Cardiopulmonary resuscitation for sports medicine diploma

Series editors: Paul MacIntyre, W S Hills

Advanced life support

Advanced life support (ALS) involves the use of specialised equipment and drugs in an effort to restore spontaneous circulation and is the definitive treatment for all cardiac arrests. Once cardiac arrest is diagnosed, basic life support (BLS) should normally be commenced while equipment is being gathered, although, in certain areas such as coronary care units, defibrillation should be considered immediately without BLS. BLS should not cause a delay in defibrillation.

A single precordial thump should be considered in a witnessed or monitored cardiac arrest. It is a sharp blow to the lower sternum which transfers around 20 J of kinetic energy to the myocardium, which may restore sinus rhythm in some instances of ventricular fibrillation (VF) (fig 1) or pulseless ventricular tachycardia (VT) (fig 2).

In cardiac arrest, two main disorders of cardiac rhythm are recognised (fig 3): ventricular fibrillation/pulseless ventricular tachycardia (VF/VT) and other rhythms including asystole and electromechanical dissociation (non-VF/VT). As VF/VT is the most common rhythm in cardiac arrest and is also associated with the best prognosis, the first priority for ALS is the early identification and treatment of VF/VT. ECG monitoring must therefore take place as soon as possible; an ECG machine, cardiac monitor, or defibrillator may be used. Defibrillators allow ECG diagnosis in two ways: either defibrillator leads are connected to the patient or the paddles are placed on the patient’s chest wall in the standard positions. Monitoring through paddles often speeds up diagnosis, thereby facilitating rapid defibrillation.

VF/VT

If the initial rhythm is VF/VT, a sequence of up to three shocks are administered, the first two at 200 J and the third at 360 J. One paddle is placed firmly over the cardiac apex and the other to the right of the sternum below the clavicle. Gel pads are used to improve skin contact and reduce thoracic impedance. After each shock, the cardiac rhythm is reassessed; a pulse check is carried out on the carotid or femoral artery only if the rhythm changes to a perfusing rhythm.

After the initial three shocks, one minute of BLS is performed, and subsequent shocks are delivered in a sequence (of up to three) at 360 J with one minute of BLS intervening. The airway should be secured, preferably by endotracheal intubation, although a laryngeal mask airway is an acceptable alternative. If no personnel trained in intubation are present, bag and mask ventilation should be continued. Intravenous access is established through either peripheral or central routes and 1 mg adrenaline (epinephrine) is administered and repeated every three minutes. When given peripherally, drug delivery may be enhanced by following each dose with a 20 ml saline flush and by elevating the limb.

After about 12 shocks, consideration may be given to antiarrhythmic treatment—for example, lignocaine (lidocaine), bretylium—or to alternative paddle positions—for example, anteroposterior. Sodium bicarbonate should preferably not be administered without confirmation of a pronounced acidosis, but when no measurement equipment is available, it may be considered after around 25 minutes, especially when resuscitation attempts may have been delayed. Resuscitation should not normally be discontinued while the rhythm is still VF/VT.

Non-VF/VT

If the diagnosis is either asystole or electromechanical dissociation, outcome is generally less favourable unless a reversible cause can be found and treated. If the apparent diagnosis is asystole, it is vital to ensure that a shockable rhythm is not being missed because of lead disconnection, incorrect ECG gain setting, or equipment failure. When doubt exists, treatment is given as for VF.

In non-VF/VT, BLS is carried out in three minute cycles. The airway should be secured as above, and adrenaline 1 mg is administered every cycle. In asystole, atropine 3 mg may be given once only. If electrical activity is present—for example, non-conducted P waves—external or transvenous antiarrhythmic treatment—for example, lignocaine (lidocaine), bretylium—or to alternative paddle positions—for example, anteroposterior. Sodium bicarbonate should preferably not be administered without confirmation of a pronounced acidosis, but when no measurement equipment is available, it may be considered after around 25 minutes, especially when resuscitation attempts may have been delayed. Resuscitation should not normally be discontinued while the rhythm is still VF/VT.

