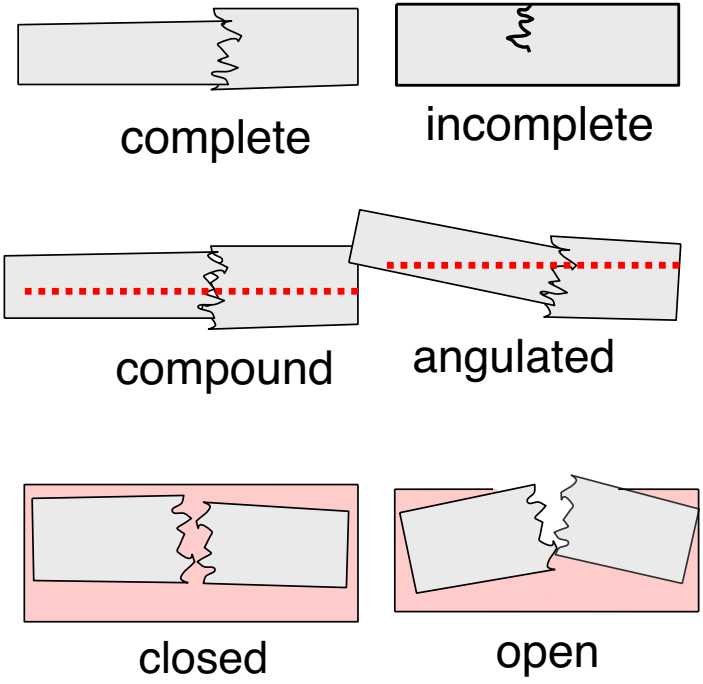
Bones trauma

FRACTURES



Signs and symptoms

- spontaneous pain, accentuated by movement
- swelling
- functional impotence
- crackling / rustling
- possible deformation of the limb (shortening, angles, abnormal rotations ...)

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Fractures

ASSESS FOR A FRACTURE

CLOSED FRACTURE

OPEN FRACTURE

WARNING SIGNS OF A FRACTURE:

- Significant pain and swelling
- An audible or perceived “snap”
- Different length or shape of limb
- Loss of pulse or sensation in the injured arm or leg
- Crepitus (hearing a crackling or popping sound under the skin)

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Long bones fractures

In the case of femur (thigh) and humerus (arm), ALWAYS remember that there is an important blood loss, even if you do not see !!!

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Bones fractures and Blood Loss

Pelvis 1000 – 4000 cc (5000 cc)
Femur (thigh) 1000 – 3000 cc
Humerus 800 – 1500 cc
Tibia 500-1000 cc

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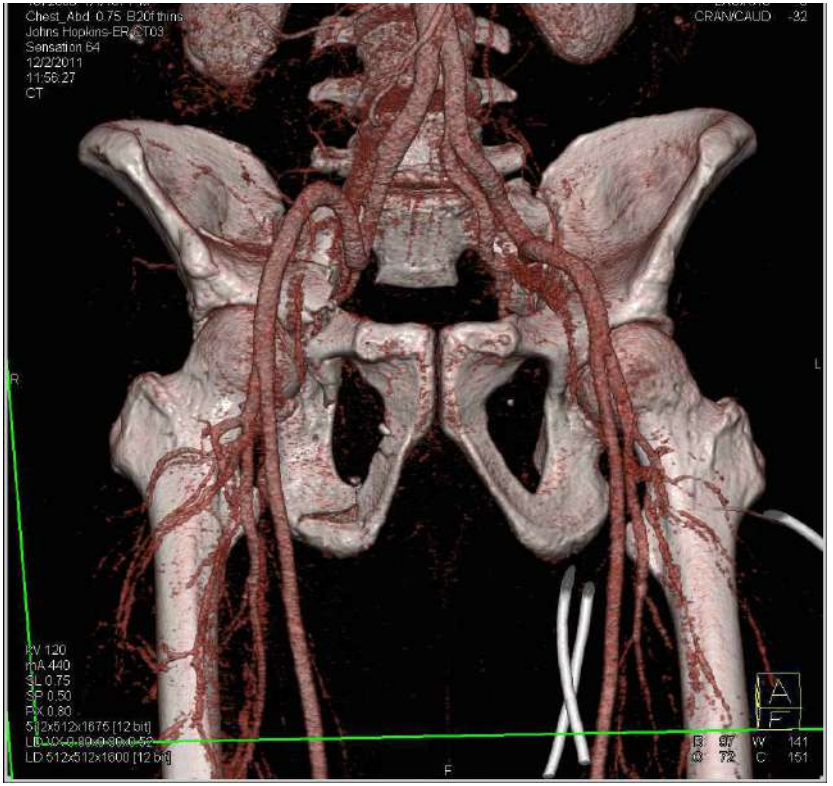
Pelvis trauma

