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TRAUMA

Introduction / Overview

- In this Emergency Department major trauma is approached utilising the principles outlined by the Advanced Trauma Life Support (ATLS) / Early Management of Severe Trauma (EMST).
- These principles involve activation of a trauma team and operate in five phases of management.

PPE

All medical and nursing staff responsible for assessment and treatment of major trauma patients must have the following personal protection equipment (PPE) available:

- Lead gowns
- Gloves
- Masks
- Plastic aprons
- The airway doctor and nurse are required to wear appropriate PPE and lead gowns
- All other team members are required to wear appropriate PPE
- All invasive procedures must be performed with aseptic / sterile technique

Criteria for Activation of the Trauma Team

The Trauma Team is to be activated when any ED or Hospital trauma criteria are filled after:

- A call received from SJA; or
- A patient arriving unannounced at triage; or
- A patient is transferred from another institution; or
- When the Triage Nurse, Assessment Nurse, Shift coordinator or Duty Medical Officer in ED believe a team is needed.
ED TRAUMA CALL CRITERIA

WHEN PATIENT MEETS BELOW CRITERIA

TRIAGE / ASSESSING NURSE to TANNOY:

“ED TRAUMA CALL” and “LOCATION”

Triage: Follow ATS protocol

Transfer patient to:
1. Resuscitation Bay (including Paediatric Patients)
2. Bay 12 or 13 (Paediatric patients to Paediatric bed)
3. Main Department bed
4. Triage Examination Room

PRE-HOSPITAL

Pregnant >20 weeks
More than 1 patient

OR

<table>
<thead>
<tr>
<th>MECHANISM</th>
<th>CLINICAL</th>
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</thead>
<tbody>
<tr>
<td>Motor Vehicle / Motorbike Crash &gt;60 km/hr</td>
<td>Hand / Foot amputation (excludes digits)</td>
</tr>
<tr>
<td>Watercraft / Quad bike Crash</td>
<td>Significant Injury One (1) body region:</td>
</tr>
<tr>
<td>Significant Vehicle Damage</td>
<td>• Head</td>
</tr>
<tr>
<td>Pushbike / Pedestrian vs Car &lt; 30 km/hr</td>
<td>• Chest</td>
</tr>
<tr>
<td>Fall &gt;2m Adults or twice Child’s height</td>
<td>• Abdominal</td>
</tr>
<tr>
<td>Penetrating /Crush Injury: Limb</td>
<td>• Pelvic</td>
</tr>
<tr>
<td>Burns &gt;10% Adult or Child</td>
<td>• Spinal</td>
</tr>
<tr>
<td>Fall from Horse</td>
<td></td>
</tr>
<tr>
<td>Dive onto head in shallow water</td>
<td></td>
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</tbody>
</table>

ED TRAUMA TEAM MEMBERS

May be upgraded at any time to Hospital Trauma Call

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HOSPITAL TRAUMA CALL CRITERIA

MANDATORY for all patients who meet the below criteria
CALL ‘55’ - “HOSPITAL TRAUMA CALL” From Triage
(All Hospital Trauma Calls to Resus)
Triage as per ATS

PRE-HOSPITAL
Ejection / Entrapment / Rollover / Fatality at scene
Pushbike / Pedestrian vs Car >30 km/hr
Penetrating / Crush Injury: Head / Neck / Torso
Blast / Explosion Injury
Fall >3 m Adults or >2 m Child
Multiple patients: >2

OR

CLINICAL

<table>
<thead>
<tr>
<th>AIRWAY</th>
<th>CIRCULATION</th>
<th>DISABILITY</th>
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<td>Compromised Airway</td>
<td>HR &lt;50 or &gt;120 Adult or Child &gt;140</td>
<td>GCS 12 or less Neurological deficit / seizures</td>
</tr>
<tr>
<td>BREATHING</td>
<td>Systolic BP &lt;100 mm Hg</td>
<td>Motor or sensory loss</td>
</tr>
</tbody>
</table>
| RR <10 or >29 Adult or Child >40 | Capillary Refill >2 seconds Pelvic Instability | Other
| SaO₂ <90% | Limb Amputation | Significant injury 2 or more body regions:
| Respiratory distress | | • Head
                  | | • Chest
                  | | • Abdominal
                  | | • Pelvis
                  | | • Spinal