Potential causes of cardiac arrest

- Potentially reversible causes
  - Hypoxia
  - Hypotension
  - Hyper/hypokalaemia and metabolic disorders
  - Hypothermia
  - Tension pneumothorax
  - Tamponade
  - Toxic/therapeutic disturbances
- Non-reversible causes
  - Cardiac arrest
  - Stroke
  - Toxic/therapeutic disturbances
  - Thromboembolic/mechanical obstruction

**Figure 1** ECG rhythm strip showing VF

**Figure 2** ECG rhythm strip showing VT.

**Figure 3** Advanced life support algorithm for the management of cardiac arrest in adults. Note that each successive step is based on the assumption that the one before has been unsuccessful. BLS, basic life support; VF, ventricular fibrillation; VT, ventricular tachycardia; CPR, cardiopulmonary resuscitation; IV, intravenous.
pacing should be carried out where this facility exists. High dose adrenaline 5 mg may be given after three loops, although its efficacy is debated.

In summary, the key to successful ALS is the rapid detection and early treatment of VF/VT. In all cardiac arrests, but especially non-VF/VT arrests, a reversible cause should be sought and promptly treated.

D Muir
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Further reading

Is the sacroiliac joint mobile and how should it be treated?

Depending on the stage of your medical training, the sacroiliac joint is variably mobile.

Way back in the anatomy lab, I remember being taught that this large joint was practically immobile. The sheer strength of the interosseous ligament together with the accessory ligaments and the roughened articular cartilage ensured maximal stability. The bulky metal bolts holding the joints together in the skeleton suspended with a watchful eye socket over our laborious studies only served to reinforce the message: sacroiliac joint—a strong stable joint.

All was to change on the orthopaedic ward, however, where we were led to believe that all joints—natural or replaced—were mobile and, if not, could be gently (or otherwise) encouraged by the omnipresent physiotherapist through varying degrees of movement. No particular significance was placed on the sacroiliac joint, and I presumed it was just as mobile as the dislocating hips and shoulders of the tiny frail old ladies and the leather clad bikers who resided in the ward.

And then on to the Sports Injuries Clinic where, amidst the minutiae of biomechanics, I began to realise the potential for the sacroiliac joint to move, to move excessively or get stuck!

Normally there are small anteroposterior movements during flexion and extension of the trunk with some rotation at end range. These movements may be exaggerated in a variety of sports, particularly if there is unilateral loading as in kicking or throwing. The surrounding ligaments may be sprained if there is a twisting or jarring injury or a direct fall on to one ischial tuberosity. Minor subluxations of the joint are known to occur particularly in young athletes with hypermobility or if there is ligament laxity. Similarly during pregnancy and sometimes premenstrually, hormonal changes allow greater than normal movement. Conversely, there may be a restriction of movement, and this can be noted by the trained eye as an abnormal or absent movement of the posterior superior iliac spine. This dysfunction can be caused by acute or chronic injury: the athlete complains of pain which may be localised or radiate to the buttock.

In the management of the sacroiliac joint, electrotherapy is used to reduce pain and to stimulate repair. Mobilisation and manipulation aims to correct any restricted movement by rotational manoeuvres. Thereafter the athlete is encouraged to continue stretching and strengthening exercises at home with particular emphasis on stretching tight hamstrings and strengthening the abdominal and trunk muscles.

Once settled, it is important to look for a cause in the absence of acute injury. Often there is a training error or overtraining with unilateral loading; astroturf is known to exacerbate jarring type injuries and may have to be avoided. There may also be a chronic injury pattern if there is some anatomical imbalance such as leg length discrepancy or muscular imbalance about the hips or lower back or secondary to childhood hip problems. Associated problems such as pubic stress injury and Achilles tendonitis may have to be addressed.

Athletes with hypermobility have to be managed carefully to avoid excessive movement; an acutely disrupted joint needs bed rest or occasionally surgical fixation. In the extreme case, sclerosant injections or even external frame fixation can treat chronic ligamentous laxity.

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