Early management
(without equipment)



They can cause huge blood loss, even if you do not see it !!!

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Bones trauma

Early management (without equipment)

- Evaluate the vital functions → Danger of major bleeding NOT VISIBLE in the event of:
  - Pelvic fractures
  - Long bone fractures
- Open fractures:
  - Do not touch the injury site
  - DO NOT bring back the bone that comes out
  - Control the bleeding by remote compression
  - If contamination (soil, grass, etc.) wash with a jet of water
  - DO NOT DISINFECT !

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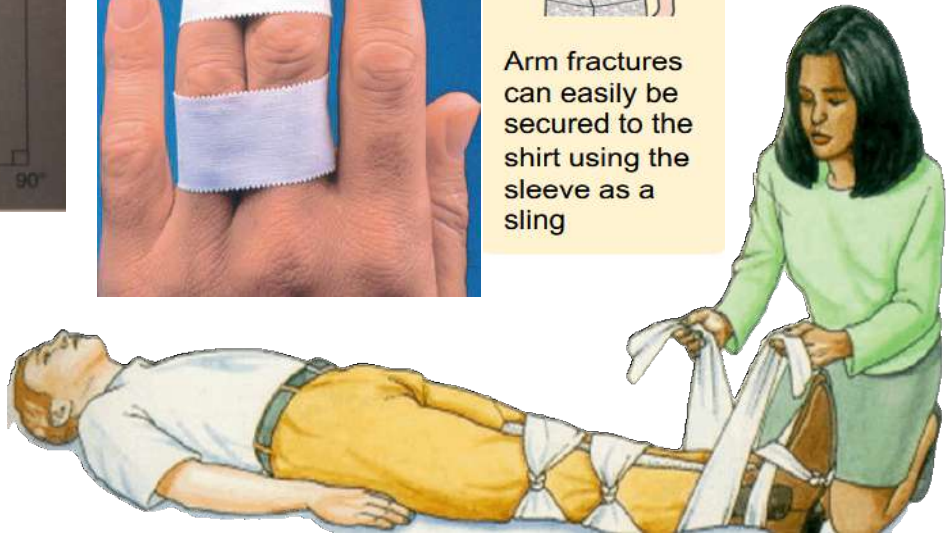
Fractures splinting

SPLINTING WITHOUT EQUIPMENT

You have to immobilize both the joint above and the joint below the area where a fracture is suspected

Arm fractures can easily be secured to the shirt using the sleeve as a sling



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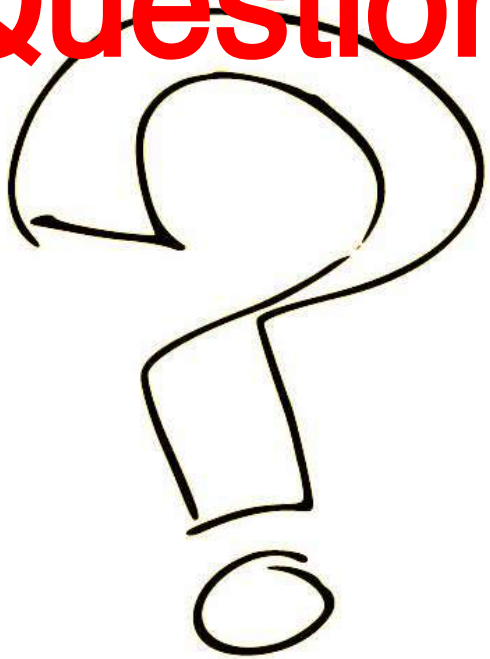
Questions



