

# Circulation

including Heart Attack and AED

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Revision notes for

DFMRT Casualty Care Examination Course

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# Indicating special information in “Revision Notes” presentations

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**NEW**

New information since *Casualty Care in Mountain Rescue* was published in 2006.

*NOTE: This presentation only includes essential information. To know the subject in greater depth, you must read *Casualty Care in Mountain Rescue*.*



# Casualty Care syllabus 2009-13

## Circulation

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- Appreciate basic anatomy & physiology
- Be able to assess circulation and recognise abnormalities
- Understand types of shock and their causes
- Be aware of the major causes of blood loss in the trauma casualty
- Understand general treatment principles
- Be able to use appropriately the team's AED



# Components of the circulatory system – Circulating fluid (blood)

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- Fluid component (plasma)
  - Contains chemicals called *clotting factors* to make blood clot.
- Cellular component
  - Red blood cells carry oxygen
  - Platelets help blood to clot
  - White blood cells fight infection



# Pulse (1)

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- What is it?
  - Artery pulsating
  
- Which arteries?
  - Radial
  - Femoral
  - Carotid
  - Brachial
  - Dorsalis pedis (foot)

Practical Tip Practice taking a pulse every opportunity you get (all casualties, family, friends, etc.). Then you will be able to do it reliably when faced with a sick casualty.



## Pulse (2)

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### What to feel for

- Presence/absence
- Rate (fast, normal or slow)
- Rhythm (regular or irregular)
- Strength (strong or weak)



# Pulse (3) – Interpretation of findings

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- Fast (>90-100 in adults)
  - Distress, Pain
  - Bleeding
  - Chest problems e.g. asthma, pneumothorax
  - Abnormal heart rhythm
  - Drugs e.g. amphetamines
- Slow (<60 but could be much less) (adults)
  - Spinal cord damage (upper thoracic or above)
  - Cardiac arrhythmia
  - Severe hypothermia
  - Pre-existing due to drugs; someone who is very fit
  - Severe brain injury
- Irregular
  - Irritable heart e.g. after MI
- Weak
  - Shock e.g. hypovolaemic (blood loss); anaphylaxis; cardiogenic (after MI)
  - Dehydration
  - Severe hypothermia



# Blood Pressure

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- Know the normal (approximately 120-140/70-90)
- Know how to take it properly
- Predicting the blood pressure from the palpable pulses
  - Radial + femoral + carotid = systolic BP probably 80 mm Hg or more
  - Femoral + carotid only = systolic BP probably about 70 mm Hg
  - Carotid only = systolic BP probably about 60 mm Hg

NB These are guides only. They are not 100% accurate





# Capillary Refill Time

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- Normal is <2 seconds.



# Major causes of blood loss in trauma

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Four major sites

- Chest
- Abdomen
- Pelvis
- Femur

The casualty can bleed to death from bleeding at any of these sites, particularly the first three.



# Few practical points

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- *Be suspicious* if history is compatible with major blood loss but there is none/little to see. It may all be inside the body.
- Typical blood loss after fractures:
  - Upper arm 250 – 1000 ml
  - Lower leg 500 – 1000 ml
  - Shaft of femur 1000 – 2000 ml
  - Rib fracture ± haemothorax 150 – 2000 ml
  - Pelvis 500 – 3000 ml

(Q: Why is the range so great in rib and pelvic fractures?)

- NOTE: several smaller injuries can cause as much blood loss as one big one.



# General measures for managing moderate to major bleeding at any site

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- Oxygen
- Lie casualty down
- Keep casualty warm
  - Hypothermia seriously impairs blood clotting – part of the “Triad of Death”
- If BP very low, can raise legs to return some blood from them back to the heart BUT if you do that, remember that if you put the legs down, the BP will fall again
- Small amounts of IV fluids sufficient to keep radial artery palpable (for those people who can do this procedure).



# Specific management of moderate to major bleeding

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- If bleeding from an extremity, elevate the limb
- Direct pressure on bleeding site through a pad
  - Don't forget to wear gloves
- Avoid displacing blood clots. Avoid unnecessary movement (especially pelvis). Stabilise fractures by splinting.
- Pack large open wounds that have big surface area
- Others
  - ?Tourniquet
  - Haemostatic agents are carried by some teams. These are powders that can be poured into an open wound.



# Important 'C' questions when assessing a casualty

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- Is this casualty showing signs of shock?
- Is there any external bleeding?
- Is there possibility of concealed haemorrhage?
- Is there potential for shock to develop?



