Mass Casualty Incidents

Clinical Guidelines

2023

Queensland Health

Queensland Government

The Queensland Government acknowledges and respects traditional owners and Aboriginal and Torres Strait Islander elders past and present, on whose land we work to support the provision of safe and quality health care.

Mass Casualty Incidents Clinical Guidelines 2023

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An electronic version of this document is available at https://qheps.health.qld.gov.au/hdmu

Disclaimer

Introduction

We acknowledge and appreciate the initial work from the NHS in which this document has been based and their generous support in sharing this with Queensland.

Mass Casualty Incidents Clinical Guidelines

Contents

Foreword

The delivery of high quality and timely care in Queensland has unique challenges due to the significant geographical distances and decentralised and diverse populations.

Mass casualty incidents present an additional challenge and require an extraordinary response from both the healthcare system and all of its component parts, and our frontline healthcare workers.

The Clinical Guideline for Mass Casualty Incidents provides the guidance and protocols to support clinicians to meet the significant challenges of a mass casualty event.

This innovative guideline is intended to assist our clinicians when facing the challenges of a mass casualty event, especially those practising in locations and facilities which may not deal with trauma on a routine day to day basis. The principles of the guideline are intended to be flexible, scalable and applicable in both rural and remote and urban settings.

The guideline is both evidence based and peer reviewed, and it represents the current state of best practice in the field of mass casualty management.

The Queensland guideline is an adaptation of a guideline developed by the United Kingdom National Health Service (NHS) in response to an increased threat of mass casualty events in Europe. Queensland Health accordingly acknowledges the generous and unconditional sharing of an already extensive document by our United Kingdom colleagues.

Queensland Health's Disaster Management Branch collaborated with the Jamieson Trauma Institute in order to adapt the clinical guideline to the Queensland system and context, using a clinical panel of Queensland based content experts from tertiary, regional, rural and remote facilities, in additional to Queensland Ambulance Service and other agency partners.

I commend this guideline to any clinician and facility which might find itself involved in the response to a significant mass casualty incident. Whilst this guideline has been developed for mass casualty incidents, it is sincerely hoped that this will also prove to be a valuable resource and assist in the care and management of all patients with major trauma in Queensland.

Shaun Drummond

Director-General
Queensland Health

JAMIESON TRAUMA INSTITUTE

Queensland Government

Introduction

Disaster Management Branch

The Disaster Management Branch (DMB) provides state-wide strategic and operational leadership and governance for disaster and emergency incident management for Queensland Health. Along with having custodianship of the State Health Emergency Coordination Centre, the DMB strives to provide the plans, training, tools and resources to support Queensland Hospital and Health Services responding to mass casualty and other disaster events.

The DMB is pleased to partner with the Jamieson Trauma Institute to deliver this clinical guideline, originally developed by the NHS, and with their kind permission, adapted specifically to the Queensland health system and context. This guideline is the culmination of a true collaboration between the Jamieson Trauma Institute, Queensland Health, Queensland Ambulance Service, the NHS and subject matter clinical experts in Queensland through the Clinical Working Group.

We are proud to present a clinical guideline that provides practical guidance to frontline clinicians providing healthcare in a mass casualty event across Queensland.

Jamieson Trauma Institute

The Jamieson Trauma Institute represents a unique collaboration of service partners, striving to advance trauma prevention, research and systems, clinical management, and disaster preparedness, to deliver the best possible care for people who suffer a traumatic injury.

This guideline originally developed by the NHS in the United Kingdom and gifted to Queensland, is designed to give our frontline clinicians the confidence and support to manage a variety of traumatic injuries in their local facilities. This resource will not replace their local policies and protocols, but rather complement them with a united goal of quality disaster preparedness.

It is important to acknowledge the Clinician Working Group and the State Emergency Services Teams, and their respective networks, who as representatives from across the State, were given the task of reviewing the NHS version and making adaptations to suit Queensland's unique health landscape.

We are proud to partner with the Disaster Management Branch and the NHS, to develop a clinical guideline that is specific to the challenges of providing healthcare in a mass casualty event across Queensland. Like our counterparts and partners, we hope that the scenario this guideline represents never eventuates, but rather that this guideline is primarily used to inform our education, preparation, and training for such an event.

How to use this guide

If a Major incident has been declared, turn to MI STAND UP and follow the guidance from this point. If there is time, the mechanism of injury section should be reviewed as the METHANE report communicates the types of injury mechanism(s) involved.

It is important that these guidelines are practical, self explanatory, relevant to the users and updated regularly. Individual guidelines can be (and will be) updated independently. You can check that you are using the most up to date version of any guideline by checking the version number on the latest index page at the front of the guidelines or on the web https://qheps.health.qld.gov.au/hdmu/docs-and-policy or https://www.publications.qld.gov.au/dataset/queensland-health-disaster-management-plans.

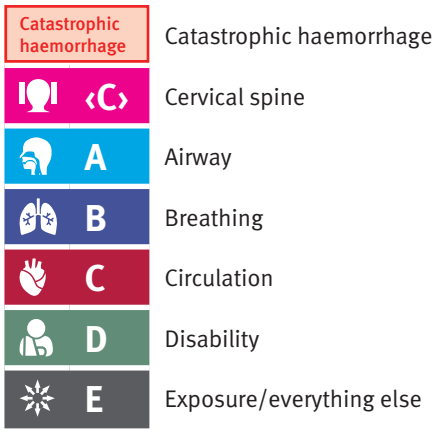
All feedback and suggestions, from current and future contributors will be gratefully received. Please email DMB@health.qld.gov.au or Jamieson_Trauma_Institute@health.qld.gov.au.

We look forward to hearing from you.

Key

The following symbols are used throughout these guidelines to emphasise the text, but have not been strictly applied. They may mean:

- must do, mandatory, immediate action
- check this has been done
- choices, look for, decision to be made
- consider, point of note
- alerts, warning
- avoid, do not
- link to internal reference
- time critical



Catastrophic haemorrhage

Cervical spine

Airway

Breathing

Circulation

Disability

Exposure/everything else

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Mass Casualty Incidents

Pre-event planning

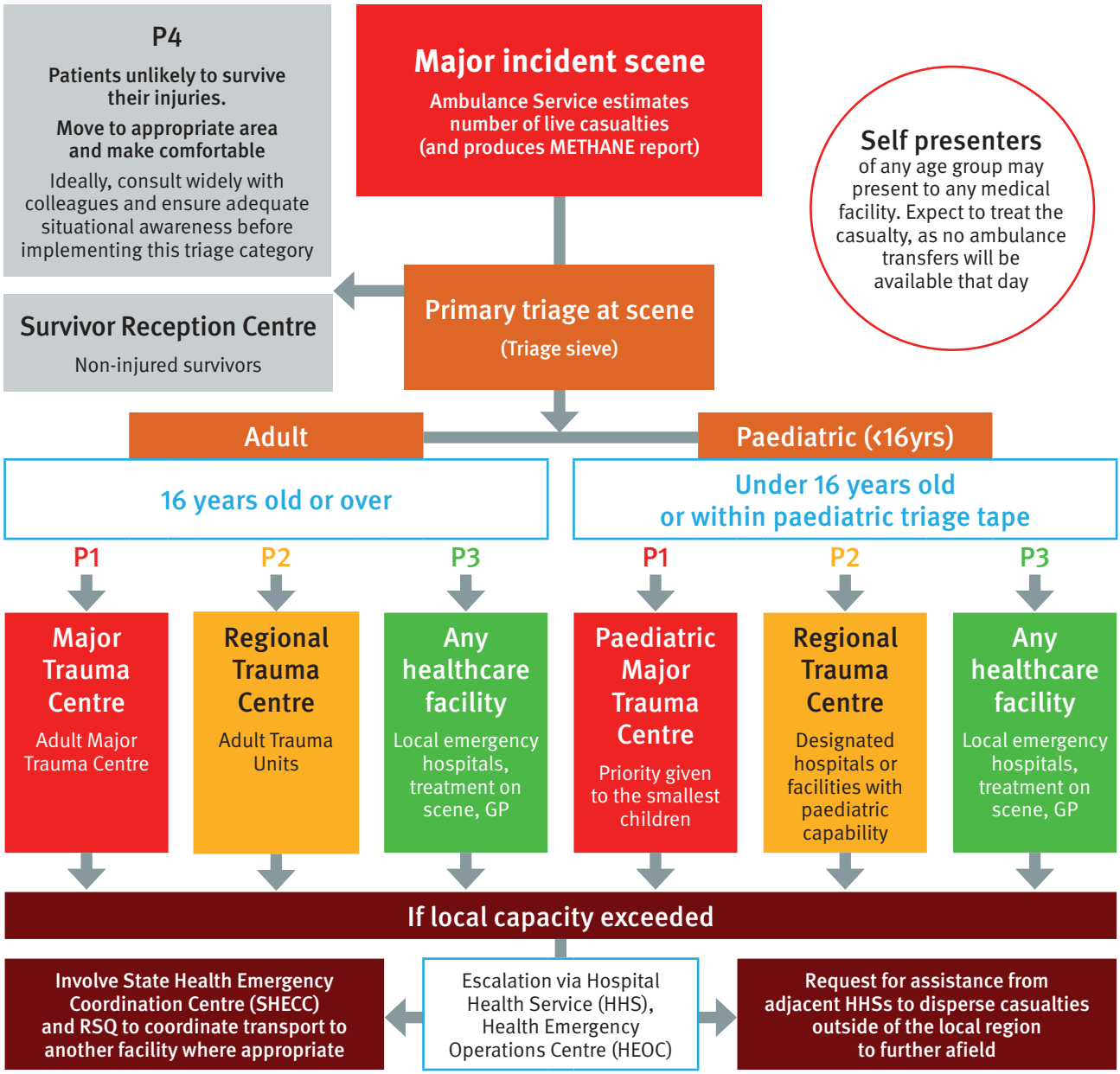
Mass casualty incident awareness

A mass casualty incident for health resources in Queensland is an incident (or series of incidents) causing casualties on a scale that is beyond the normal resources of the emergency and healthcare services' ability to manage. This supply-demand mismatch may be significantly influenced by the exact location of the incident, since available manpower and resources for response will be significantly more constrained in regional and remote areas when compared to the available resources in the south east corner of the state.

- May involve a small or large number of casualties with a range of injuries, the response to which will be beyond the capacity of normal major incident procedures to cope and require further measures to appropriately deal with the casualty numbers.
- Casualties are likely to be a mixture of categories with 25% requiring immediate life saving intervention (P1), 25% requiring intervention that can be delayed (P2) and 50% being walking wounded or minor injuries (P3).
- Usually caused by sudden onset events, and exclude casualties as a result of infectious diseases such as pandemic influenza or COVID-19.

Several smaller incidents may combine, or be geographically located, so as to require a mass casualty response to be enacted due to the large number of simultaneous casualties.

For specialist services such as burns, neurosurgery, spinal surgery and paediatric intensive care, the trigger for activation of their mass casualty arrangements will be lower due to the limited availability of resources for incident response.



Major incident awareness

A major incident is any occurrence that presents serious threat to the health of the community or causes such numbers or types of casualties, as to require special arrangements to be implemented.

A major incident is any occurrence that presents serious threat to the health of the community or causes such numbers or types of casualties, as to require special arrangements to be implemented.

A major trauma centre (MTC) should expect to receive predominantly (P1) patients, other facilities should expect to receive (P2) and (P3) patients. However, a mix of casualties should be planned for, as there will be little (if any) ability to transfer patients between sites for the first 24 hours.

To assist a regional response to a mass casualty event, a pre-determined patient dispersal plan (casualty regulation) should be used, showing where casualties will be dispersed to by the ambulance service and how many casualties each hospital has pre-agreed to accept in the first hour.

Local services (ambulance/police/fire) are usually the first to notice unusual activity in their control rooms and will notify their incident manager. They will decide if escalation of the incident is required and if this is a potential or actual major incident. If there is a surge of casualties arriving in ED without warning, or if there is news (via social media or word of mouth) of an emerging incident, then the ED consultant on call/senior nurse on duty will contact the medical director or clinical site manager and decide whether to self-declare and start escalation of the hospital major incident plan.

The Queensland context

Queensland remains the most decentralised jurisdiction in Australia, with 2014 figures showing just 48% of the population residing in Greater Brisbane, as opposed to 78% in Greater Perth.

An inevitable consequence of the large geographical area of the state in conjunction with relatively widely distributed population is that response times for incidents may be protracted for some areas. These longer response times mandate a strategy of early activation both of healthcare facilities and emergency services in response to incidents.

