SECTION 3

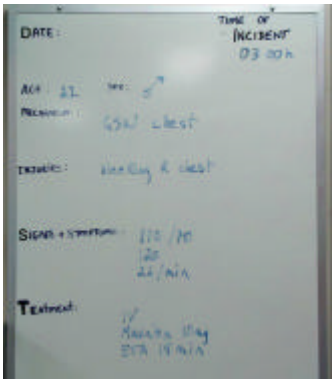
CLINICAL GUIDELINES

SECTION 3

The acronym for the rapid transmission of necessary information from the pre-hospital care providers is 'MIST':

- **M** Mechanism of injury
- **I** Injuries sustained or suspected
- **S** Signs- vitals on scene and during transport
- **T** Treatment initiated (drugs, fluid, etc)

Whether you are getting information from ambulance control via the "BAT" phone or in direct communication with the ambulance attendants via the radio in the resuscitation room, this information allows the best preparation for the arriving injured patient. If the information is not transmitted, ask for it and then document it on the whiteboard at the head of each patient bay in the resuscitation room well before patient arrival.



This is the information that the rest of the trauma team relies on to assist in preparation. Missed information is a missed opportunity to provide quicker, more directed care.

With the arrival of the pre-hospital care providers and the patient, it is important that this information along with the most recent observations and treatment be reiterated. The Trauma Team Leader must ensure that the resuscitation area is absolutely quiet and that the information is audible to all team members.

Once this information is transmitted (should take less than 30 seconds), the ambulance officer or paramedic then ensures that the correct MIST information is on the whiteboard at the head of the patient trolley.

Transfer of the patient from the ambulance trolley to the resuscitation bay can occur during hand-over as long as quiet is maintained. If required by an obvious need, the Airway Doctor commences primary survey during hand-over.

ENSURE THE HAND-OVER ADHERES TO THE 'MIST' INFORMATION ONLY. ANY FURTHER INFORMATION OR CLARIFICATION CAN BE COMMUNICATED AFTER THE PRIMARY SURVEY.

PRIMARY SURVEY

The primary survey provides for the **systematic evaluation, detection and management of immediately life threatening complications resulting from severe trauma**. It is imperative that each step is followed in the correct sequence and that progress to the subsequent step only occurs if the prior step has been fully assessed and managed. Each team member can follow the sequence as a team and members allocated roles such as "Airway", "Circulation", etc. will be fully aware as to the timing of their involvement. This allows for greater team cohesion and ease of management by the Team Leader.

PRIMARY SURVEY

Airway - and total spine control
Breathing
Circulation - with haemorrhage control.
Disability - brief neurological evaluation (AVPU).
Exposure - completely undress the patient.

GREAT MISTAKES OF THE PRIMARY SURVEY

A Forgetting to look into mouth
Neglecting the spine
B Inadequate examination
Leaving clothes on!
C Resuscitation but not stopping the bleeding
D Doing "D" before "C"
E Under and over exposure

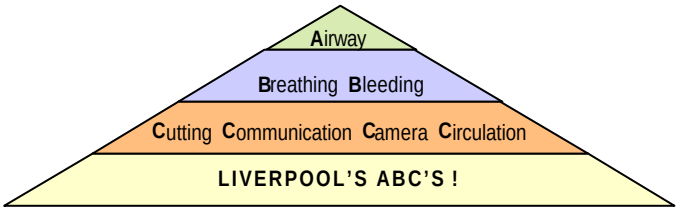
Step 1: (Airway Doctor) Ask the patient his / her name. If the patient fails to respond appropriately (i.e. vocalise, eyes open and look towards the doctor) then such patients are immediately identified as high risk.

Step 2: If the patient responds appropriately, he / she should be asked to take a deep breath. Observe and listen for evidence of upper airway obstruction (tracheal tug, use of accessory muscles, inability to perform manoeuvre adequately, presence of stridor, etc). Look for chest expansion abnormalities (one side hyperinflated with poor expansion suggesting pneumothorax, in-drawing suggesting obstruction, paradoxical movement suggesting high cervical spine injury, flail segment, etc).

Step 3: Ask the patient to cough. This allows for a second observation of a deep breath and assesses ability of the patient to close his / her glottis (laryngeal injury, which also may have become obvious when patient first vocalised, chest wall integrity and pain from rib fractures or subdiaphragmatic abdominal organs, etc). Patients with penetrating eye injuries, pulmonary barotrauma, significant head and spinal injuries should not be asked to cough.

AIRWAY

Problems may be a direct result of injury or as a complication of other injuries (e.g. severe head injuries, effects of drugs / toxins (e.g. alcohol, nonprescription drugs, carbon monoxide, etc).