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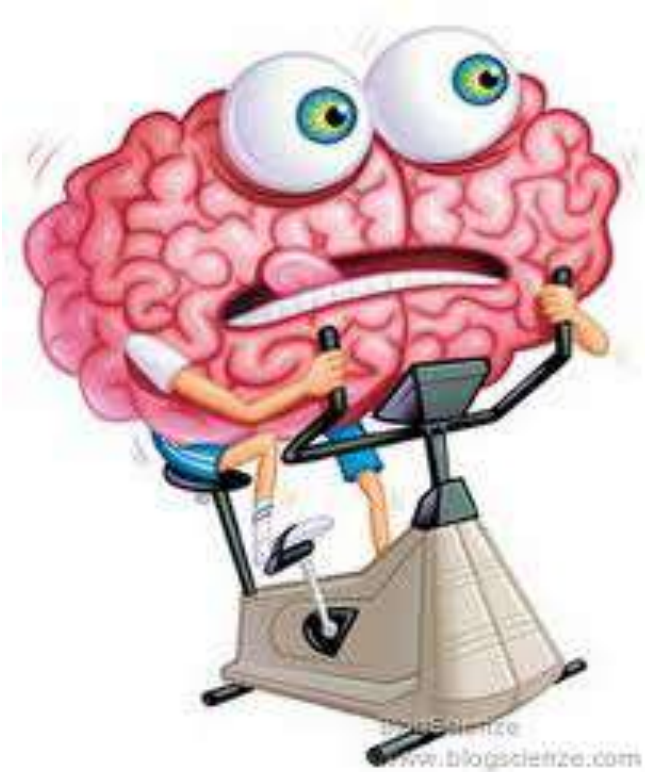

Some mental training …

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Case study

You are driving along a two-lanes roadway with a kerb in between and in front of you a car/motorbike accident just happe

☆ = biker position

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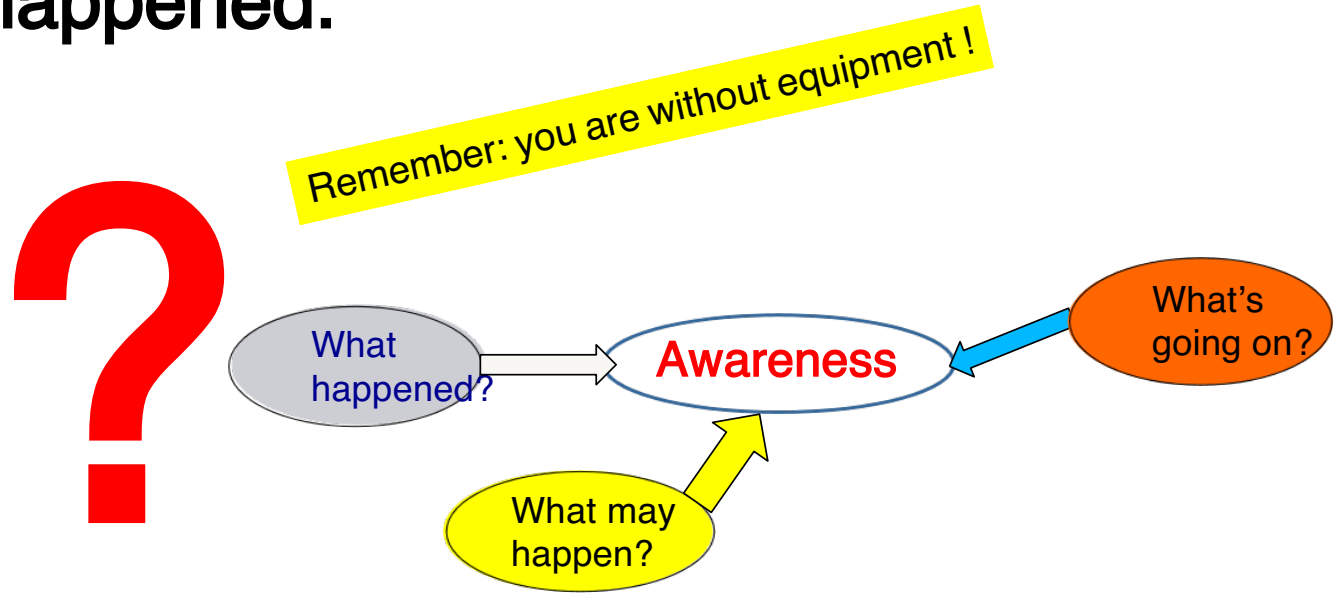
Case study