This early activation policy may require both a willingness to trigger a response based on limited information from the scene as well as an acceptance that a proportion of responses will be stood down as more information comes to light. The significant benefit of an early activation strategy, however, is that less time is wasted waiting for further situation reports and that response times should be correspondingly shorter.

Healthcare providers who are involved in response to any incident, especially those in more regional and remote areas, should therefore not ask themselves the question "*Am I overwhelmed?*", but instead should pose themselves the question *"Based on what currently know about this incident, am I likely to become overwhelmed in the next 4 hours?"*. If the answer to the latter question is affirmative then consideration should be given to activating a major incident response at that point.

This decision should be based not only upon the severity of injuries being encountered and overall numbers, but also their nature (blunt trauma, burns, penetrating trauma etc.) and the geographical location of the incident.

The Queensland Disaster Management Arrangements (https://www.disaster.qld.gov.au/dmg/Pages/DM-Guideline.aspx) emphasise the importance of maximising the utilisation of local resources in any response, and local communities in Queensland show significant initiative and resilience in optimising the use of their local capabilities. Integration of planning between Local Disaster Management groups (LDMGs) and local healthcare facilities is therefore imperative. Protracted incidents may pose significant logistical issues for regional and remote facilities, and non-medical resources may be a useful stop gap if accessed via the LDMG.

If there is a risk of a facility becoming overwhelmed, then the impacted facility may be able to source additional resources or assistance from other regional facilities in order to share the load of the event across more than one facility.

State level assistance is also available from Retrieval Services Queensland, who should be involved early in any response, since flight times to many areas of the state may be protracted and aeromedical asset availability cannot be guaranteed at any one time.

The following is an idealised representation of casualty flow from a mass casualty incident.

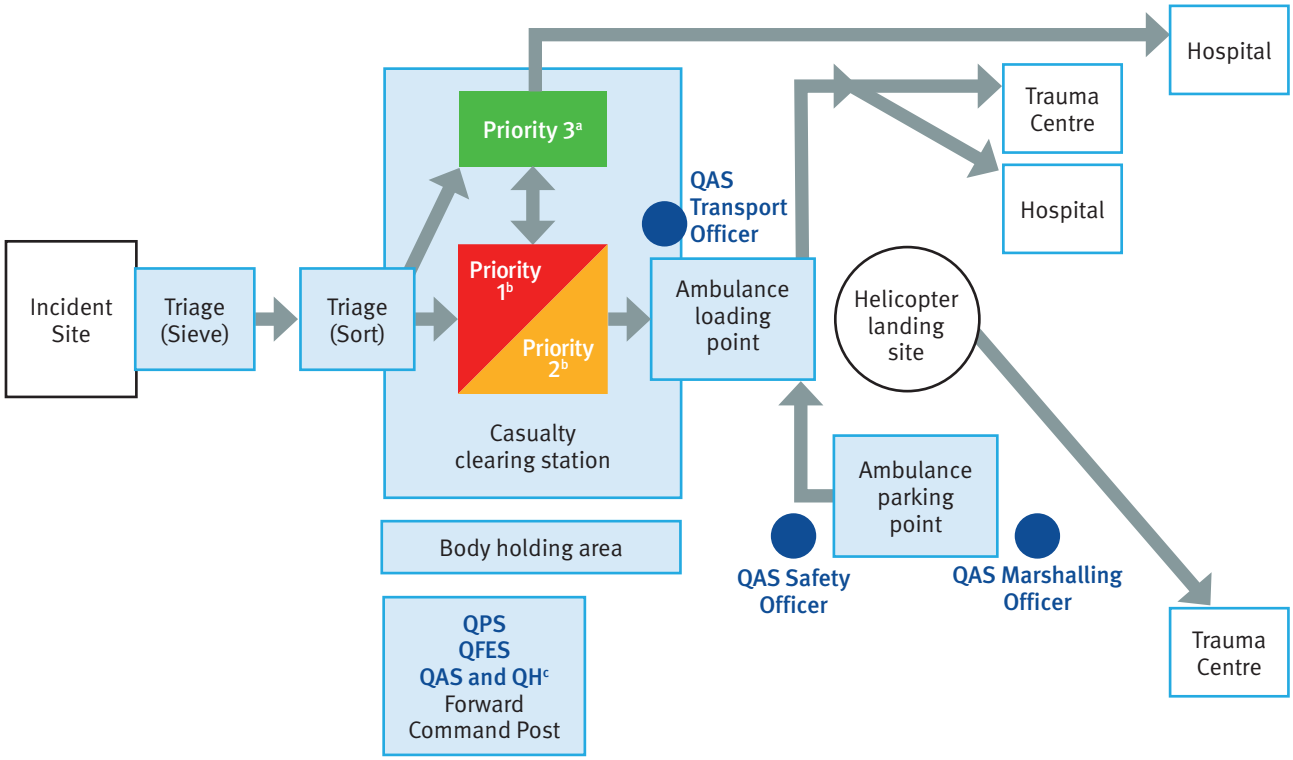
In locations such as the South East of Queensland, where several tertiary facilities are located, the above casualty flow process may be both realistic and achievable.

In many areas of Queensland however, this may not be the case, and the following distribution principles should be adhered to:

- Patients should be transported to the nearest facility which is able to provide definitive care for their injuries wherever possible.
- The right patient should be delivered to the right facility at the first attempt wherever possible.
- Patients should be distributed, according to their injuries, across multiple facilities in order to minimise overload of any individual facility
- Coordination of patient distribution should occur early and from a single point

Further detail around appropriate models of patient distribution within Queensland are beyond the scope of this document, and are contained in the Queensland Health Mass Casualty Incident plan.

Major incident awareness



Notes

a. Priority 3 (Green) category patients may be allocated an area and treated outside the physical boundaries of the Casualty Clearing Station.

b. Priority 1 (Red) and Priority 2 (Yellow) category patients may share a treatment area.

c. Queensland Health (QH) may be represented at the scene by a QH Medical Commander. The QH Medical Commander's role is to assist QAS in appropriate patient disposition decisions.

Incident management and emergency coordination

Queensland Health as the lead agency with the support of Queensland Ambulance Service, takes responsibility for mass casualty management under the Queensland State Disaster Management Plan.

Queensland Disaster Management Arrangements

The Queensland Disaster Management Arrangements (QDMA) describe a comprehensive, all hazards approach to disaster management which aligns all agencies to the *Disaster Management Act 2003*. These arrangements also give effect to the State Disaster Management Plan which assigns agency responsibilities for effective disaster prevention, preparedness, response and recovery activities.

Queensland Health has support structures in place to effectively coordinate a health response to any event, incident or disaster using an Incident Management System (IMS). These structures are designed to be flexible and scalable in order to be agile in changing environments. Queensland Health incident management is based on the Australasian Inter-Service Incident Management System (AIIMS). AIIMS is a foundation for a unified, consistent, approach to disaster and emergency incident management. AIIMS principles are applied through the Queensland Health arrangements which are consistent across all areas of planning and response.

Emergency coordination in Queensland Health

Whilst the immediate priority in mass casualty management is the provision of care to those impacted by the event, it is important that the overall health response can be coordinated beyond the casualty site and the primary receiving facility.

An effective health response to a mass casualty incident will include many moving parts across the pre-hospital and hospital response. Should an event occur requiring coordination, a Health Emergency Operations Centre (HEOC) can be activated at a facility or at a Hospital Health Service (HHS) level. This may initially take the form of a Code Brown emergency activation and the convening of an incident management team.

- Some of the functions that a HHS may coordinate in a mass casualty incident include, but are not limited to:
  - Coordination of communications between first responders, aeromedical retrieval teams, receiving emergency departments and other stakeholders as required
  - Coordination between hospital departments to ensure that the receiving facility can maximise capacity to receive patients, including prioritising discharges or undertaking decants
  - Provision or reallocation of additional resources between hospital departments or health facilities
  - Provision of additional equipment or resourcing to support responding teams
  - Gathering intelligence and compiling situation reports to inform and enable sound decision-making
  - Liaison with the State Health Emergency Coordination Centre (SHECC) where required
  - Liaison with Local and District Disaster Coordination Centres for whole-of-Government assistance where required.

HHS HEOC arrangements are described in respective HHS disaster plans that can be found at: https://qheps.health.qld.gov.au/hdmu/docs-and-policy.

Where an event is beyond the capacity of a HHS to effectively respond and extraordinary support is required, this can be escalated to the SHECC as a request for assistance.

- The functions that SHECC may undertake in a large-scale MCI are similar to those of the HEOC but at a state level. This can include:
  - Coordination between HHSs to identify available beds across the system, particularly in neighbouring HHSs or appropriate trauma centres
  - Redistribution of resources between HHSs to provide support to impacted HHS(s)
  - Coordination and liaison between impacted and supporting HHSs, as well as the QAS State Operations Coordination Centre (SOCC) and Retrieval Services Queensland (RSQ)
  - Liaison with the State Disaster Coordination Centre (SDCC) for whole-of-government assistance where required.

Further information can be found in the Queensland Health Disaster and Emergency Incident Plan (QHDISPLAN): https://www.health.qld.gov.au/__data/assets/pdf_file/0031/628267/disaster-emergency-incident-plan.pdf.

Queensland Trauma System

The Queensland Trauma System comprises of many integrated elements that allow provision of high-quality clinical management for patients that sustain traumatic injuries across Queensland and northern New South Wales.

The pre-hospital services work with Queensland Health facilities to commence early assessment and management of the patient, prior to providing transport to the nearest appropriate facility for ongoing specialist care. The hospitals and health services are assigned a level on the Trauma Clinical Services Capability Framework. This ensures the patient is moved to the right place at the right time, where all required care can be provided.

In the pre-hospital environment, the Queensland Ambulance Service (QAS) provides emergency pre-hospital care and transport coordination by road response from 302 locations across the state, as well as planning and coordinating multi-casualty incidents and disasters. Retrieval Services Queensland (RSQ) work closely with the QAS to provide clinical coordination of all aeromedical patient transfers to ensure the patient receives the definitive care required without delay. The Royal Flying Doctor Service (RFDS) works with RSQ and can provide primary retrievals from RFDS bases around Queensland.

Trauma care may be provided by a major trauma centre, regional trauma centre, rural and remote hospital or primary health care centre. Major trauma centres typically provide the entire spectrum of care for any major trauma patient. They contain multiple specialist services (some contain a statewide service) and can assist with clinical guidance in the pre-hospital setting as well as transfer and bypass decision-making, prior to receiving the patient for definitive care. Regional hospitals may have some specialty services onsite to provide definitive care or can stabilise a patient for an interhospital transfer to the nearest major trauma centre. Rural and remote facilities or primary health clinics can manage patients with minor trauma, however, may have a patient with major trauma present to the facility and be involved with initial care and management prior to a transfer out. These facilities have established escalation processes to ensure early notification to RSQ to ensure the patient is transferred to definitive care as soon as possible.

Queensland Ambulance Service

https://www.ambulance.qld.gov.au

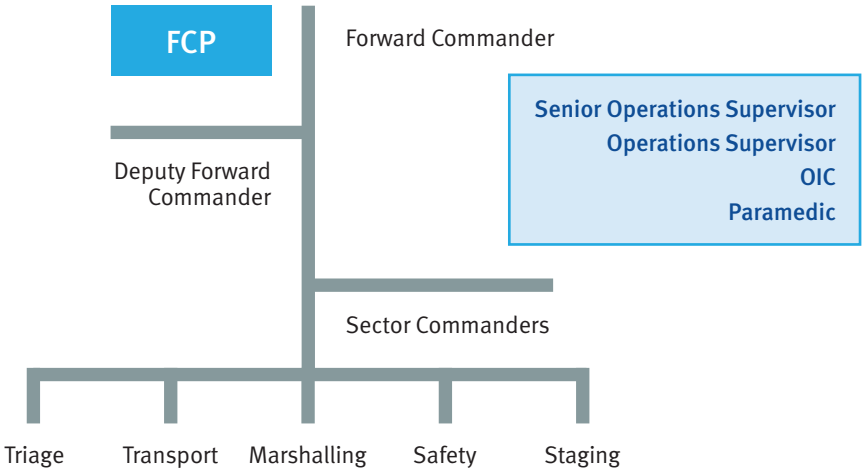
What we do

- The Queensland Ambulance Service (QAS) is a integral part of the primary healthcare sector in Queensland through the delivery of timely, patient-focused ambulance services.
- The QAS operates as a statewide services within Queensland Health, and is accountable for the delivery of:
  - pre-hospital ambulance response
  - emergency and non-emergency pre-hospital patient care and transport service
  - inter facility ambulance transport
  - casualty room services
  - planning and coordination of multi-casualty incidents and disasters
  - confidential health assessment and information services.
- The QAS operates more broadly as a fully integrated part of the health system in Queensland working in partnership with other health professionals.