TRAUMA CALL TEAM (HOSPITAL) MEMBERS

ED TRAUMA TEAM PLUS

Surgical Registrar
Anaesthetic Registrar / 9121
Radiology / 5181
After Hours Manager / After Hours CNC

Orderly Coordinator
• Orthopaedic Registrar
• Paediatric Registrar
• O&G Registrar

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ROLE ALLOCATION

The Trauma Team (TT)

- The composition and roles of the TT are as follows:
  - Trauma Team Leader
  - Doctor 1, Airway and cervical spine
  - Airway Nurse (R1), assist intubation manage ventilation
  - Doctor 2, Patient assessment, IV access and procedures, stands to right of patient
  - Circulation Nurse (R2), set up procedures, drugs, operate defibrillator
  - Doctor 3, IV access and procedures, stands to left of patient
  - Scribe Nurse, documentation, check drugs
  - Radiographer
  - Orderly
  - Specialist doctors / teams as required (ICU, anaesthetics, general surgery, orthopaedics, paediatrics)

Once a decision to activate the trauma team has been made, only the Trauma Team Leader may reverse that decision.
Team Member Priorities

The Trauma Team Leader (TTL):

Stands back at the foot of the bed

- **Who:**
  - ED Consultant On Duty, or;
  - ED Registrar if consultant not present, or;
  - Senior Medical Officer nominated by the ED Consultant On-duty / On-call.

- **Roles:**
  - The principle roles of the TTL is to:
    - Coordinate the assessment and resuscitation of the patient and the activities of the TT.
    - Oversee the management and progress of the case
    - Liaise with the other specialist teams
    - Prioritise management and investigative procedures
    - Predict and communicate expected difficulties in management e.g. airway / intubation / vascular access
  - In the phase of pre-hospital preparation the TTL supervises
    - The preparation of the resuscitation area
    - The other members of the TT to receive the patient.
  - The TTL assigns roles and delegates responsibilities for tasks to the medical staff in the TT
  - Takes handover from the ambulance officers and clearly identifies what issues have been addressed and what issues are outstanding e.g. cervical / thoracic / lumbar spine clearance, possible intra-abdominal / pelvic blood loss, possible urethral injury etc.

- Delegates responsibility for, primary survey
- Delegates responsibility for, secondary survey
• Coordinates activities of the TT, orders and oversees resuscitation, investigative / therapeutic procedures
• Coordinates the disposition of the patient to the appropriate inpatient team and or facility.
• All staff defer to the TTL
• All communication is through the TTL
• Any disputes are addressed through the TTL
• De-escalates as appropriate by asking non-essential team members to leave the resuscitation area to ensure smooth running of the department.
• Responsible for communication with family / NOK (or delegates role to appropriate person)

Doctor 1: Airway and cervical spine
Stands at head of patient
• Who:
  • ED consultant / Reg / SMO
  • Anaesthetist / Reg; Intensivist / Reg; Supervised RMO as assigned by TTL
• Roles:
  • Prepares resuscitation area for airway and cervical spine management
  • Ensures that the appropriate airway equipment is available and checked
  • Supervises transfer of patient from ambulance stretcher onto resuscitation trolley
  • Assesses and establishes airway patency and communicates to team
  • Manages airway and ventilation
  • Verbalises expected difficulties in airway or intubation to TTL and airway nurse
  • Manages cervical spine immobilisation
  • Communicates with patient regarding care

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PERFORMS other tasks as assigned by the TTL

Airway Nurse (Resuscitation 1) - is the nursing team leader of resuscitation area