You are driving along a two-lanes roadway with a kerb in between and in front of you a car/motorbike accident just happened.



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Case study; Scene overview

- Motorcyclist on the ground, 3-4 meters away from the bike;
- Helmet flew away (was not fastened),
- He lies on his back, across the kerb;
- Rapid respiratory rate;
- Rapid and weak radial pulse;
- He's bleeding from his left knee completely shattered, but he only complains of severe back pain;
- A bone stump comes from the knee wound;
- He does not remember what happened, but he remembers his name and knows what day of the week is.

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Case study; situational awareness

What happened?

Biker projected far away after the impact; lying down in between of a roadway; poor head protection; important bleeding from an open knee fracture. High suspicion of pelvic fracture as well (fall on the kerb).

What's going on?

ABCD check-list

A. Airways:
B. Breathing:
C. Circulation:
D. Disability:

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Case study; situational awareness

What happened?

Biker projected far away after the impact; lying down in between of a roadway; poor head protection; important bleeding from an open knee fracture. High suspicion of pelvic fracture as well (fall on the kerb).

What's going on?

ABCD check-list

A. Airways: Patent (until now!)
B. Breathing: Rapid respiratory rate
C. Circulation: Radial pulse weak and rapid
D. Disability: Impaired consciousness (even level A as «Alert» on the A-V-P-U scale, he:
   - Does not remember what happened
   - Complains for back pain BUT not for limb pain)

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Case study; situational awareness

What may happen?

ABCD check-list

A. Airways:
B. Breathing:
C. Circulation:
D. Disability:

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Case study; situational awareness

What may happen?

ABCD check-list

A. Airways: Likely to remain patent
B. Breathing: Respiratory labour
C. Circulation: Hypotension/shock — Why ?
D. Disability: Worsening of consciousness — Why ?

- C= Hypotension/shock
- Direct bleeding from the open fracture of knee
- Possible pelvic fracture
- Likely spinal cord injury → vasoplegic shock
- D= Worsening consciousnes
- Poor oxygen delivery to the brain (see «B» and «C» steps)

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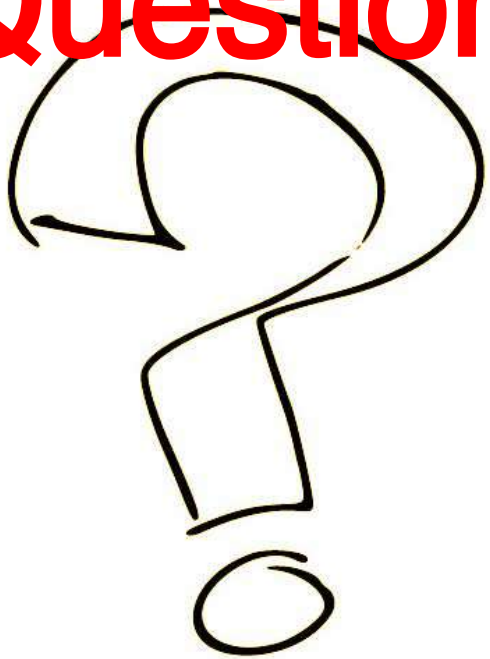
Questions



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Summary

You will always have to D.E.C.I.D.E.

→ High levels of thought organization

- D = define the problem → A good situational awareness
- E = establish the criteria → Shared mental models (i.e. A-B-C-D)
- C = consider all the alternatives
- I = identify the best alternative
- D = develop and implement a plan of action
- E = evaluate and monitor the solution

Decision-making process leads to more effective decisions.

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Thank you for your attention