Multi Casualty Incident Management

- The QAS MCI response focuses on a flexible and scalable incident management structure combined with a multi agency collaborative approach. This ensures information sharing between partner agencies and maintains coordinated command and control.
- The QAS has adopted, and works within, the principles of the Australian Inter-Service Incident Management System (AIIMS). AIIMS provides a holistic, common incident management framework for all responding agencies and personnel, enabling seamless integration of activities and resources for the effective and safe resolution of any incident.
- The QAS, through this Incident Management Framework, leads health care management at an MCI through efficient triage, effective use of resources to create balance between the available supply of health personnel and equipment.
- The QAS MCI response comprises of a scalable and agile approach, providing holistic scene management ensuring incident requirements are met. An all hazards approach, allows flexibility and scalability to adjust to all situations statewide.
- QAS officers adopt command and triage responsibilities ensuring information is received and shared to the QAS Communication Centre ensuring appropriate resources are available, including appropriate scene command.
- The Forward Commander is responsible for all ambulance resources and the management of operations at the site. The Forward Commander liaises with partner agency commanders to maintain joint incident management and assumes total command of all ambulance resources on the site. When in situ, the Forward Commander should provide regular situation reports to the Operations Centre. The Forward Commander is identified by a red helmet and vest marked 'Commander' and located at the Forward Command Post (FCP).
- The triage officer appointed by the Forward Commander is the most clinically qualified and experienced QAS officers on scene. The Triage Officer is identified by a yellow helmet, a vest marked 'triage' and is responsible for the initial triage of casualties and assessment of resource requirements.
- QAS officers working to the QAS mission under the direction of the QAS Forward commander will use Incident Management system functions to triage patients to prioritise patient management and transport.
- The QAS actions transport decisions based on multi agency consultation with Queensland Health and Retrieval Services Queensland. The QAS transport officer supervises the loading and movement of all casualties by road, sea and air, to the designated medical facility.
- The QAS has the ability to provide state Coordination through the State Operations Coordination Centre (SOCC) at a state level and through Regional Ambulance Coordination Centres (RACC) at a HHS level.

Incident site

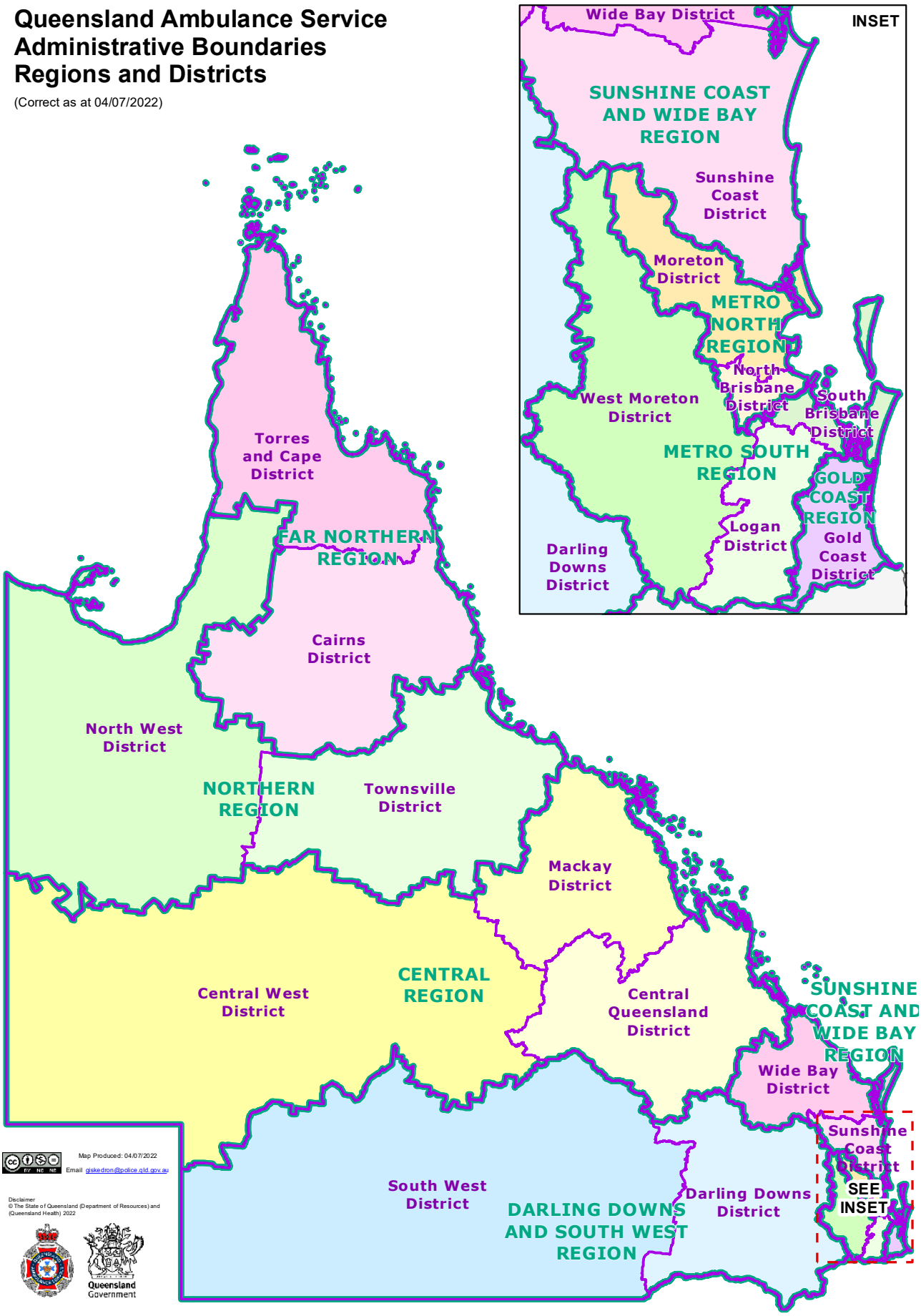


Queensland Ambulance Service

https://www.ambulance.qld.gov.au

Queensland Ambulance Service Administrative Boundaries Regions and Districts

(Correct as at 04/07/2022)



Retrieval Services Queensland – 1300 799 127

https://qheps.health.qld.gov.au/rsq

RSQ is a unit within the Queensland Ambulance Service (QAS) and is responsible for the provision and governance of aeromedical services within Queensland and parts of Northern New South Wales.

What we do

- **Clinical coordination** – RSQ is responsible for the coordination and approval of all aeromedical retrievals and transfers of patients from parts of northern New South Wales up to the Torres Strait Islands.
- **Governance** – RSQ provides state-wide operational leadership for contracted health aeromedical providers and specialist retrieval services.
- **Major incidents response** – coordinates all aeromedical resources reporting through to the QAS SOCC.

Clinical coordination

RSQ provides a multidisciplinary operational partnership between Queensland Ambulance Service and Queensland Health for the clinical coordination, tasking and tracking of all aeromedical retrievals and transfers. It operates from two centres, RSQ Brisbane and RSQ Townsville 24/7.

RSQ coordinates primary response, search and rescue and inter-facility aeromedical transfers (helicopter and fixed wing) for public and private health care facilities. This includes the return of patients from tertiary or larger facilities to their referring centre, when aeromedical resources and a clinical escort are required.

RSQ Medical and Nursing Coordinators work with the referring agency or clinician to provide clinical management advice, determine retrieval team composition and assist in arranging a critical care bed in the receiving facility. RSQ plays a crucial role in communication between the referring, retrieving and receiving clinical teams, as well as clinical supervision of the retrieval teams. The Medical Coordinators, (all critical care specialists with pre-hospital and retrieval experience) determine the most appropriate mode of transport for patients, depending on circumstances and clinical requirements. RSQ uses a statewide video-conferencing network to support its aeromedical retrieval referrals.

RSQ partners with specialist paediatric and neonatal medical coordinators and obstetric advisors to deliver clinical support and paediatric, neonatal and high-risk obstetric retrieval capability to rural, regional and remote clinicians, in conjunction with CHQRS, NeoRESQ, ANTS–NQ and Yalurin, along with ObsRESQ.

Major incident response

RSQ's works within the QAS Incident Management System (IMS) to provide a scalable aeromedical response, along with coordination and communication services. This response capability is enhanced by the utilisation of dedicated telemedicine technologies and IT systems. During any major incident RSQ reports through to the QAS SOCC to ensure a coordinated approach to the response.

RSQ integrates and collaborates with multiple local and statewide services and organisations involved in response major incidents and disasters. Such services include but are not limited to:

- QPS
- QFES
- Specialist trauma and medical - services such as ICU, Major Trauma Centres, burns, paediatric critical care
- Aeromedical Providers

In response to an incident RSQ may task an aeromedical asset for a variety of missions such as:

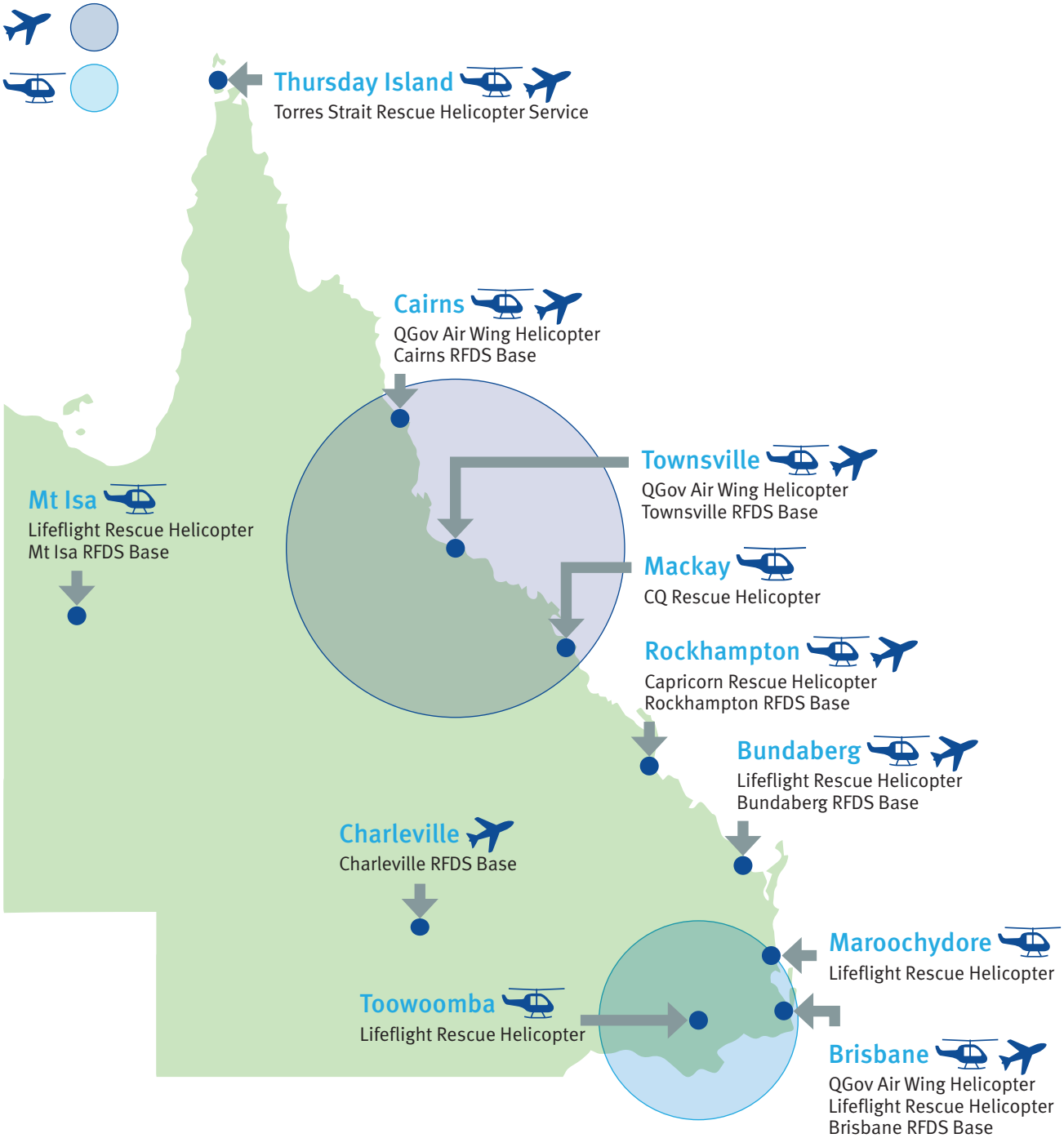
- Provide retrieval and transport of patients from the scene to definitive care centres directly
- Transport critical care teams and retrieval teams to pre-hospital site or rural/remote facility
- Deployment of other emergency service teams (QFES/QPS)
- Transport of critical equipment – for example road crash rescue

Retrieval Services Queensland – 1300 799 127

https://qheps.health.qld.gov.au/rsq

RSQ is the unit within Queensland Health responsible for the provision and governance of aeromedical services within Queensland and parts of northern New South Wales.