Oxygen Starvation?
Apply oxygen via a self-inflating resuscitation bag and mask which can be used to support ventilation for bradypnoeic patients pre-intubation and post-intubation. All other patients should receive high flow oxygen (at least 15 l/min) via a facemask fitted with a reservoir.

Upper Airway?
Restoration of an obstructed airway can involve oropharyngeal suction, jaw thrust (avoid chin lift for those at risk of cervical spine injury) and oropharyngeal airways. The latter are only a "bridge" to insertion of an oral endotracheal tube (ETT) and should never be relied upon as a substitute for an ETT.

Secure the Airway!
ETT insertion should always be performed using a pre-rehearsed algorithm, that includes a difficult to ventilate and difficult to intubate drill with which you are familiar. A failed emergency oral endotracheal intubation should be followed up with an immediate surgical airway. The laryngeal mask airway (LMA) can be considered as a means for attaining temporary airway and / or ventilatory control during an initial failed oral intubation or as a "bridge" to a surgical airway. All other artificial airway manoeuvres at this stage should be otherwise largely disregarded.

Anaesthesia should always be induced with appropriate medications as judged from the clinical circumstances. At least 3 assistants are required. One to maintain manual in-line cervical spine immobilisation, another to draw and give drugs and hand over airway equipment and a third to apply careful cricoid pressure.

Capnography must be used for initially confirming ETT placement and then continued. ETT position within the trachea should be verified by CXR.

CERVICAL SPINE
Always apply an appropriately sized hard collar with sandbags and appropriate head tapes.

BREATHING
Immediate life threatening problems of tension pneumothorax should be addressed by insertion of an under water sealed pleural drain. The indications for emergency department needle thoracocentesis are very infrequent. All needle thoracocentesis (pre-hospital and in-hospital) should be immediately followed by insertion of a pleural drain (32Fr in an adult).

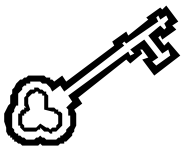
Alert!
Mechanical ventilation should be commenced with great care and always be monitored with capnography and pulse oximetry. In the presence of any unresolved ventilatory problems, the patient should be immediately disconnected from the ventilator and hand ventilated with inspired oxygen of 100% whilst the problems are assessed.

Don't forget inspection – a key to diagnosing tension pneumothorax and flail chest.

CIRCULATION
The 4 most common causes of shock in trauma patients:

Haemorrhage
Bleeding
Exsanguination
Hypovolaemia

Hypovolaemia is the most common cause of shock in trauma. Therefore, in the presence of hypotension, it is reasonably safe to assume haemorrhage and direct team efforts toward stopping the bleeding. Other causes that may require immediate attention are: tension pneumothorax, cardiac tamponade, cardiac dysfunction as a result of contusion, spinal shock and anaphylaxis.

5 KEY TOOLS FOR DIAGNOSING MAJOR BLEEDING			
	**Site**	**Tool**	**Time Required**
	Chest	CXR	6 minutes
	Abdomen	FAST or DPL	5 minutes 15 minutes
	Pelvis	PXR	10 minutes
	Long Bones	Eyes	2 minutes
	External	Eyes	1 minute

Management involves initiation of intravenous fluids, definitive surgical and / or angiographic intervention. Never delay the latter so as to "catch up" with the fluid administration.

STOPPING THE BLEEDING IS THE MOST IMPORTANT PRIORITY!!

All obvious external haemorrhage should be identified by adequate patient exposure and managed by applied pressure. Appropriate splinting of long bone fractures through alignment and immobilisation is also important.

Initial fluids may be isotonic crystalloids or colloids. It probably does not matter which, as long as they are warm (taken directly from the fluid warmer and administered through a Level 1™ warmer). These can be followed up by O negative blood (immediately available), group specific blood (delay of 20 - 30 minutes) or fully cross-matched blood (delay of 45 minutes).

Intravenous access should consist of 2 large bore IV cannulae (16G or greater in adults). Failing that, a venous cutdown (saphenous vein or antecubital) or femoral central access with a large bore rapid infusion, single-lumen catheter. There is no place for multi-lumen central venous catheters in early trauma resuscitation.

A RAPID INFUSION CATHETER CONNECTED TO THE LEVEL 1™ IS BEST IN AN UNSTABLE PATIENT – KNOW HOW TO USE ONE!!

OTHER IV ACCESS SITES

- Cutdowns – ankle / groin.
- Intraosseous – remember BIG™ (Bone Injection Gun) in adult.
- Corpus cavernosum (men only).

