

accumulates in the pleural space, causing lung collapse and eventually mid-line mediastinal shift towards the other side. This in turn causes a kinking of the great vessels (particularly veins) where they enter the chest. The increase in intrathoracic pressure will also tend to collapse intrathoracic vessels and interfere with cardiac filling. This can significantly reduce venous return and therefore cardiac output.

It is important to remember that tension pneumothorax should be a clinical rather than a radiological diagnosis. It requires immediate decompression. A mechanism for use with a sealed open pneumothorax is mentioned above.

For other cases, (and if removing the dressing above does not help) immediate decompression should be accomplished by inserting a large bore (at least 16g) needle in the second intercostal space, mid clavicular line. Penetration of the pleura results in a characteristic hissing sound as air rushes out, and immediate improvement in the patient's condition. This manoeuvre has converted the tension pneumothorax into an ordinary pneumothorax. Leave the needle in place. It will now be necessary to insert a formal UWSD. This is true even if air failed to rush out as there is a possibility that the needle itself could damage the lung and lead to further air leak.

Tension pneumothorax should always be looked for after beginning positive pressure ventilation (IPPV) in the trauma patient, as IPPV is associated with a higher incidence of this problem.

Massive Haemothorax: This entity is rare but life-threatening. The syndrome of signs has been described above. Usually more than 1500ml of blood has been lost into the chest cavity which may lead to lung compression. Thus blood loss is compounded by hypoxia. UWSD insertion may result in release of a tamponade effect on the bleeding points and as such it is essential to restore adequate intravascular volume as soon as possible. Thoracotomy will need to be considered if the initial drainage of blood is 1500ml+ or if the ongoing loss is 200ml+/hr.

Flail Chest: Flail chest occurs when a segment of the thoracic wall does not have bony continuity with the rest of the thoracic cage. Most commonly this is caused by multiple rib fractures, but damaged cartilages and sternal fractures may also contribute.

The flail segments move paradoxically, that is it moves in when the rest of the chest is expanding and out when the rest of the chest is moving in. This paradox will, of course, only be present in the spontaneously breathing patient as IPPV will cause all segments to move the same way at the same time. Flail chest is invariably associated with underlying lung contusion.

Occasionally flail chest may be initially missed. This may be because of splinting of the chest wall due to muscular spasm, or to the flail being placed in the axilla and splinted by the adjacent arm. Always examine the side and the back of the chest. Many of these patients can be managed with oxygen, analgesia and careful fluid administration. However in the acute situation, if ventilation appears inadequate, consideration should be given to early IPPV.

SUMMARY: Good breathing assessment and management is important and includes inspection, palpation and auscultation. Significant life-threatening chest injuries identified during the primary survey include;

- airway obstruction
- open pneumothorax
- tension pneumothorax
- massive haemothorax
- flail chest
- cardiac tamponade

Therapeutic manoeuvres include;

- airway management
- sealing open wounds
- needle thoracocentesis
- formal UWSD insertion
- IPPV
- intravascular volume replacement
- pericardiocentesis (see next issue)

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MEDICAL HELICOPTERS FOR MOTORSPORT - THE CASE FOR MINIMUM STANDARDS

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Helicopter transport of the injured patient has a history of some forty years, beginning with the military, but continuing in the civilian setting. Despite this relatively long history the subject remains controversial.



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Opinion tends to be polarised into two groups: those who see helicopters as a retrieval panacea - and those who see them as nothing more than expensive, noisy, and dangerous toys.

Neither view point is rationally tenable. The West German Luftretting program has shown EMS (Emergency Medical Service) helicopters can be both safe and cost effective (1). It is also a useful model of appropriate tasking, staffing and equipment - the key to maximising benefit from the use of EMS helicopters.

Most major motorsport events now have helicopter "medevac" capability, either on site or on call. International regulations usually require that a helicopter be made specifically available for the management of injury to competitors. Sometimes competitors are medevac'd by helicopter for convenience rather than any real medical indication. Obviously though, the aircraft is deployed primarily for transport of the critically injured, and must be suitable for that role.