1 hour flight radius



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Mass Casualty Incidents

Mechanism of Injury

Ballistic injury

Introduction

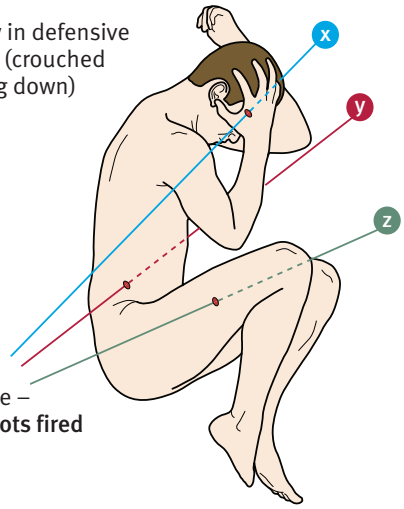
Bullets cause injury by two main mechanisms:

1. Tissue being crushed and lacerated along the bullet path.
2. Tissue being stretched and displaced by the temporary cavity.

The clinical effects will depend on the body area and underlying organs hit by the bullet.

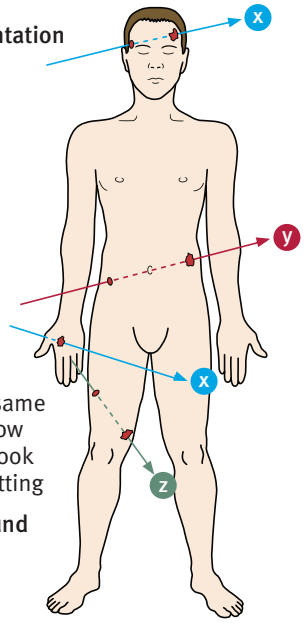
Summary

- Immediate casualty management follows the standard CABC approach and is dictated by the casualty's clinical condition.
- Diagrams below demonstrate the average path of bullets. However,it must be appreciated that bullets will tumble, fragment and produce fragments that are not in the average path.



Casualty in defensive position (crouched and lying down)

Origin of gunfire – **three shots fired**



Clinical presentation of casualty

Figure shows same person, and how wound tracts look in a clinical setting

Note: **four wound tracts**

A

- Gunshot involving face/neck – see Speciality Overview – **Head, face and neck injuries in a major incident**
- Gunshot not involving face/neck = standard airway management

B

- Standard care

C

- Standard care.
- The bullet path will not respect anatomical boundaries, so look for multicavity/multi organ injury
- Small entry and exit wounds may be associated with significant internal injury

Be guided by the clinical condition – 'what you see may not be what you get'

D

- Low velocity, low calibre bullet wounds to the head may result in significant delayed deterioration with minimal external signs of injury
- Monitor and respond to deteriorating GCS

E

- Immediate wound management as per IMED – **MI immediate wound management**
- Entry and exit wounds do have different characteristics but practically, can be very difficult to distinguish (and it is rarely important during initial care)
- The actual path taken by the bullet within the casualty will depend on how they were orientated when struck (standing, sitting, crouching, running) – which is often not the position the casualty is examined in by responding clinicians
- Bullets that ricochet off an intermediate surface or pass through intermediate targets (bags, clothes) may become unstable, hit side face on (rather than with the tip) and produce greater immediate energy transfer

Key points

- Bullets that fragment may lead to multiple wound tracts across different body (or anatomical) regions
- Some tissues tolerate deformity from temporary cavitation better than others i.e. skeletal muscle versus bone

Small entry and exit wounds may mask catastrophic internal damage

Investigations

- The pattern of bone fragments and bullet debris may show the direction of travel of the bullet within the casualty
- Some bullets break up ('fragment') within the casualty producing multiple wound tracts
- CT is used to screen for bullet fragments prior to MRI (if needed). Retained bullets and fragments are likely to have steel components and be affected and moved by the MRI magnetic field

Imaging is covered in ED Resus – **MI Imaging**

Ballistic injury

Ammunition

A round of ammunition consists of **two main parts:**

- **Bullet** (the part that leaves the gun and strikes the target)
- **Cartridge case** that contains primer and propellant.

The cartridge is ejected from the gun (a 'spent case' or 'brass') and may be present at the incident scene.

Ammunition is often described by width and length:

- A '9 x 19mm' has a bullet head 9mm in width and a brass case 19mm long. This describes ammunition often fired from a handgun/pistol
- A '7.62 x 39mm' has a bullet 7.62mm wide and a case 39mm long. The longer case, compared to the 9 x 19mm ammunition, allows for more propellant to be packed into the case. This gives the bullet more kinetic energy when fired.

Ammunition can also be described using imperial measurements for the bullet width – usually fractions of an inch (e.g. .223) or using both imperial and metric measurements (e.g. 0.223in/5.56mm).

A further type of ammunition which may be encountered by clinicians in civilian practice is shotgun ammunition. Shotgun ammunition consists of a self contained cartridge, usually larger in size than conventional ammunition. The cartridge contains propellant and a number of metallic projectiles which are usually spherical pellets. On firing, these pellets spread in a conical pattern, and impact the target in specific patterns depending upon the distance at which the target is hit. At short range, the pellets may be sufficiently compacted to leave one huge wound. At longer distances the pellets will impact the target in a more diffuse pattern, resulting in a cluster of penetrating wounds. In this context each pellet behaves much like a low calibre pistol round.

Bullet effects

When a bullet impacts a target, energy is transferred to the target. The effects depend on:

1. the material properties of the target
2. the bullet design i.e.

a full metal jacket vs a hollow point round

This is illustrated using the figures on the facing page depicting bullet impacts into 500 x 250 x 250mm 10% gelatine blocks (derived from high speed digital photography of actual impacts). When shot, 10% gelatine behaves in a similar way to muscle tissue.

The temporary cavity is also shown superimposed on the outline of a human torso to illustrate possible wounding effects.

The energy from the bullet impact creates a 'temporary cavity' within gelatine or muscle lasting for fractions of a second. This collapses down around a much smaller permanent tract created by the bullet.

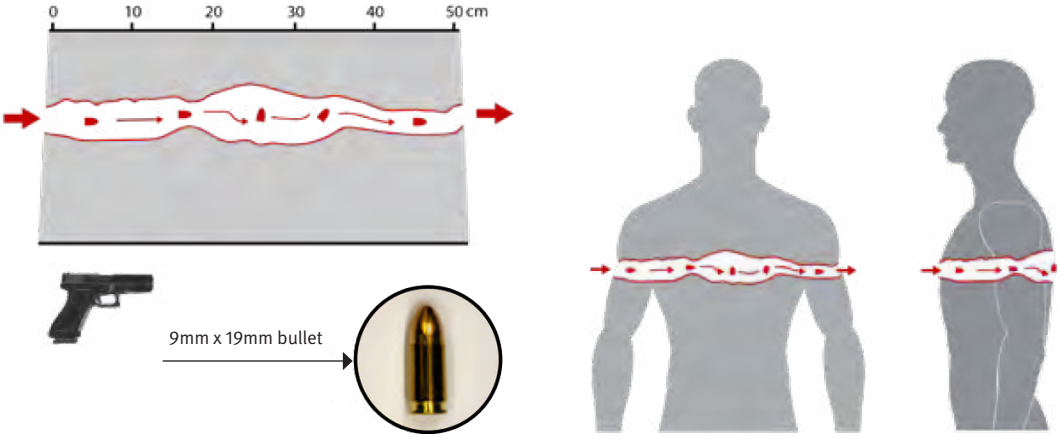
If the bullet becomes unstable within the gelatine or muscle and begins to tumble, it will present its side face to the material rather than its tip. In this way more energy is transferred, due to a greater contact surface area between the bullet and tissue, and the cavity will be larger.

Ballistic injury

Pistol

e.g. 9 x 19mm ammunition

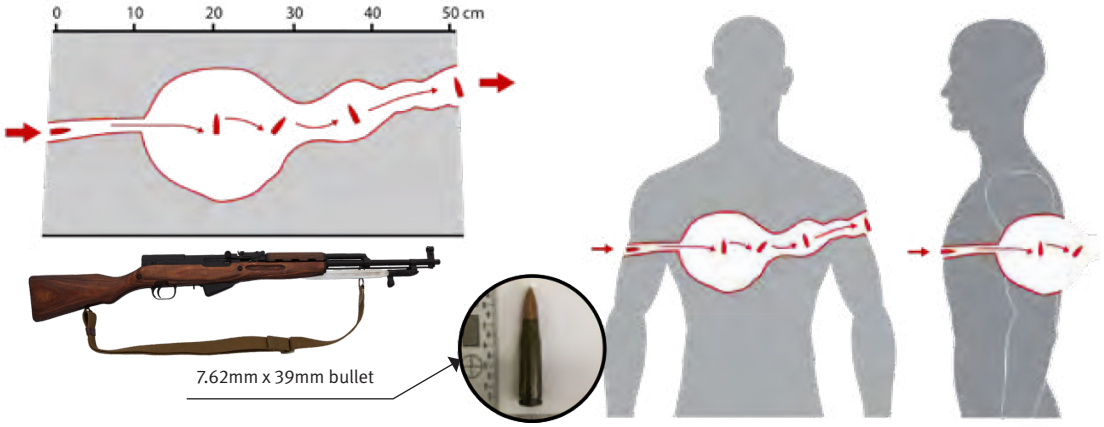
The temporary cavity is smaller than that associated with rifle ammunition.



SKS

e.g. 7.62 x 39mm ammunition

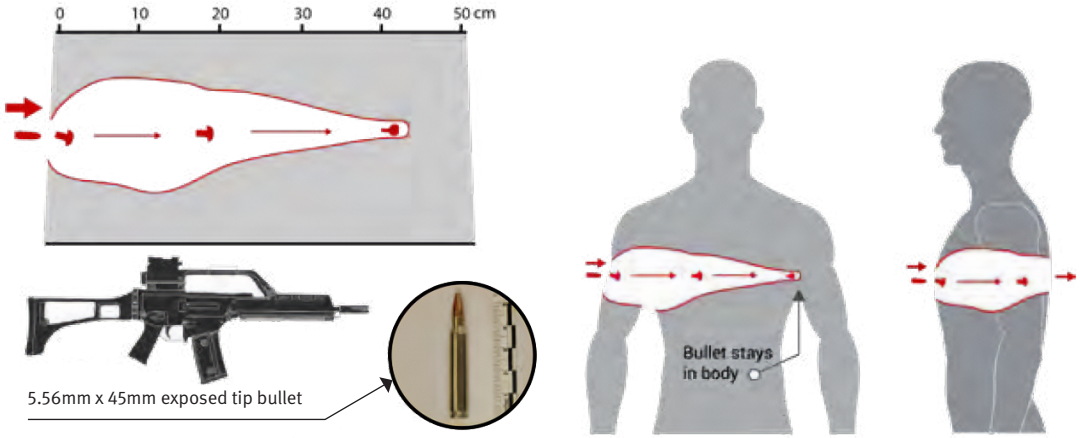
The bullet flies straight initially then becomes unstable, creating a large temporary cavity associated with tissue stretching and tearing.



Police rifle

e.g. 5.56 x 45mm exposed tip

This is an example of a bullet designed to flatten out ('expand') soon after impacting on a target, so that energy is transferred rapidly and the temporary cavity is large early in the bullet's flight. The bullet is more likely to stay in the body of the first person shot and not go through and hit someone else.