# Myocardial infarction (heart attack)

## The history (1)

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- Chest pain can be due to many causes including
  - Angina
  - Heart attack
  - Pneumothorax
  - Pulmonary embolism ('clot on the lung')
  - Musculoskeletal
  - Indigestion
- Key to distinguishing MI from other causes of chest pain is to take a good history.
- Important general points in the history
  - Angina / Previous heart operation for angina / Anti-angina drugs
  - Previous MI
  - Smoker / diabetic / family history / obesity / high cholesterol



# Myocardial infarction

## The history (2)

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- Typical MI history
  - Crushing central chest pain lasting >20 minutes
  - ± pain radiates to neck, jaw, L arm, upper abdomen
  - Sweatiness
  - Nausea / vomiting
  - Breathlessness
  - Palpitations
  - Dizziness
  - NB Can mimic bad indigestion





# Myocardial infarction Examination

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- In pain
- Breathless when lying down (allow them to sit up)
- Breathing fast
- Colour (pale)
- Heart rate
  - Fast (distress, abnormal heart rhythm)
  - Slow (abnormal heart rhythm; also, can be caused by some anti-angina drugs patient is taking)
- SpO<sub>2</sub>
  - May be low especially if heart failure or fluid collecting in lungs



# Myocardial infarction

## Diagnosis and management

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- If you have a good history, assume MI and treat appropriately.
- Reassure the casualty (repeatedly). Anxiety makes things worse.
- GTN
  - Worth trying if it could be angina. But if pain >20 minutes, assume MI
- Aspirin
  - If not vomiting
  - Contraindications: Allergy to aspirin; Patient already on it and taken it today
- Good analgesia is essential
  - Diamorphine IN (intra nasal) if available
  - Morphine IM (can occasionally be problem as risk of bleeding from injection site if clot-busting drugs are then used in hospital). If IM morphine is all that you have, THEN USE IT.
- ± antiemetic
- Keep casualty warm. Hypothermia makes heart work harder.
- Monitor and record vital signs. Watch for adverse trends.
- Attach AED and be prepared to use it
- Rapid evacuation to hospital (ideally by air)



# Principles of AED use

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- AED means Automated External Defibrillator not Automatic
- Uses a controlled electric shock passed through the heart to change some cardiac arrest rhythms back to normal rhythms
- The electricity is delivered to the patient via adhesive pads that are stuck on the chest wall
- The machine will assess the cardiac rhythm and advise if a shock is needed



# Principles of AED use – SAFETY

## Use in the presence of water (1)

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- “Remotely possible” to get shocked or to shock bystanders if pooled water around and under the patient (American Heart Association). However, there are no published case reports of this.
- Studies of simulated patient (a turkey or a pig) lying in fresh water, salt water or with wet surface:
  - No significant current leakage when defibrillating a wet pig
  - Maximum voltage 15 cm from patient was 14V peak (14 mA peak) fresh water
  - Maximum voltage 15 cm from patient was 30V peak (30 mA peak) salt water
  - Everywhere else,  $\ll 1V$
  - 30V may result in some minor sensation but is unlikely to be hazardous
- Defibrillators designed for out-of-hospital use have sealed cases so can be used in rain or snow.



# Principles of AED use – SAFETY

## Use in the presence of water (2)

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### Practice points

- Move casualty to dry area if possible.
- Cut off wet clothing covering chest and dry the chest wall.
- Avoid getting the AED pads wet.
- Make sure no one is touching patient when shock button is pressed.
- Defibrillation on a metal surface is safe e.g. helicopter floor.

### REFERENCES in case you want to read more.

- Questions & Answers about AEDs and defibrillation. American Heart Association.  
[http://www.tvfr.com/safetytips/docs/AHA\\_aedqa.pdf](http://www.tvfr.com/safetytips/docs/AHA_aedqa.pdf) (accessed 11/1/13).
- Lyster T, et al. The safe use of Automated External Defibrillators in a wet environment. *Prehosp Emerg Care* 2003; **7**: 307-11.
- Medtronic LIFEPAK 500 Automated External Defibrillator – commonly asked questions (2003).
- Philips Technical note HeartStart AED – Defibrillation on a wet or metal surface (2005).
- Zoll Technical Report – Defibrillation on a wet or metal surface.
- Schratte A, et al. Abstract 82: External cardiac defibrillation during wet surface cooling in pigs. *Circulation* 2006; **114**: II\_1205.



# Principles of AED use – Before placing the pads

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## The five P's

- Perspiration and suntan oil
  - Dry the chest
- Pendants
  - Remove them
- Pacemakers
  - See later slide
- Piercings
  - Remove if possible. If not, place pad to side of piercing
- Patches (e.g. nicotine, GTN)
  - Some substances can explode
  - Remove if near pad site

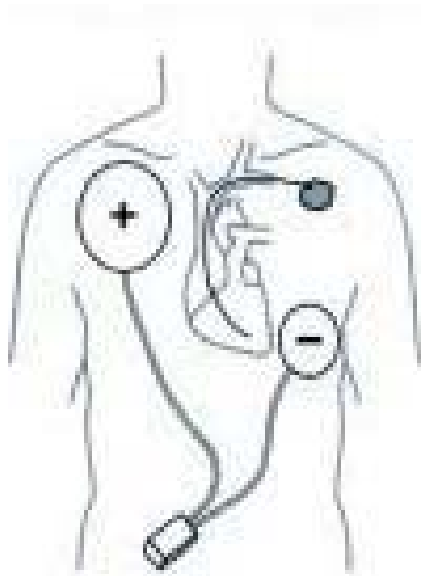
# Principles of AED use – Pad positioning