DISABILITY

Disability, in terms of the primary survey, is assessed by the AVPU scale:

A - alert, that is responds to voice appropriately, i.e. obeys commands
V - vocalises, may be inappropriate or incomprehensible sounds
P - responds to pain only (should be assessed in all 4 limbs if initial limb fails to respond)
U - unresponsive to pain.

A more complete Glasgow Coma Score can be determined as part of the secondary survey. Care should be taken when interpreting the Vocal and Eye components as these can be affected by injury or presence of ETT, etc. The most reliable is the Motor component and this should always be scored accurately after assessing all limbs.

EXPOSURE

- Expose the patient.
- Log roll and examine the back.
- Attend to PR examination. This must be done prior to male catheterisation.

Expose the patient only for the duration of the external examination. Once this has been completed, cover the patient with warm blankets and keep him / her covered unless re-examination is necessary.

Adjuncts to the primary survey include:

Radiology:

- CXR first
- PXR second
- C-spine third

For physiologically unstable patients a chest and pelvic x-ray should be taken and developed immediately. All other radiological investigations (including cervical spine) can follow. Patients with uncorrected cardiovascular / respiratory systems should only be going to the radiology department for immediate definitive angiographic procedures and cerebral CT scans (avoid the temptation to add to the initial radiology management plan). Patients must always have an appropriate medical escort.

In haemodynamically unstable patients only (otherwise, these wait until after secondary survey):

1. **Diagnostic Peritoneal Lavage (DPL): open technique,** lower section of the umbilicus (non pregnant)

   OR,

2. **Focused Abdominal Sonography for Trauma (FAST):** only by trained and accredited operators.

The secondary survey involves a full assessment of the patient after the initial primary survey and resuscitation. It should be guided, in part, by the MIST hand-over and the severity of injury to the patient. It is a **systematic and definitive examination by the trauma or general surgery registrar from head to toe** and guides the trauma team's subsequent management. It is imperative that the secondary survey is performed methodically and all findings are carefully documented. Identification of all major injuries allows a rational treatment algorithm to be formulated. A missed injury may lead to unexpected morbidity and mortality.

The secondary survey covers (in this order):

1. Head and scalp / maxillofacial.
2. Cervical spine and neck.
3. Chest.
4. Abdomen and pelvis.
5. Back and perineum.
6. Extremities.
7. Neurological.

HEAD / SCALP / MAXILLOFACIAL

The entire scalp / head should be examined for contusion / bogginess / laceration / fracture.

DO NOT forget the bleeding occipital laceration as the patient can slowly exsanguinate whilst other injuries are being attended to. Haemorrhage should be controlled before continuing the secondary survey.

The eyes should be reassessed before haematoma / oedema closes them i.e. pupils / acuity / conjunctival haemorrhage / ocular penetration / ocular entrapment / contact lenses (remove).

LOOK FOR SIGNS of base of skull fracture such as otorrhoea / rhinorrhoea / Battle's sign and raccoon eyes. Check midface mobility / loss of teeth / mandibular occlusion / mandibular fractures.

USE AN OROGASTIC tube if midface or frontal bone fractures are suspected.

REMEMBER orbital rim deformity / infraorbital nerve entrapment.

CERVICAL SPINE AND NECK

Patients with head injury / maxillofacial trauma or those wearing helmets must be assumed to have an unstable cervical spine injury. Absence of neurological signs DOES NOT exclude a c-spine injury.

CHECK for cervical spine tenderness. BEWARE of distracting injuries.

CHECK for subcutaneous emphysema, tracheal deviation / laryngeal fracture / carotid artery dissection / penetrating neck wound / expanding haematoma / arterial bleeding / airway compromise / brachial plexus injury.

DO NOT explore neck wounds that penetrate the platysma in the emergency department (i.e. avoid the “cranio-digital reflex”!!).

DO NOT REMOVE a cervical collar until the cervical spine has been assessed clinically and radiologically. Remember in-line immobilisation if the patient is to be moved or log rolled. A lateral c-spine x-ray should be obtained as an adjunct to the primary survey along with chest and pelvic x-rays.

Remember the best way to access the mandible as part of the secondary survey is to take off the cervical collar – if you do, get someone to hold the head and stabilise the c-spine.

CHEST

The entire chest should be inspected for adequate expansion / sucking wound / flail segment.

Palpation of the clavicles / ribs / sternum for tenderness / subcutaneous emphysema. Auscultate for absent air entry (haemothorax / pneumothorax / ruptured diaphragm), Hamon's crunch (pneumo-pericardium), noisy air entry, distant heart sounds plus distended neck veins / hypotension (cardiac tamponade).