Graphics used with kind permission from Defence Academy of the United Kingdom, Shrivenham, Nov 2017

Blast injury

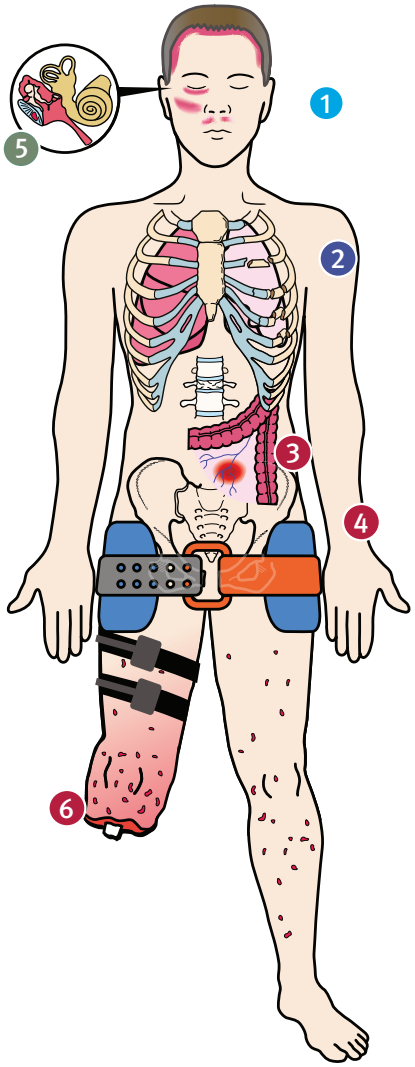
Introduction

- Aggressive resuscitation is required in close range survivors.
- Look for a occult injuries and monitor for evolving injuries.

Catastrophic haemorrhage

Does patient have a traumatic amputation or is this an isolated injury? Look for other associated injuries:

- **Blast thorax** – high risk of catastrophic great vessel and aortic disruption – seek early cardiothoracic opinion
- **Blast lung** – early intubation, lung protective ventilation from outset and through to ICU care
- **Blast abdomen** – risk of significant intra-abdominal bleeding and late bowel perforation, even if abdominal wall is not breached
- **Blast pelvis** – high mortality rate from exsanguination, especially if SI joints are open (of relevance for landmines, IEDs and floor-based devices)
  → apply pelvic binder, gain rapid proximal control, resuscitation/surgery



A

- Have a high index of suspicion for **airway compromise** if blast and casualty were in a confined space (bus/underground/metro)
- Flash burns indicate a high risk of blast lung 1

B

Have a high index of suspicion for blast lung (incidence increases when casualty in an enclosed space) see Speciality Overview – **Blast lung in a major incident**

- Blast Lung is the most common fatal injury among initial survivors
- Low initial O_2 sats may indicate primary blast lung injury
- Rib fractures, pneumothorax and lung contusions are commonly associated with a blast 2
- ? Have a low threshold for chest decompression/chest drain
- ? Consider early intubation and lung protective ventilation from outset and through to ICU care

C

Neck

Penetrating neck injuries are common and often fatal

Chest

- ? Great vessel/aortic injury
- ? Pericardial tamponade
- ? Myocardial contusions – may lead to cardiac arrhythmias

Abdomen

Blunt abdominal injury caused by secondary and tertiary blast mechanisms can cause significant bleeding and late bowel perforation, even if the abdominal wall is not breached 3

- ? Liver/splenic rupture
- ? Air embolism leading to mesenteric ischaemia

Pelvis

- Significant bleeding can occur with open SI joints
- The wider the pubic symphysis, the greater the transfusion requirement
- → Manage initially with pelvic binder and rapid proximal control
  Further resuscitation and surgery may be required 4

Traumatic amputation

- ✓ Check tourniquet(s) have been applied 6
- → Prepare to exchange for pneumatic tourniquet(s)
- ⚠ Avoid crystalloids during resuscitation (worsens coagulopathy)

D E

Key points

- ✓ Early CT whole body (head to ankles) if available
- ✓ Use rapid transfuser (Level I)
- ✓ Give tranexamic acid (TXA) early
- ✓ Do a blood-borne virus screen (BBV) in fragment injury
- ? Fasciotomy for blast limbs
- ? Plan for damage control surgery initially

Blast injury

D

Neck

- Diffuse axonal injury (DAI), skull fracture, cerebral contusions, stroke
- Penetrating injury with exposed brain
- Globe perforation, subconjunctival haemorrhage, foreign body
- TM rupture, inner ear disruption 5

Spine

- Spinal cord injury

Chest

- Blast lung injury
- Haemothorax, pneumothorax, pulmonary contusions and haemorrhage

E

- Blood borne virus screen may be advised
- Air embolism is common and can present as stroke, MI, acute abdomen, spinal cord injury, limb claudication, loss of hearing or sight
- Observe for late fungal infection if there is major soft tissue damage

Classifications of blast injury

- **Primary** – injury resulting in direct tissue damage from the shock wave hitting the body
- **Secondary** – injury from fragments ('shrapnel') from a device or the environment
- **Tertiary** – injury from displacement of the body (thrown against a wall/up in the air)
- **Quaternary** – other types of injury (for example: burns, inhalation injuries etc.)
- **Quinary** – sequelae and late complications, for example fungal infection if major tissue damage.

Blast injury environment

Explosive devices

Explosive device may be predominately blast weapon, or packed with fragments, for example, with screws, nuts, ball bearings etc.

- **Blast weapons** increase the risk of primary blast injuries such as blast lung and building collapse.
- **Fragmentation weapons** increase the risk of fatality especially over longer distance in the open field – explosion outside, victim outside.

Distance from blast

Primary blast injuries common in fatalities, but rare in survivors as overpressure effects reduce rapidly with increasing distance from the device.

- **Close range injuries** – mutilating injuries common, traumatic amputations, open head, chest, abdominal injuries with exposed contents.

→ **Aggressive resuscitation in survivors is required.**

- **Further away** – secondary and tertiary blast injuries predominate and survival much more likely, with increasing distance fragments are less numerous, and less serious unless vital structures damaged.

Blast location

- **Enclosed space: explosion inside, victim inside (bus bombs, pub bombings etc.)**
  - Complex blast environment with increased effects of overpressure due to reflection and amplification
  - Primary blast injuries especially blast lung common in both fatalities or survivors
  - Effects may be localised if protection offered by walls or furniture.
- **Explosion outside – victim inside building or vehicle.**
  - Low risk of primary blast injury
  - Victim also protected from fragments
  - Tertiary blast injuries predominate, with civilian pattern fractures
  - Safest environment, unless building collapse occurs.

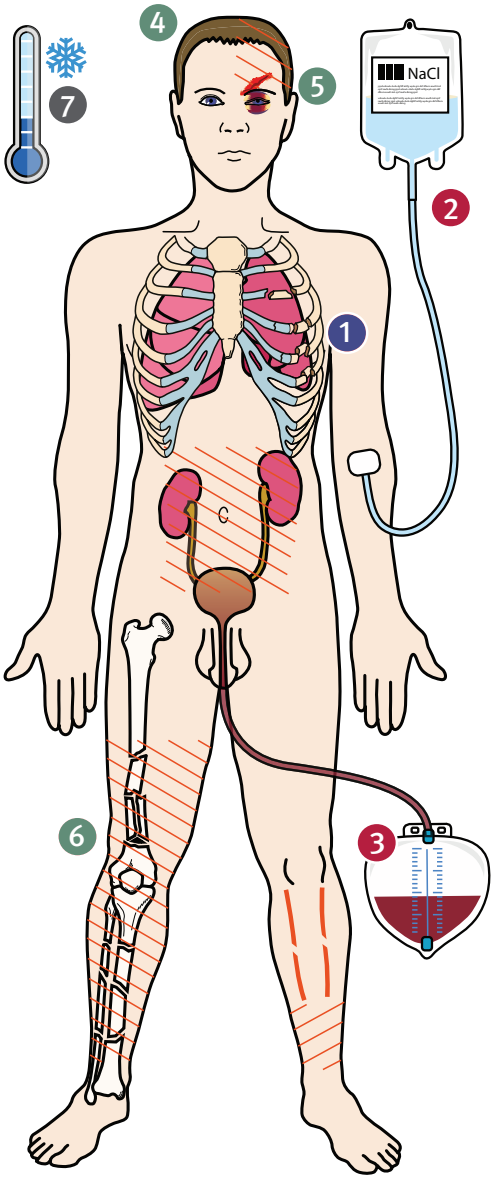
Suicide bombers

- Main effects as above and related to type of explosive device and environment
- Secondary fragments from bomber or other victim can occur – especially bone fragments
- Risk of infection (e.g. blood borne viruses) from biological implantation.

Crush injury

Summary

- Patients may have multiple injuries affecting different tissues and organs and are at risk of crush syndrome.
- In explosions, additional injury types such as blast and fragment injury should also be considered.
- Prolonged entrapment may occur.
- Extrication after a long period of entrapment is associated with a high risk of cardiovascular collapse; may lead to worsened renal failure or cardiac arrest.



A

- Standard care
- ⚠ Do not use Suxamethonium for RSI – risk of hyperkalaemia/death

B

- Lung Protective Ventilation for all ventilated patients from ED onwards

Rib fractures 1

- Early multimodal analgesia
- Surgical stabilisation of flail segment if more than four ribs involved

C

Risks

- CV collapse on release from entrapment
- Risk of internal bleeding from organ contusions
- High risk of pelvic fracture with associated haemorrhage
- Consider need for pelvic binder

If prolonged extrication, patient may have had IV fluids at scene

- Continue adequate fluid resuscitation
- Patient is at risk of rhabdomyolysis 3
- Use blood if haemorrhagic shock is present, then give crystalloid solutions to ensure adequate urine output 2
- ⚠ Do not apply tourniquet to a crushed extremity unless there is catastrophic haemorrhage

D

Cranial trauma 4

- Associated with poor outcome → seek early neurosurgical advice

Penetrating eye injuries

- Are easily missed → inspect the globes (if unable to do so, refer to ophthalmology) 5

Multiple fractures are common 6

- Look for occult nerve/tendon damage
- small child/frail older person with co-morbidities are at increased risk of death due to crush syndrome

E

- Treat hypothermia if present 7

Key points

Consider multiple other injuries:

- burns
- fragmentation injuries
- blast lung
- multi-fragmentary fractures
- subdural haematoma
- eye injuries
- tympanic membrane rupture – steroids may salvage sensorineural hearing loss.

⚠ Have a high index of suspicion for crush syndrome

- Rhabdomyolysis:
  - → Check creatine kinase
  - → Check urine myoglobin
- Give crystalloid to establish good urinary output if rhabdomyolysis suspected or confirmed

Crush injury and crush syndrome

Pre-hospital, the patient may have had the following management:

- intravenous fluids may have been given prior to releasing the crushed body. This is especially important in cases of prolonged crush (>4hrs)
- a tourniquet may have been used on the affected limb– slow release of tourniquet may be required.

Observe all crush casualties, even those who look well

Reperfusion injury

- Acute Ischaemia with metabolic abnormalities
- May occur when a trapped limb or casualty is suddenly released
- Medical condition Reperfusion caused by traumatic rhabdo

Observe for:

- Cardiac arrhythmias (may be lethal)
- Myoglobinuria (release of toxins from necrotic tissues into the circulation which may cause renal failure)

Hypotension

- Casualties may require considerable fluid replacement in the first 24hrs (third space losses)

Observe for:

- Compartment syndrome (consider prophylactic fasciotomies)
- Signs of renal failure

ED Resus

- Initiate (or continue) IV hydration—up to 1.5L/hour

Renal failure

Rhabdomyolysis releases myoglobin, potassium, phosphorous, and creatine kinase into the circulation

- Myoglobinuria may result in renal tubular necrosis if untreated
- Release of electrolytes from ischaemic muscles causes metabolic abnormalities

ED Resus

- Patient may require IV fluids and mannitol to maintain diuresis of at least 30mls/hr, to prevent renal failure

ICU

Continuous renal replacement therapy (CRRT) Indications:

- Acute renal failure
- Acute life-threatening electrolyte abnormalities

Metabolic abnormalities

- **Hypocalcaemia:** Calcium flows into muscle cells through leaky membranes
- **Hyperkalaemia:** Potassium from ischaemic muscle
- **Metabolic acidosis:** Lactic acid from ischaemic muscle may cause life-threatening cardiac arrhythmias, including cardiac arrest; metabolic acidosis may exacerbate this situation

ED Resus

- Consider correcting Hyperkalaemia/Hypocalcaemia
  - If required, give **calcium gluconate 10% 10mls** or **calcium chloride 10% 5mls IV** over 2mins; **sodium bicarbonate 1mg/kg IV slow push**; regular **insulin 5–10 U and D50 1–2 ampoules IV** bolus; **kayexalate 25–50g with sorbitol 20% 100mL PO or PR**
  - Continuous or repeated administration of calcium should be conservative as this may exacerbate further muscle injury

Coagulopathy

ED Resus

- Severe crush injury/crush syndrome is associated with coagulopathy subsequent to release of tissue thromboplastin from muscle trauma

  This may manifest itself as PT raised, platelets reduced, raised fibrinogen degraded products.