- The pads generally have a required orientation with the positive over the upper R side of the chest.
- Pads usually have a picture indicating where they should be placed
- Place the R pad above the R nipple but not over the clavicle
- Place the L pad below the left breast and to the side
- Press firmly to get good contact with skin (may need to shave chest)

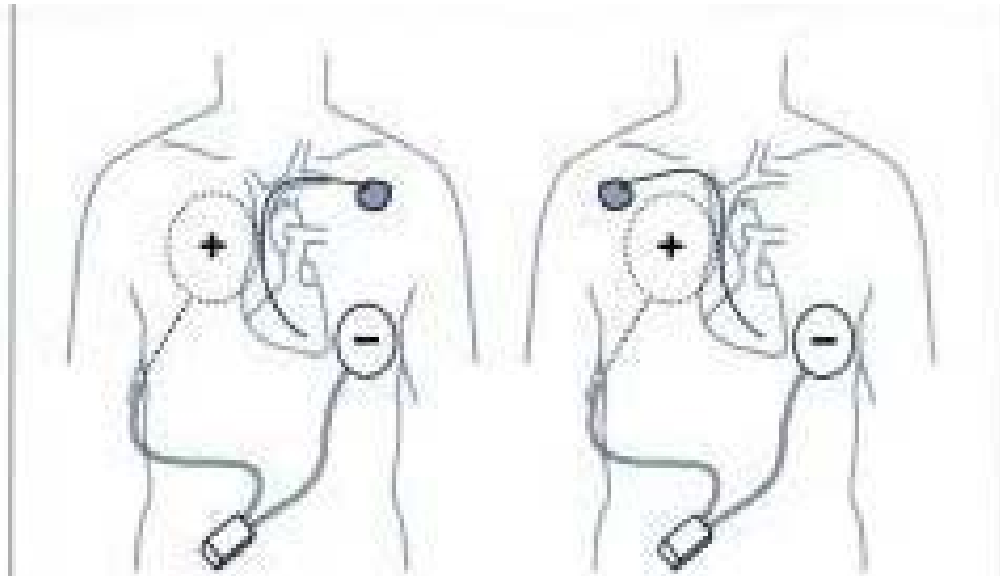


# Principles of AED use – The patient with a pacemaker

- Aim is to place defibrillation pads in patients with pacemaker as far as possible from the pacemaker box.
- When a pacemaker is located where a pad would normally be placed, position the pad at least 1" away from the device.



Ideal position



Alternative anterior-posterior pad placement  
with positive on back of the chest



# Principles of AED use – Safe operation of the device

- Switch on AED (button 1)
  - Voice prompt “Apply Electrodes”
- Place electrodes as above
  - AED will check that pads are making good contact
  - If not, press pad firmly in centre to see if that helps
  - If necessary, remove pads, clean skin, ± shave hair and reapply
- Press button 2 (blue) to start analysis
  - Stop chest compressions during analysis



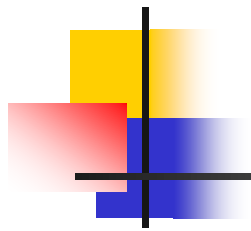
# Principles of AED use – Safe operation of the device

- Shock is needed
  - Voice prompt –  
“Do not touch the patient – Charging”

- Remove any oxygen mask and place >1m away to prevent reservoir of oxygen building up around patient's face.



- BEFORE DELIVERING THE SHOCK, THE PERSON WHO WILL PRESS THE BUTTON MUST VISUALLY CHECK THAT NO ONE IS TOUCHING THE PATIENT AND MUST SHOUT OUT “STAND CLEAR”
- Press button 3 (orange) to deliver shock, and then immediately straight back on to the chest





# Cardiac Arrest

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## Basic Life Support

- Safe to approach
- Shake and shout
- Call for help
- Airway – chin lift/head tilt and look in mouth
- Breathing – count audibly for 10 seconds
- If no signs of life, straight on to chest NB must be IMMEDIATE
- CPR 30:2
- Bag-valve-mask
- 2<sup>nd</sup> person can hold the mask with two hands whilst the person doing chest compressions squeezes the bag
- Use one hand only to squeeze the bag (avoids squeezing too hard and filling the stomach with air)



# CPR – Important issues

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- Know how to use FRED
- i-Gel/LMA insertion
- Severe accidental hypothermia
- How to change the person doing chest compressions
- VF = no circulation i.e. no pulse
- Applying defibrillation pads
- Is it safe to defibrillate a patient lying in a pool of water?
- When should CPR be started?
- When should CPR be stopped?



# Training points

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- Practice taking pulses, CRT and BP.