**Responsibilities are to:**

- Work on the patient’s right
- Confirms resuscitation area checks are carried out.
- Ensures Airway, Circulation, Team leader and scribe stickers are used during a priority / trauma patient
- Assist Doctor with airway management and intubation and communicates with airway doctor clearly
- Anticipates the need for difficult airway equipment
- Cares for and assists in the ongoing management of ventilated patients
- Support resuscitation 2 & Scribe Nurse
- Manages the resuscitation area in relation to patient flow
- Liaise with Shift coordinator and Main floor nursing team leaders regarding patient acuity and flow

Doctor 2: Circulation and Patient assessment, IV Access / Procedures

**Stands at patient’s right**

- **Who:**
  - ED Registrar / RMO
  - Surgeon / Surgical registrar
  - As assigned by TTL

- **Roles:**
  - Control major external haemorrhage (with nursing assistance)
  - Prepares and obtains large bore IV access, draw bloods for essential investigations
- Prepares equipment for likely procedures as determined by pre-hospital notification and as directed by the TTL
- Assesses patient – primary followed by secondary survey
- Performs procedures as directed by the TTL
- Performs other tasks as assigned by the TTL
- Documents the assessment and treatment of the patient (using the trauma form)

**Circulation/Procedures Nurse (Resuscitation 2)**

- **Responsibilities**
  - Preparation of drugs / infusions after liaison with Medical team leader
  - Works on the patient’s left
  - Assists doctor in control of external haemorrhage
  - Removes / cuts off patient’s clothes
  - Records manual blood pressure and then a full set of observations
  - Applies monitoring equipment
  - Records 12 lead ECG
  - Administration of drugs as instructed by medical team leader
  - Does cricoid pressure (if responsible for doing this then does nothing else until cricoid no longer required)
  - Prepares for and assists with procedures
    - IVC
    - IDC
    - Arterial line
    - CVC
    - ICC
  - Prepares equipment and patient for transfer to:
Doctor 3: IV Access / Procedures

Stands at patient’s left

- **Who:**
  - ED Reg / RMO
  - As assigned by the TTL

- **Roles:**
  - Control of major external haemorrhage (with nursing assistance)
  - Pulse check on patient
  - Prepares and obtains IV access and draws bloods for essential investigations
  - Sends bloods for FBC, UEC, LFT, Lipase, Coagulation profile, Group and Hold (ensures that labelling is correct and takes responsibility for this), Calcium (as requested by TTL)
  - Notifies lab of required urgency
  - Performs tasks as assigned by the TTL
  - May be required to perform Cricoid pressure if required

Scribe Nurse

- **Responsibilities**
  - Works at the end of the bed
  - Documentation of primary, secondary survey and interventions in time order
  - Ensures all forms commenced and completed
  - Check infusions / drugs

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• Ensures all drugs given are written up and signed for on medication chart
• Documents names of trauma team members as well as names and time of attendance of inpatient teams (hospital trauma call)

Shift Coordinator

• Responsibilities

  • Ensure resuscitation team is gathered
  • Ensure trauma call activated if appropriate
  • Ensure priorities are met in the ambulance entrance with the Medical team leader and orderly.
  • Ensure Triage of priority 1 is carried out
  • Provide assistance and clinical support as required for R1, R2, and scribe nurse
  • Support relatives or delegates appropriate staff to do so

Phases of Major Trauma Assessment and Management

1. Pre-hospital preparation.
2. Primary survey and management of immediate life-threats.
3. Resuscitation Phase.
4. Initiation of shock management, reassessment of oxygenation, and re-evaluation of haemorrhage control.
5. Secondary survey.
6. Definitive-Care: Disposition / transfer for further investigation, definitive treatment, ongoing management.