Complications

Compartment syndrome

- Apply ice to injured areas and monitor for pain, paresis, pain on passive movement, and reduced temperature of affected limb
- Fasciotomies Injury management in ED – **MI universal fasciotomies**

Open wounds

- Manage open wounds with antibiotics, tetanus toxoid, and debridement Injury management in ED – **MI immediate wound management**

Penetrating knife injury

Terror related stab wounds differ from inter personal and non-terror related penetrating blade injuries. There are usually a greater number of wounds, particularly of the upper body and neck, and more body regions injured.

Terror related stab injuries (TRS)

- Usually inflicted by a powerful overhand grip, with the intention to kill.

Interpersonal stab injuries

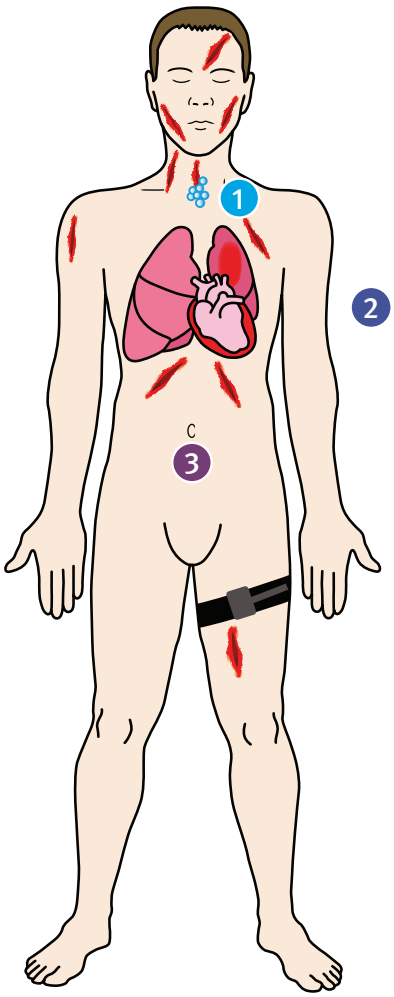
- Most likely to be caused by an underhand grip, with the intention to threaten the victim.

The management of penetrating trauma is likely to involve:

- endotracheal intubation
- chest drain insertion
- IR (if available) and/or surgery.

Catastrophic haemorrhage

- Non-compressible? → Does patient need to go direct to theatre?
- Compressible? → Apply direct pressure/junctional techniques



A

- Airway Injury – bubbling wound, stridor, change of voice 1
  - Consider early intubation or access to airway via wound
- Oesophageal/nerve injuries can usually wait

B

- Tension pneumothorax → needle decompression
- Cardiac tamponade → resuscitative thoracotomy 2
- Most (75%) penetrating injuries to the chest can be managed with CABC and a chest drain

C

If patient is stable:

→ a whole body CT

If patient is unstable:

- potential cardiac and abdominal injury → manage/exclude the cardiac injury first

Be mindful of transient responders 3

- an occult ongoing bleed in the abdomen may suddenly decompensate. Only 40% of patients with peritoneal penetration have an injury requiring laparotomy. Even if stable, keep the patients NBM for – 12–24hrs and observe.

D

⚠ Don't forget to examine the back

Key points

- Tertiary survey (don't forget the back)
- Whole body CT imaging with contrast, as soon as patient is stable enough
- Timely clinical reviews and re-review of imaging, to look for occult injuries. GI/GU injuries are challenging to diagnose
- Blood Borne Virus PEP given multiple victims may be attacked with the same weapon. Draw serology from all Speciality Overview – **Antimicrobial prophylaxis**
- Consider counselling. Speciality Overview – **Coping with Stress following a major incident**

Penetrating knife injury

Penetrating knife injury patients in mass casualty events:

- More likely to arrive in worse condition (hypotensive with lower GCS)
- More likely to require blood transfusion
- Will require more hospital resources to manage these patients
- Half are likely to require emergency surgery
- One third will require critical care (ICU)
- Have a significantly longer hospital stay compared with other mechanisms of injury
- Six times more likely to die in hospital after penetrating knife injuries

Anatomy of penetrating knife wounds

Head and face

- Associated with an increased number of head, face and neck wounds, of greater severity

Spine

- More injuries to the spine and upper extremities

Chest

- More likely to have thorax and MSK injuries
- Chest injuries are more severe

Abdomen

Abdominal injuries are less likely, however the wounds tend to be more severe.

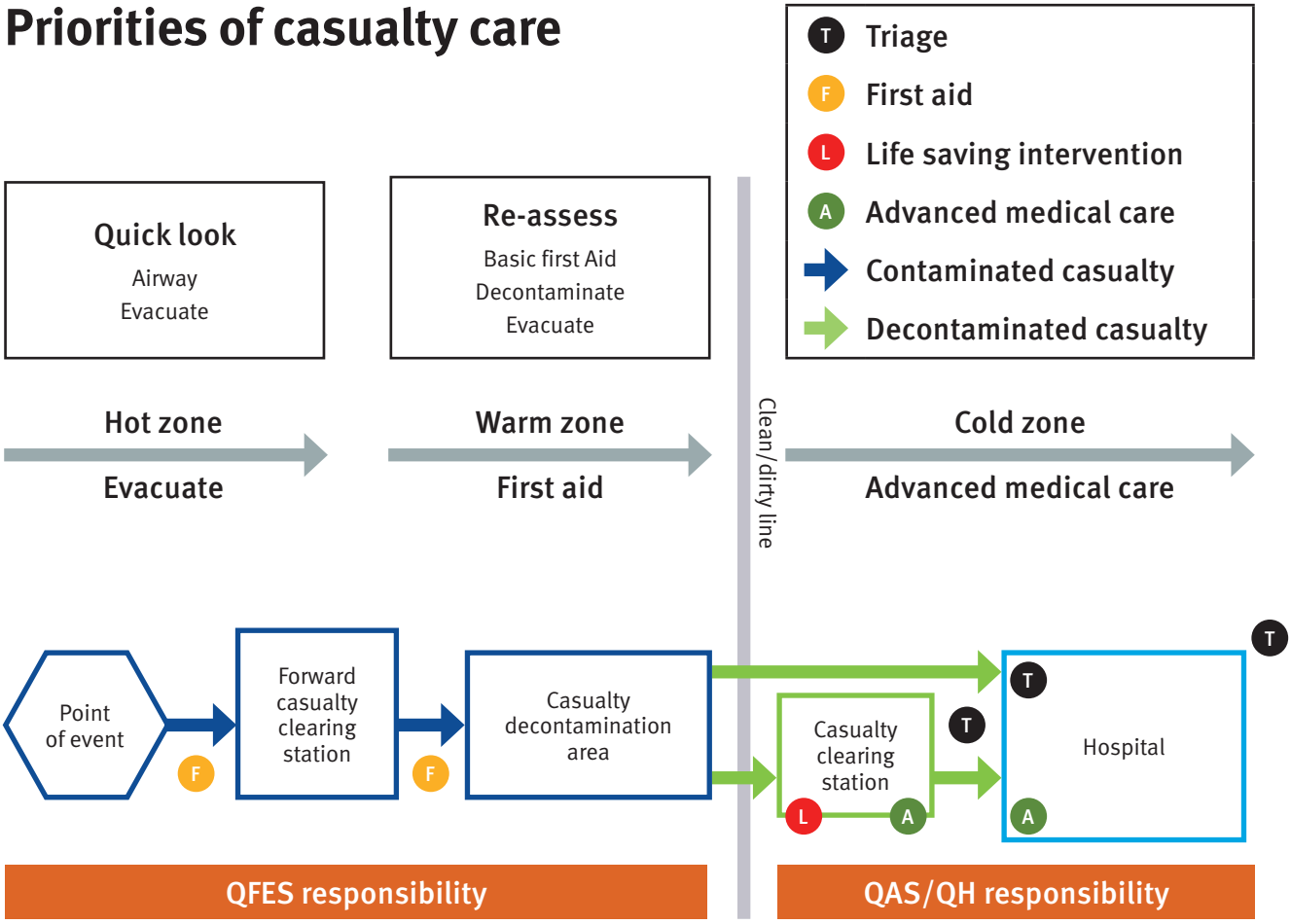
In non-mass casualty stabbing events, casualties are more likely to have abdominal and lower limb injuries.

Hazardous Materials (HAZMAT) and Chemical, Biological, Radiological and Nuclear (CBRN) events

The management of CBRN casualties including HAZMAT follows general principles as well as specific treatment priorities including trauma care. Priorities depend on the type of exposure and presence of any contamination or contagious casualty hazards.

Queensland Poisons Information Centre
13 11 26

Priorities of casualty care



Hazardous Materials (HAZMAT) and Chemical, Biological, Radiological and Nuclear (CBRN) events

CBRN Guidelines: Recognition

- Any symptoms involving emergency services and hospital staff
- Multiple casualties with similar non-traumatic symptoms and signs (STEP 1-2-3 PLUS)
- Unusual taste, smell or mist
- Unexplained dead animals
- Unexplained symptoms including:
  - altered vision
  - eye pain
  - headache
  - excessive secretions
  - chest tightness
  - difficulty in breathing
- non-thermal burns (erythema, blistering and necrosis)

Any unusual or unexplained symptoms, signs, illness or deaths

Unusual investigation result(s) including laboratory and diagnostic imaging

Chemical exposures are more likely to be associated with immediate or acute (minutes to hours) onset symptoms although not in all cases. Biological and radiological exposures may not be obvious and have a longer onset time.

Step 1-2-3 Plus – Safety triggers for emergency personnel

(adapted from United Kingdom Joint Emergency Services Interoperability Programme for hospital use)

If any ambulance or hospital staff have symptoms – go straight to Step 3

Step 1: One person incapacitated with no obvious reason
- Manage using standard protocols (consider standard precautions)

Step 2: Two people incapacitated with no obvious reason
- Manage with caution using standard protocols (consider personal protective equipment)

Step 3: Three or more people in close proximity, incapacitated with no obvious reason
- Manage in a safe area well ventilated area(s) (consider disrobing before handover)

PLUS: these safety interventions may include:
- **Evacuate** – consider removing the patient, other patients and/or non-essential staff
- **Communicate** – inform staff, management and/or emergency services
- **Disrobe** – as a minimum remove clothing from P1 patients; and
- **Decontamination** – consider the requirement and type of formal decontamination, however where practicable life-saving interventions should be performed first

Reference and specialist advice

References: TOXINZ Poisons Information accessible via CKN

Hazardous Materials (HAZMAT) and Chemical, Biological, Radiological and Nuclear (CBRN) events

CBRN Guidelines: Nerve Agents

Nerve agents are highly lethal organophosphorous compounds with varying physical properties ranging from volatile liquid and vapour hazard through to non-volatile liquid. Antidotes and supportive therapy are the main treatment options.