At a recent motorsport event in Australia, a competitor suffered limb injuries and a spinal crush fracture. A decision was made to evacuate this patient by helicopter. The helicopter concerned was a light utility class, four seater, machine, made available to the event as a result of sponsorship. It was equipped with a litter kit, but had no other medical fitments.

The patient, who had received narcotic analgesia but no antiemesis, was strapped supine to the litter, and the litter placed in the helicopter where there was no adequate access by the medical attendant, nor was suction available. Fortunately, this patient did not vomit in transit, however, had he done so there, could have been serious sequelae. This case highlights the lack of guidelines for helicopter medevacs at motorsport events.

In this case, helicopter transport did not permit adequate clinical standards due to the provision of an unsuitable aircraft with inadequate medical facilities. Such a compromise should not be necessary.

There is a tendency to regard every helicopter as suitable for medevacs - a misconception akin to regarding every car as a road...

...continued from page 13 ambulance. Light utility craft such as the Bell JetRanger and Hughes/McDonnell Douglas 500 series are four to five seat aircraft with cabin space equivalent to a small hatchback such as a Daihatsu Charade. As significant medical interventions are not possible within the confines of such craft, their use for transport of patients with other than minor injuries is difficult to justify.

Moving up a class, the Aerospatiale Squirrel and Bell Long Ranger are six to seven seat craft which can be satisfactorily adapted for the aeromedical role. By removing the co-pilot seat, a single patient can be carried longitudinally with room for two medical crew, including one behind the patient's head in the vital airway control position. Also in this class is the light twin MBB B0105 whose unusual design permits double patient transport, with loading via rear clamshell doors.

Up a class again are medium weight twins such as Bell's 412, Aerospatiale's Dauphin, and MBB's BK117 - all of which can carry two patients and two or more medical crew in a cabin separated from the cockpit. This class of aircraft is becoming more common with EMS programs in Australia. Any of these aircraft mentioned can be adapted for the patient transport role, as can larger models.

Having selected a suitable aircraft one must then select the staff and equip it appropriately. Naturally any patient should be actively resuscitated and stabilised prior to transfer. Unfortunately this does not preclude further problems in transit; especially in blunt trauma, where injuries to some organ systems may initially be occult and go unrecognised. The medical crew must be capable not only of continuing therapy, but diagnosing and treating change or deterioration. The team should number at least two, and include one procedurally skilled senior medical member (anaesthetist, intensivist or A&E specialist).

Similarly, the medical facilities must aim to enable continuation of an advanced level of monitoring and care, plus enable enhancement (eg intubation, CPR, needle thoracostomy) if required. Minimum standards for equipment for transport of the critically ill have been outlined (2,3,4) as have compact, mobile intensive care modules (5,6,7), which enable an adequate medical facility to be provided in a suitable multi role helicopter.

The following is a suggested code of minimum standards for designated medical rotorcraft. These are not a Utopian formula, rather they represent what can be realistically achieved upon an appropriate helicopter with medical input.

- 1 Capacity of at least one stretcher patient.
- 2 Ability to seat two medical attendants, one of whom shall be at the patients head.
- 3 Provision of main and reserve (portable) oxygen and suction systems.
- 4 Fitted with mobile intensive care equipment including ECG, pulse oximetry, BP monitoring, ventilator with disconnect alarm, and at least one infusion pump, preferably in a detachable module.
- 5 Fitted with overhead IV hooks.
- 6 Equipped with full range of ALS drugs, self-inflating (Ambu type) bag, intubation equipment, IV fluids with giving sets and cannulae and equipment for needle to tube thoracostomy.
- 7 Equipped with a defibrillator that can be safely used in flight if required.
- 8 Intercom with VOX (voice activated, hands free) facility for medical crew; and ability to isolate pilot(s) to allow unrestricted voice communication between medical crew.
- 9 Fitted with appropriate emergency service radios for the area of operations.

The standard of medical support at major Australian motorsport events compares favourably with anywhere in the world. However, a laissez faire attitude to the medevac component of medical services can easily see it become the Cinderella of the system.

The same standard of professionalism must be applied to helicopter medevac as to the rest of the medical system; the aim always being to produce clinical excellence all the way from trackside to treating hospital.

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