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Phase 1: Pre-hospital Preparation

- In most instances of significant trauma presenting via ambulance to this hospital there will be notification made by the attending ambulance team. This is usually in the form of a phone call, either from the ambulance team directly or indirectly from ambulance control.
- Telephone call to be taken by senior doctor or nurse.
- Complete the Priority One Call sheet. If time allows, there is potentially useful information that can be obtained at this stage, which can aid in the preparation to receive the patient e.g.:
  - Age and sex of patient, and identifying details if available.
  - Circumstances of injury / accident.
  - Condition of patient on arrival of ambulance team to site of injury.
  - List and estimated severity of injuries.
  - Condition of the patient during transport, e.g. airway patency.
  - Haemodynamic status, level of consciousness etc.
  - Estimated time of arrival.
  - Other possible casualties apart from the index case which are in transit to the ED.
- On the basis of the information obtained from the notification call a decision as to whether to activate the Trauma Team should be made – see ED Trauma and Hospital Trauma Call Criteria. If there is any doubt it is preferable to err on the side of caution and activate the team.
- Prior to the patient’s arrival the following steps should be undertaken to prepare for reception:
  1. Activate the Trauma Team through switch via ‘55’ if indicated.
  2. Ensure that adequate appropriate staff are assembled, or notified.
3. If an ED Consultant is not immediately available the most senior Registrar present should take the role of the Trauma Team Leader.

4. Assign roles to members of the Trauma Team and identified by using stickers provided.

5. Prepare the resuscitation area.

6. Appropriate resuscitation bay to receive patient.

7. Decant stable patients to appropriate beds.

8. Ensure adequate staffing to monitor patients unsuitable for decanting from resuscitation area.

9. Check equipment.

10. PPE for all staff.

11. Each member of the trauma team is responsible for checking equipment relevant to their tasks.

12. Airway equipment, ETT, BVM, suction, drugs, hard collar.

13. IV access equipment, cannulae, fluids, blood-tubes, request forms and ED trauma documentation / form.

14. Other equipment that may be required on the basis of the pre-hospital notification, e.g. ICC setup, Bare-Hugger (forced warm-air blanket) etc.

**Phase 2: Primary survey, resuscitation and management of immediate life-threats**

The aim of this phase is the rapid identification and simultaneous management of immediate life threatening injuries.

The following mnemonic summarises the primary survey:

A **Airway maintenance with cervical spine control**

Identify and manage foreign body in airway, facial fractures, loose or broken teeth, laryngeal / tracheal injury, and associated cervical spine injury. **Note: always assume there is a cervical fracture in any patient with multisystem trauma, distracting injuries and / or a relevant mechanism.**
B Breathing and ventilation
Identify and manage thoracic injury e.g. tension / open / haemo / pneumothorax, flail chest, fractured ribs etc.
Remember: adequate oxygenation and ventilation of the trauma patient must include the delivery of adequate volume and inspired concentrations of oxygen.

C Circulation with haemorrhage control
Identify and manage haemorrhage from ‘external wounds’, thoracic, abdominal, pelvic, long bone injury. Also consider reduced cardiac output from tension pneumothorax, pericardial tamponade, cardiac contusion etc.

D Disability: Neurological status
A rapid neurological evaluation at the end of the primary survey establishes the patient’s level of consciousness (GCS or AVPU), papillary size and reaction and any obvious lateralising deficit.

DON’T EVER FORGET GLUCOSE
Remember to check the BSL.

E Exposure/Environmental control
Completely undress the patient to allow a thorough assessment, however prevent hypothermia and be aware of the patient’s modesty. Once the assessment has taken place care should be taken to keep the patient warm – e.g. use of blankets, forced air rewarming etc.

It should be emphasised that management of immediate life threats is initiated at the time of identification.
Assessing the response to therapy or deterioration of the patient’s condition should prompt completing another primary survey.