Triage

P1 (Severe)	P2 (Moderate)	P3 (Mild)
Unconscious, convulsions, respiratory distress, respiratory paralysis/arrest, profound bradycardia (<40), cyanosis	Not walking Excessive secretions, confusion, not obeying commands, wheezing, incontinence	Walking Pinpoint pupils, dimmed vision, eye pain

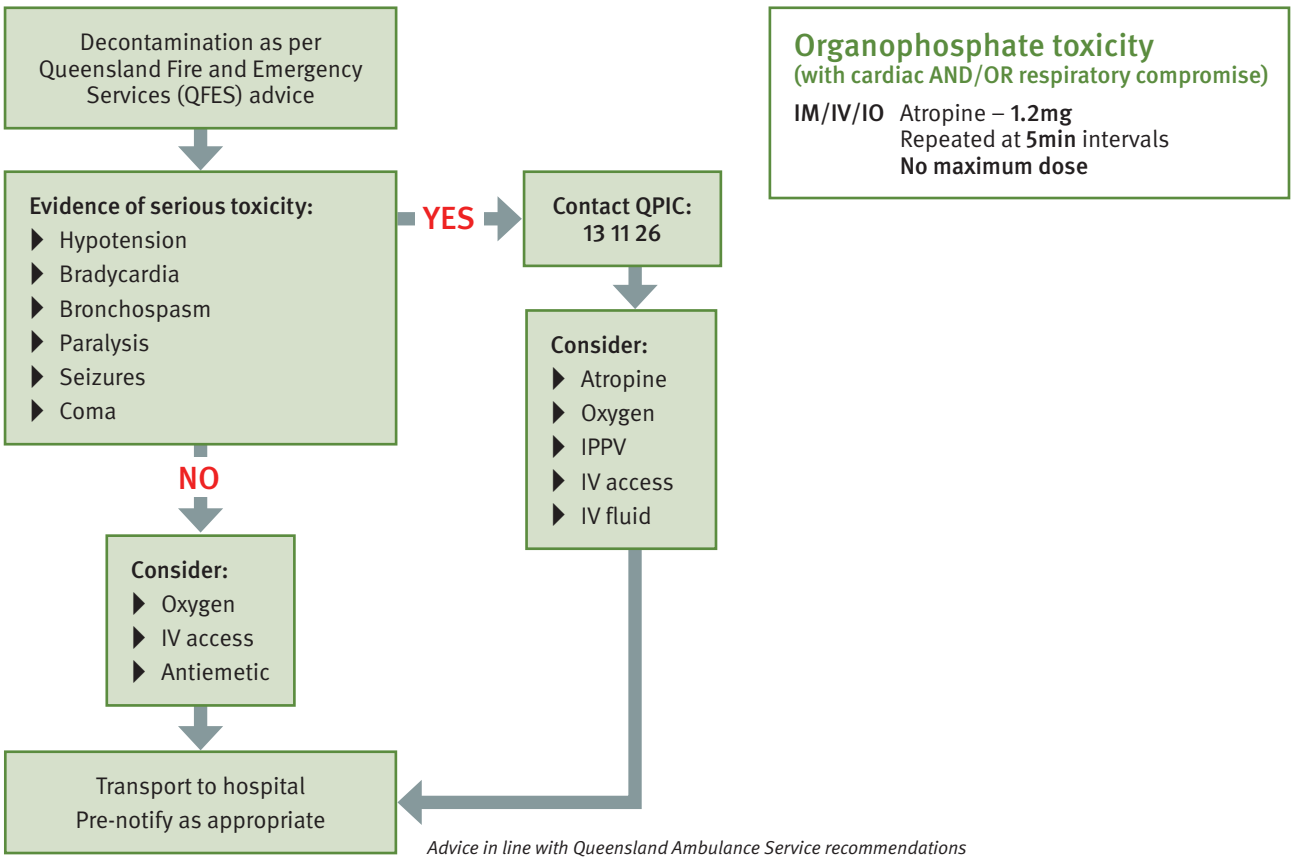
Casualty (CRESS) assessment

Conscious	Respiration	Eyes	Secretions	Skin	Other
Convulsions, Unconscious	Increased, then reduced or apnoea	Pinpoint pupils (delayed following skin exposure)	Increased vomiting	Sweating	Bradycardia

Emergency medical treatment

Queensland Poisons Information Centre (QPIC): 13 11 26

Pre-hospital medical treatment



Advice in line with Queensland Ambulance Service recommendations

Hazardous Materials (HAZMAT) and Chemical, Biological, Radiological and Nuclear (CBRN) events

Emergency medical treatment

Queensland Poisons Information Centre (QPIC): 13 11 26

Hospital medical treatment

If organophosphate or carbamate poisoning is suspected, urgently contact a clinical toxicologist or poisons information centre (**13 11 26**). Management of organophosphate poisoning includes resuscitation and antidotal therapy with atropine.

In hospital management is as per Therapeutic Guidelines via CKN (https://tgldcdp.tg.org.au/etgAccess)

Evidence of serious toxicity?

Clinical Presentation:

- Hypotension
- Bradycardia
- Bronchospasm
- Paralysis
- Seizures
- Coma

Decontamination complete?

NO → Contact Queensland Fire and Emergency (QFES) for decontamination advice

YES

Contact QPIC: 13 11 26

Consider antidote:

Atropine

Atropine 1.2mg (child: 0.05mg/kg up to 1.2mg) intravenously. Double the dose every 5mins until the target end points below are reached. In some cases, cumulative loading doses up to 100mg may be required.

**Pralidoxime use is controversial and routine use is not recommended. Consult with QPIC for patients with on-going severe poisoning.*

Target end points for atropinisation are:

- clear chest with no wheeze on auscultation
- heart rate more than 80 beats per min
- systolic blood pressure more than 80mmHg

Supportive measures where required:

- Consider early airway intervention and ventilatory support
- For hypotension consider intravenous fluids as first line. If hypotension persists, consider inotropic support.

Note: the vagal response to intubation can precipitate profound bradycardia. Give Atropine before intubation to block vagal response.

Hazardous Materials (HAZMAT) and Chemical, Biological, Radiological and Nuclear (CBRN) events

CBRN Guidelines: Nerve Agents

GA	GB	GD	GF	VX
Tabun	Sarin	Soman	Cyclosarin	

Triage

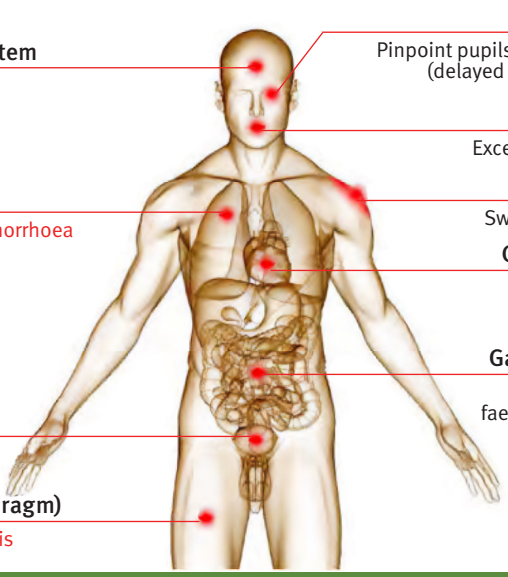
Nerve agents cause the inhibition of the enzyme acetylcholinesterase that breaks down the neurotransmitter acetylcholine. This results in over-stimulation of the following parts of the nervous system:

Parasympathetic: Miosis, secretions (tears, bronchorrhoea, salivation), vomiting, incontinence, bradycardia

Central nervous system: Confusion, coma, seizures and central respiratory failure

Sympathetic ganglia: Tachycardia, hypertension, sweat glands: sweating

Neuromuscular junction: Fasciculation (systemic and local), depolarising paralysis, respiratory failure



Medical

Atropine: Atropine is an antimuscarinic and reverses nerve agent parasympathtic effects. The dose is titrated to effect based on the reversal of bradycardia (endpoint ›90), bronchospasm and secretions. High doses (up to 1000mg) have been used in the past especially in the absence of effective oxime therapy. Alternatives to atropine include hyoscine.

Benzodiazepines: Benzodiazepines are used as anti-convulsants and are also neuroprotective. Ventilation strategy: This is similar to the asthma ventilation strategy due to high airway pressures, and atropinisation can be monitored by reversal of bronchospasm and capnography normalisation.

Oxime therapy: Oxime therapy such as Pralidoxime, use is controversial and routine use is not recommended. Pralidoxime can reactivate acetylcholinesterases that are inhibited by organophosphates; however, it is only effective if ageing (irreversible inhibition) of the acetylcholinesterase-organophosphate complex has not occurred. Consult with QPIC for patients with on-going severe poising.

Reference and specialist advice

References: TOXINZ Poisons Information accessible via CKN

Mass Casualty Incidents

Major incident LEAN FORWARD

Major incident LEAN FORWARD

Major incident LEAN FORWARD message has been announced:

- **External source of order**
  Message has been received from any of the emergency services or State Health authorities, direct into ED, requesting your hospital to LEAN FORWARD for a major incident.
- **Internal source of order**
  Unusual activity reporting within ED, news via social media or other sources etc. may lead to a self declaration of major incident LEAN FORWARD by an ED consultant in discussion with the hospital executive on call.

Use the METHANE chart to record details of any alert messages. If you are self-declaring, other agencies may call you to ask for your METHANE information, so make it visible to all.

Exact numbers are difficult, therefore estimates of total numbers of P1+P2 casualties may be given to help receiving hospitals understand severity of incident and numbers to prepare for.

M	**Major** incident standby
E	**Exact** location of incident
T	**Type** of incident
H	**Hazards**/potential hazards
A	**Access** (best routes for access to and exit from the hospital)
N	**Number** of casualties
E	Which **emergency services** are involved/needed?

Self presenting casualties may start to arrive without warning, pre-alert or declaration, particularly if non-ambulance service transport is used.

Queensland activation response model includes four stages. For more information go to Glossary/list of terms

Hospital major incident LEAN FORWARD

Emergency Department

- Initiate staff call-in
- Locate and check the pre-printed/collated patient registration documents for a major incident
- Establish an ED Triage Station. Consider a location outside the ED (e.g. ambulance loading bay or external entrance)

Critical care

- Identify ICU patients suitable for transfer to ward
- Liaise with Theatre Coordinator for admissions to ICU

All wards

- Assess patient potential for discharges/transfers
- Send appropriate patients to the discharge area
- Prepare Trauma Ward to accept admissions and ICU stepdowns

Theatres

- Consider suspending all operations except for life saving surgery
- Set up theatre coordination point
- Establish and attend clinical coordination meeting e.g. Incident Management Team (IMT) meeting)

Resus

- Assemble Triage Teams and nominate roles ED Resus – **Trauma team roles in a major incident**
- Aim for one doctor and one nurse per incoming casualty
- Include scribes and photographer if available
- Create checkpoints (to monitor patient flow. Ideally, patients should flow in one direction), with white boards, pens, casualty flow log/record book(s) and runners
- Patient Support Officers to move all available trolleys to ED Reception
- Identify treatment areas, expanding Resus if required based on casualty estimates, consider creating a P3/non-urgent area away from ED
- Prepare to move patients already in the department

Ambulatory

- Discharge home (or to discharge area to await transport)
- Patients should receive a follow-up phone call the following day

Non-ambulatory

- Admit or transfer urgent cases requiring medical intervention

Imaging department

- Prioritise use of ED scanner for non-ambulatory or P1 cases
- Suspend all non-urgent inpatient and outpatient imaging

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METHANE report

METHANE is the recognised common model for passing incident information between services and their control rooms.

All services have use a common model which will mean information can be shared in a consistent way, quickly and easily, whoever the information is passing between.

M	Major incident	Major incident STAND UP been declared? (Yes/No)
E	Exact location	What is the exact location or geographical area of the incident?
T	Type of incident	Blast/Explosion/Gunshots/Fire/ Building Collapse/Flood/ Chemical/Nuclear/Biological/ Radiation
H	Hazards	What hazards or potential hazards can be identified?
A	Access	What are the best routes for access and exit?
N	Number of casualties	How many casualties are there, and what condition are they in?
E	Emergency services	Which, and how many, emergency assets and personnel are required or are already on-scene?

Major incident LEAN FORWARD	Major incident STAND UP
Standby message received: Date: _____ Time: _____	Declared message received: Date: _____ Time: _____

Please use the following spaces to write details and any changes/updates:

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Mass Casualty Incidents

Major incident STAND UP

Major incident STAND UP

Be prepared to update the METHANE report or give out METHANE information to others

M	MAJOR incident STAND UP					
E	The EXACT location is					
T	The TYPE of incident is					
H	HAZARDS identified are					
A	Casualties should ARRIVE by					
N	Estimated NUMBER of Casualties are P1		P2		P3	
E	The EMERGENCY services involved are:					
	Fire and Rescue/Police/Others?					

Major incident STAND DOWN

If the message, 'Major incident STAND DOWN' is received, no new casualties are expected.
The call may be full or a partial STAND DOWN, and this will be further described by the Incident Director.