Clinical signs of a tension pneumothorax:

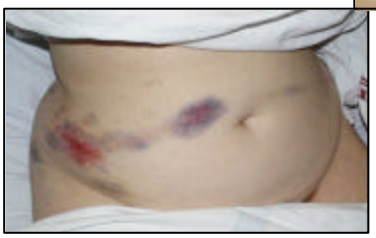
- Respiratory distress "I can't breathe"
- Hyperinflated chest
- Deviated trachea
- Decreased breath sounds / increased resonance
- Tachycardia
- Hypotension.

BEWARE rapid progression of pulmonary injury / contusion to respiratory failure in the elderly patient.

INTERPRET the CXR carefully and systemically				
A	-	Airway	-	deviation?
B	-	Lung Fields	-	pneumothorax?
			-	contusions?
			-	haemothorax? (remember patient is flat)
C	-	Heart & Great Vessels	-	wide mediastinum?
			-	apical cap?
D	-	Diaphragm	-	intact?
E	-	Extremities + Bones	-	fractures?

ABDOMEN

The anterior abdomen extends from the 4th intercostal space to the symphysis pubis / inguinal ligaments. The upper abdominal viscera are partially covered by the lower bony thorax. The abdominal viscera may be injured by a direct blow or torn by decelerating forces such as a high speed motor vehicle crash (MVC).



Take a careful history of the mechanism of injury i.e. blunt / penetrating / stab / high or low velocity gunshot / number of wounds / exit sites / distance from the assailant / amount of external bleeding at scene. The relevant history in an MVC includes closing speed / type of collision / patient trapped or crushed / deployment of airbags / use of and type of seatbelts / patient position in vehicle and status of other passengers.

A large amount of blood may be present in the peritoneal cavity without any change in girth / appearance. The diagnosis of peritonitis may be compromised in the injured patient by decreased level of consciousness / altered sensorium e.g. spinal cord transection / distracting injuries. Remember the pancreas can be fractured on the vertebral body by a direct blow / MVC.

BUCKLE UP!!
THINK BOWEL AND BLADDER INJURY

BEWARE the patient with abdominal bruising from seatbelt lapsash as they may have a bowel injury (mesenteric or hollow viscus) which can be missed on CT scanning.

The key to determining bowel injury in a patient with a seat belt mark is identifying tenderness and guarding distant from the seat belt burns.

A DPL is a very useful test!

BEWARE the cyclist with handlebar injury to abdomen and shoulder tip pain.

The abdominal examination includes inspection / auscultation / palpation / percussion.

LOOK for:

- penetrating wounds
- abrasions
- contusions
- lacerations
- impaled foreign body
- evisceration
- blood at the urethral meatus.

LISTEN for the presence / absence of bowel sounds.

Bowel sounds may be important:

- Absent bowel sound = ? peritonitis
- This clinical test requires a stethoscope and 20 seconds of your time.

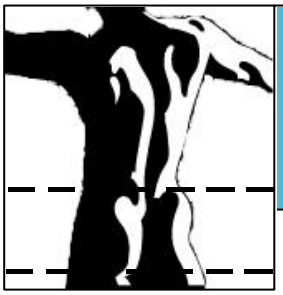
PALPATE for signs of peritonitis i.e. involuntary muscle guarding / rebound tenderness. Check for pelvic instability.

PERCUSS for hypertympany in acute gastric dilatation / diffuse dullness of haemoperitoneum / subtle signs of peritoneal irritation.

BACK AND PERINEUM

After the anterior abdomen has been assessed the patient should be log rolled with in-line immobilisation of the cervical spine. The entire spinal column should be palpated for tenderness.

- Any entry / exit wounds should be noted.
- Scrotal or perineal bogginess.
- Bruising may indicate a urethral tear.
- Rectal examination may reveal loss of anal tone (cord transection).
- High riding prostate gland (ruptured urethra).
- Blood in the rectum (bowel injury).
- Pelvic fractures.
- Check for vaginal lacerations.



The gluteal region extends from the iliac crests to the gluteal folds and any gluteal penetrating injury can cause significant pelvic visceral lacerations. BE WARY!

EXTREMITY
LOOK / FEEL / MOVE. Inspect and palpate for deformity / tenderness / pulses / haematoma.

Loss of sensation or function may be due to cord or nerve transection, but remember ischaemia or compartment syndrome as causes.

Ligament rupture and fractures of small bones of hands and feet may not be apparent until the tertiary survey.

NEUROLOGICAL
This involves a re-evaluation of the GCS score, complete sensory and motor assessment of the upper and lower limbs.