The following is a list of the important/frequently missed problems to be sought with each step of the primary survey, along with some notes:

**Airway and cervical spine**
- Foreign body in the airway
- Mandibular or maxillo-facial fracture
- Tracheal or laryngeal separation
- Cervical spine injuries (Remember: Assume a cervical fracture in any patient with multisystem trauma)

**Breathing and Ventilation**
- Tension pneumothorax
- Flail chest with pulmonary contusion
- Open pneumothorax
- Massive haemothorax

**Circulation with Haemorrhage Control**
Hypovolaemia resulting form:
- Intra-abdominal or intra thoracic injury
- Fractures of the femur and/or pelvis
- Penetrating injuries with arterial and/or venous involvement
- External haemorrhage from any source

Reduced cardiac output from haemodynamically significant injuries:
- Pericardial tamponade
- Tension pneumothorax
IMPORTANT:
Assessment of the circulation involves evaluating the patient’s blood volume/cardiac output by estimating the amount of blood loss that has occurred (direct observation and blood loss at scene), any ongoing blood loss as well as clinical evaluation for signs of shock/ reduced cardiac output

Blood volume and cardiac output:
Three elements of observation:
1. Level of consciousness:
   - Cerebral perfusion is critically impaired and unconsciousness results when the circulating volume is reduced by 50% or more
2. Skin colour:
   - Ashen grey skin of the face and white skin of blood drained extremities implies blood volume loss of at least 30%.
3. Pulse:
   - Rapid thready pulses are early signs of hypovolaemia.

Ongoing blood loss:
- External, exsanguinating haemorrhage should be identified and controlled in the primary survey. Direct pressure on the wound or pneumatic splintage of long bone fractures may be life saving
- Continuing haemodynamic instability despite control of obvious haemorrhage and adequate resuscitation usually indicates ongoing occult blood loss

Disability: Neurological status
- Decreased oxygenation
• Shock
• Head Injury
• Altered level of consciousness secondary to alcohol and/or other drugs

NOTE:

• A rapid neurological evaluation at the end of the primary survey establishes the patient’s level of consciousness, pupillary size and reaction, and any obvious literalised deficit.
• “AVPU” or Glasgow Coma Score (GCS)
  • AVPU
    • Alert
    • Responds to Vocal stimuli
    • Responds to Painful stimuli
    • Unresponsive

Exposure/Environmental control

• Complete exposure of the patient is mandatory to fully assess for life threatening injuries that may be hidden by clothing or bedclothes. However iatrogenic hypothermia can develop quickly and, once adequate assessment is made, attention should be paid to keeping the patient warm.
• This may be achieved by:
  • the use of warmed blankets
  • forced air rewarming
  • warmed and humidified inspired gases
  • the use of a blood/IV fluid warming device if large quantities of IV fluids are to be infused.
PRINCIPLES OF RESUSCITATION:

The principles of volume resuscitation are simple: “turn the tap off and replace losses”

- The resuscitation phase commences simultaneously with, or soon after, the primary survey. It is characterised by the initiation of shock management along with continual reassessment of response to treatment, and treatment of life threatening conditions identified in the primary survey.
- If at any stage of management the patient becomes unstable then the primary survey is performed again to identify and treat causes for change in condition. This includes reassessment of airway control, ventilation, blood volume/cardiac output, ongoing losses, and neurological injury.

1. Control ongoing haemorrhage
   - Obvious external haemorrhage and long bone fractures are identified and managed early.

2. Establish adequate IV access
   - Usually two large bore (16 gauge+) cannulae, one in each upper limb
   - Alternatives to this will depend on the patient’s injuries but it is always preferable to gain IV access above the diaphragm.

3. Commence infusion of an adequate volume of an appropriate IV solution
   - Crystalloid followed by blood/blood products as required
   - Blood lost should be replaced with blood products

4. Reassess the patient and their response to resuscitation
The management of the multi-trauma patient is a dynamic process requiring continual monitoring and reassessment of the patient's condition and response to treatment.

The patient’s response to initial fluid resuscitation is the key to determining subsequent therapy.

Continuing instability despite adequate resuscitation measures (e.g. 2000 mL crystalloid in an adult, 40 mL/kg crystalloid in a child) is indicative of ongoing occult blood loss. It indicates a need to alter the therapeutic approach, i.e. use of blood or blood products, emergent transfer to theatre, reassessment for signs of pericardial tamponade etc.

Phase 3: The Secondary Survey

The secondary survey commences only after the primary survey and management of immediate life-threats has been completed, and resuscitation has been commenced.

It should be emphasised that ongoing or recurrent instability mandates a return to the primary survey and a reassessment of the resuscitation efforts.

In some instances transfer to theatre for definitive management of injuries resulting in ongoing or recurrent instability may be necessary prior to completion of the secondary survey.

The secondary survey is characterised by a head-to-toe examination with the aim of identifying all injuries, both major and minor.

Documentation should reflect not only the injuries identified, but also the areas examined in which injuries are excluded, and areas not examined and which need to be assessed at a later time.

This is important as in the setting of severe multi-trauma it is easy to miss seemingly trivial injuries (e.g. a fractured digit) which, if left untreated, may later lead to significant functional disability.
The secondary survey includes the “trauma series” of X-rays (i.e. CXR, cross-table lateral c-spine, and pelvis) as well as a “log-roll” to assess the patient’s posterior surface.

An examination of the perineum and a rectal examination should not be forgotten.

In addition, this is the time to place naso/orogastric tubes and urethral catheter.

Trauma ultrasound (FAST) is appropriate if an experienced person who can perform this procedure is available.

**Phase 4: Definitive Care / Disposition**

- Disposition of the patient clearly depends on the injuries sustained, the patient’s response to resuscitation, and ongoing clinical condition.

- Decisions regarding disposition and transfer for definitive care are made by the TTL in consultation with the inpatient teams (e.g. ICU, General Surgery, Orthopaedics etc.).

- Any dispute regarding the disposition of a major trauma patient should be referred to the ED Consultant On-Call.

- It should be emphasised that no patient who is unstable should be transferred from the resuscitation area (e.g. to CT scan). An exception would be a patient being transferred to the Operating Theatre for urgent surgery.

- Major trauma, in most instances, will require transfer to a major trauma centre.

**Phase 5: Tertiary Survey**

- A thorough head to toe clinical examination of the patient must be performed within the next 24 to 48 hours of presentation by the admitting team.

- The goals of the tertiary survey is to diagnose injuries missed during the primary and secondary surveys.

- In addition to clinical examination, all X-rays and CT scans should be reviewed and new X-rays requested as indicated from the physical examination.
• Injuries that may be missed during primary survey and that need to be identified during the tertiary survey often have great functional importance and impact the return of the patient to normal occupational, family and social functions.

• They usually pose little threat to life but often would lead to locomotor or manipulative disability if undetected and untreated.

• Examples include:
  o cervical spine injury without neurological deficit
  o fractures of small bones in the hands and feet
  o ligamentous injuries to the knee or ankle
  o dislocated acromioclavicular joint
  o peripheral nerve injuries.

• Review of previous X-rays will sometimes result in a new diagnosis of pneumothorax, widened mediastinum, pelvic fracture or rib fractures that require specific management.

• Occult visceral injury, in particular small bowel injury, may be suspected at this stage on the basis of increasing pulse rate, increasing temperature and localised abdominal tenderness. Subtle signs of brain injury must be sought.

• The tertiary survey will in all likelihood be performed at the tertiary trauma centre for patients transferred from Joondalup Health Campus.

eFAST - Extended Focused Assessment With Sonography for Trauma

• Ultrasound has emerged as a sensitive and reliable tool to evaluate patients presenting to the emergency department with acute and sub-acute chest and abdominal trauma with hypotension.
• Focused bedside ultrasound can accurately detect fluid in the peritoneal and pleural cavities and air in the pleural cavity and it is more reliable than physical examination if performed by a trained operator.

• Furthermore, use of bedside ultrasound in chest and abdominal trauma expedites time to definitive care, because it can help determine whether an emergent intervention such as an intercostal chest tube or trauma consultation and surgery are required.

• The specifics of eFAST are beyond the scope of this document.