Remember to check for sensory level / priapism / loss of anal sensation or tone.

REFERENCE:
1. *Advanced Trauma Life Support for Doctors. Instructor Course Manual Book 1 - Sixth Edition,* 1997, American College of Surgeons, Chicago.

The trauma radiology series (CXR, PXR, lateral c-spine) is performed during the patient's resuscitation and assessment as part of the primary survey. Further specialised tests may be needed during the secondary survey.

Maximum Time to Imaging:

- CXR 1 - 3 minutes
- PXR 5 - 10 minutes
- C-spine 10 - 15 minutes

CONTRARY to what you have been taught – a tension pneumothorax SHOULD be on a CXR!

Why?

Because the patient should have an x-ray by the 1 minute mark.

'MIST' information transfer takes 45 seconds and the team MUST be lead gowned for all trauma team activations.

IF IT'S NOT ON – IT'S NOT ON!

The trauma patient SHOULD NOT be transferred out of the resuscitation area for diagnostic tests unless haemodynamically stable.

REMEMBER: A YOUNG PATIENT WILL COMPENSATE WITH SINUS TACHYCARDIA AND VASOCONSTRICTION BEFORE ANY CHANGES IN BP ARE APPARENT.

CHEST

Mediastinum

If a widened mediastinum (aortic injury) or lung field opacity (haemothorax, pulmonary contusion) is present on supine CXR, an upright CXR should be done (after the c-spine is cleared). Persistent mediastinal widening mandates arch aortography. Erect CXR's are often not possible.

Echocardiography

Patients with blunt chest trauma and unexplained hypotension (i.e. no haemorrhage) or ECG changes (cardiac contusion / "slow" tamponade) require cardiac echo.

ABDOMINAL / PELVIC

Gastric Tube

Patients with head injury / LOC / severe injuries will invariably have acute gastric dilatation and should be decompressed with a gastric tube. USE OROGASTRIC tubes if suspected base of skull / cribriform plate fracture.

Diagnostic Peritoneal Lavage (DPL)

A DPL is used to assess the presence of a visceral injury in the patient with abdominal trauma. It should be performed in the haemodynamically unstable patient. Other DPL indications include:

a. patients who cannot respond appropriately to abdominal examination (altered LOC, altered sensation, distracting injuries, unreliable patient);
b. absence of CT / FAST for noninvasive abdominal assessment.

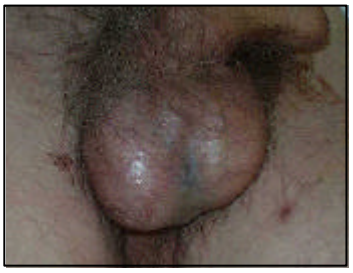
ONLY ACCREDITED personnel should perform DPL or FAST.

BEWARE the missed retroperitoneal injury if FAST or DPL is used for rapid abdominal assessment. (see pages 155 and 161 respectively)

Urinary Catheter

Urinary catheters SHOULD NOT be passed in suspected urethral injury:

- blood at meatus
- boggy perineum
- fractured pelvis
- high-riding prostate
- scrotal bruising.

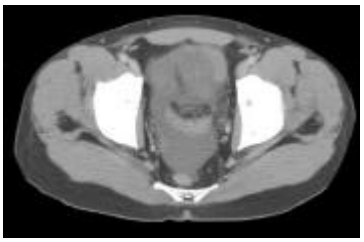


GET A URETHROGRAM BEFORE ATTEMPTING TO PASS CATHETER (remember ABC – comes before U!).

CYSTOGRAPHY should be performed in patients at high risk of bladder injury (e.g. pelvic crush fractures), where there is frank haematuria.

Abdominal CT Scan

Abdominal CT with IV and oral contrast documents organ injury in the stable patient. BEWARE free fluid on CT in the absence of solid organ injury i.e. bowel and mesenteric injury.



OTHER

Spinal x-rays

Vertebral x-ray series should be performed in patients with neurological signs, pain on palpation of spine, falls from height, high-speed motorcycle crashes and some car crashes. Additionally, patients with significant mechanisms of injury and a decreased level of consciousness require spinal x-rays.

REFERENCES:

1. *Advanced Trauma Life Support for Doctors. Instructor Course Manual Book 1 - Sixth Edition,* 1997, American College of Surgeons, Chicago.
2. Bester L, Johansson K, Kolkman K, Perez A, Sugrue M. Dilemmas in Assessment of Abdominal Trauma, in *Manual of Ultrasound in Trauma*. Liverpool Health Service and the University of New South Wales, 2000, Sydney.