General preparation checklist

- Prepare areas for clinical and administrative uses
- Call in appropriate number of staff (use cascade contact system)
- Maintain internal and external communications
- Provide a command and control structure for the medical, nursing and administrative staff
- Staff already on duty should report to their clinical areas
- Called in staff should report to the Staff Reporting Area and await further instructions
- Review MOI section of these guidelines if mechanism(s) of incident known Mechanism of Injury

ED checklist

- Hospital Ambulance Liaison Officers (HALO), if available will improve communications into the receiving hospital. They can also give real-time ED Resus capacity updates to the ambulance control centre and divert ambulances if required
- Know how many patients your hospital is expected to manage within the first hour (Patient dispersal framework and casualty capability chart) and plan to exceed this number
- Minimal relatives should attend ED, however keep parents and children together if possible
- Security may need to assist with management of relatives to the relatives area
- Documentation should be kept to a minimum
- Involve clinical photography early, to guide clinical care and for forensics
- Security screening (sanitisation) of patients and relatives may be required and must be planned for

ED triage

- Should be established outside of ED, e.g. in the Ambulance reception area
- Should be staffed by a Senior ED consultant and a Senior ED Nurse
- Patients must be re-triaged at this point, in case of any change/deterioration since their on-scene triage category was given
- Patients should be triaged to ED:
  - P1 – Resuscitation
  - P1/P2 – Acute or equivalent
  - P3 – Fast track or designated waiting area
- Ideally, P3 walking wounded patients should not enter the ED but be directed to and managed in a separate area, given a clinic appointment, or advised to see a GP/other treatment facility
- Patients should be given a pre-assigned hospital ID number and this should remain their hospital number until the patient is on the wards, even if their real identity is known

Major incident STAND UP

ED Resus

- Where possible, there should be on treatment team per patient ED Resus – **Trauma team roles in a major incident**
- A senior clinician should oversee all casualties in Resus and coordinate their transfer to theatre/imaging/critical care/ward as appropriate
- Identify, classify and record, patient's identifiers and their injuries using the **MI STAND UP**
- Staff already on duty should report to their clinical areas
- Called in staff should report to the Staff Reporting Area and await further instructions
- Review MOI section of these guidelines if mechanism(s) of incident known Mechanism of Injury

ED acute

- All patients must have a careful primary and secondary survey
- Patients must be regularly observed to identify changes in their clinical condition
- Deteriorating patients may need a trauma team response, even though they have been in the department for some time
- Some patients may be well enough to discharge directly from ED, but should always have a follow-up appointment with a hospital clinic or GP

ED fast track or designated waiting area

- Most patients will be well enough to discharge directly from ED, but should always have some form of follow-up arrangement made (e.g. phone call the next day, or a letter to take to their GP)

ED discharge area

A common discharge area is useful in order to:

- organise follow-up arrangements
- give patients time to talk to others and share their experiences
- re-unite with relatives and friends prior to discharge, to allow this to be done away from any unwanted media attention
- advise patients and their families how to cope with media attention
- receive counsel from department Social Worker or other appropriate person e.g. Hospital Chaplain (multi-faith if available)

Psychosocial first aid is important:

- listening to stories, acknowledging a traumatic event, helping families
- talk to children about bad news
- patients may have worries about going home and getting back to normal

⚠ **Immediate formal counselling is not often required and may make PTSD more likely to occur.**

⚠ **Some people will have pre-existing mental health concerns and should be referred early**
Speciality Overview – **Coping with stress following a major incident**

Other considerations

- Can refreshments be ordered for the clinical staff?
- Are crèche arrangements required to support the staff response?
- Consider placing non-MI major trauma on divert to other appropriate hospitals, whilst there is still a significant surgical workload
- Consider diverting elective/other work load to other hospitals for several days/weeks
- Consider an immediate ED team debrief once ED is cleared (*Hot debrief*)
  - Take a roll-call and ensure that all staff members (not just clinical) are invited to future debriefs
  - Multiple debrief sessions may be required to allow all staff who work shift systems to attend
  - Other debriefs will follow in the next few weeks and months

Clinical impact assessment call – patient summary sheet (*Patients 1 to 10*)

- Precise details of injuries should **not** be recorded on this summary sheet
- Please only include admitted patients
- Easiest method: use one grid for patients with single injury and one for multiple system trauma

Injury	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7	Patient 8	Patient 9	Patient 10
Hospital number										
Patient identifiers										
On scene triage SIEVE (P1/P2/P3)										
Hospital/ED triage (P1/P2/P3)										
Age										
Mechanism										
Arrival time										
Destination										
Outcome (critical care/ward/RIP)										
Traumatic brain injury										
Spinal injury – cord or fracture										
Chest trauma										
Abdominal trauma										
Vascular trauma										
Pelvic trauma										
Single open fracture										
Multiple open fracture										
Single closed fracture										
Multiple closed fractures										
Soft tissue injuries										
Burns										
Maxillofacial trauma										
Ocular trauma										
Others										

Official sensitive upon completion

Clinical impact assessment call – patient summary sheet (*Patients 11 to 20*)

- Precise details of injuries should **not** be recorded on this summary sheet
- Please only include admitted patients
- Easiest method: use one grid for patients with single injury and one for multiple system trauma

Injury	Patient 11	Patient 12	Patient 13	Patient 14	Patient 15	Patient 16	Patient 17	Patient 18	Patient 19	Patient 20
Hospital number										
Patient identifiers										
On scene triage SIEVE (P1/P2/P3)										
Hospital/ED triage (P1/P2/P3)										
Age										
Mechanism										
Arrival time										
Destination										
Outcome (critical care/ward/RIP)										
Traumatic brain injury										
Spinal injury – cord or fracture										
Chest trauma										
Abdominal trauma										
Vascular trauma										
Pelvic trauma										
Single open fracture										
Multiple open fracture										
Single closed fracture										
Multiple closed fractures										
Soft tissue injuries										
Burns										
Maxillofacial trauma										
Ocular trauma										
Others										

Official sensitive upon completion

Mass Casualty Incidents

Emergency Department

Emergency Department triage (adults)

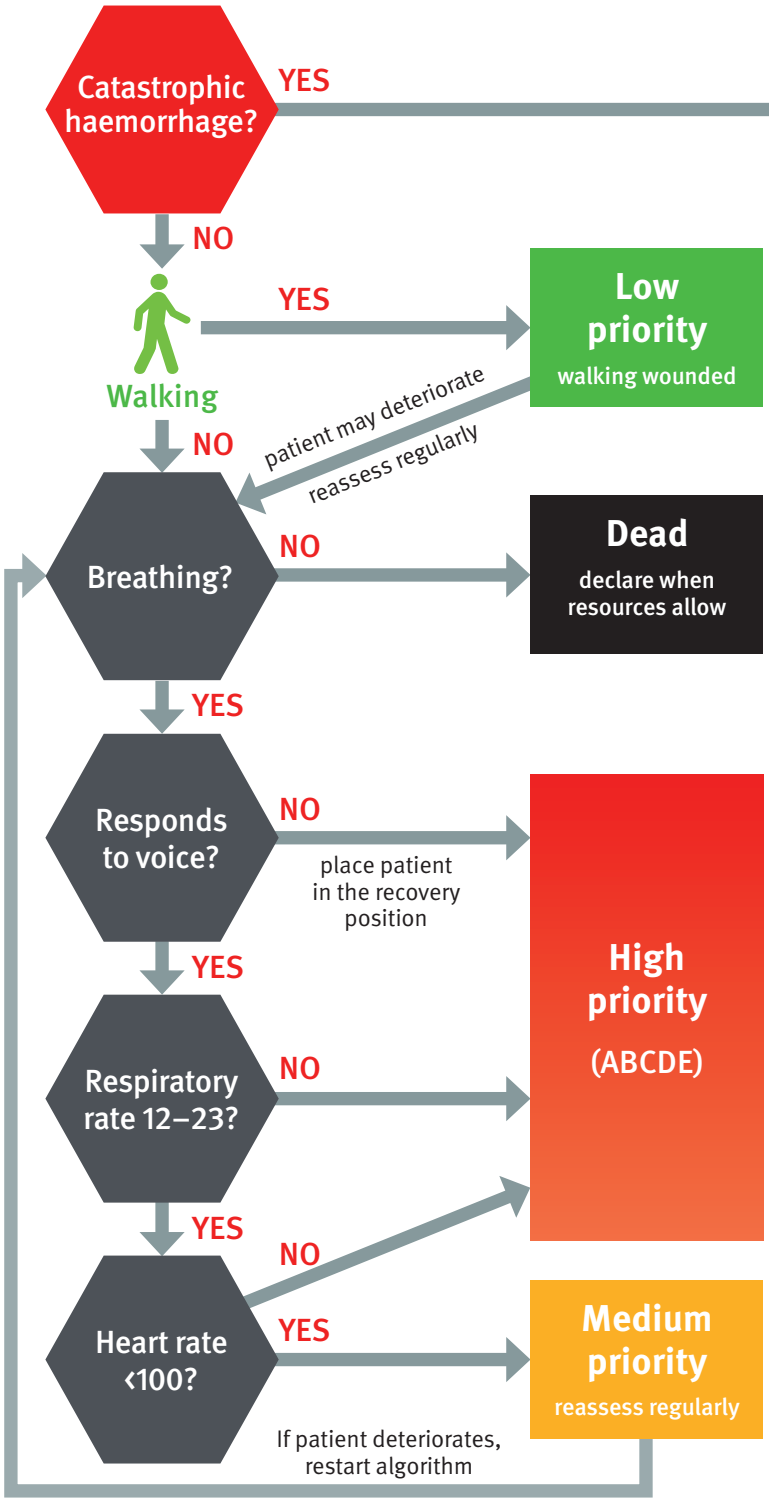
Priority for intervention

Introduction

This is an in-hospital clinical guideline for use in a major incident. It is designed to be used in times of SURGE in order to identify patients in need of a life-saving intervention and suggests the intervention(s) required.

- Early secondary assessment from senior clinicians is recommended to mitigate for initial over-prioritisation

⚠ ***Note*: this guideline is not designed for pre-hospital triage.**



High priority for intervention
(big C)

Tourniquet
Haemostatic agents
Pelvic binder

Once applied, restart algorithm

High priority for intervention
(ABCDE)

- Definitive airway
- Thoracostomy (needle/finger/tube)
- Chest seal
- Positive pressure ventilation
- ≥4 units blood products OR un-crossmatched blood
- TXA
- Laparotomy/Thoracotomy/ Pericardial window for trauma
- Surgery/IR for proximal vascular control
- ALS/ACLS for peri arrest/arrest situations
- Neurosurgery for management of intracranial haemorrhage
- Spinal precautions for suspected spinal fracture
- Seizure-terminating medication
- Correction of hypothermia
- Correction of low blood glucose
- If CBRN suspected, consider chemical antidotes

Rationale for the MPTT-24

- Can be completed by inexperienced personnel in 30 seconds
- The MPTT-24 is designed to minimise under-triage

Adapted from Modified Physiological Triage Tool 24 (MPTT-24). Vassallo 2017 CC BY 4.0

Key points

ED 'triage for intervention' principles

- Reassess patients regularly and after an intervention
- Is the patient now stable enough for:
  - CT whole body (if available)

Transfer to tertiary facility

- Is the patient still a high priority for 'direct to theatre'?

Emergency Department triage (adults)

List of life-saving interventions to be considered in a major incident or mass casualty event.

These were defined through an international Delphi consensus of experts involved in major incident management.[1]

1	Intubation for actual or impending airway obstruction	Rural and remote facilities, Regional trauma service, Major trauma service
2	Surgical airway for actual or impending airway obstruction	Rural and remote facilities, Regional trauma service, Major trauma service
3	Thoracostomy (needle/finger/tube)	Rural and remote facilities, Regional trauma service, Major trauma service
4	Application of a chest seal (commercial/improvised)	Rural and remote facilities, Regional trauma service, Major trauma service
5	Positive pressure ventilation for ventilatory inadequacy	Rural and remote facilities, Regional trauma service, Major trauma service
6	Application of a tourniquet for haemorrhage control	Rural and remote facilities, Regional trauma service, Major trauma service
7	Use of haemostatic agents for haemorrhage control	Rural and remote facilities, Regional trauma service, Major trauma service
8	Insertion of an intra-osseous device for resuscitation purposes	Rural and remote facilities, Regional trauma service, Major trauma service
9	Receiving un-crossmatched blood	Rural and remote facilities, Regional trauma service, Major trauma service
10	Receiving ≥4 units of blood/blood products	Regional trauma service, Major trauma service
11	Administration of tranexamic acid	Rural and remote facilities, Regional trauma service, Major trauma service
12	Laparotomy for trauma	Regional trauma service, Major trauma service
13	Thoracotomy or pericardial window	Major trauma service
14	Surgery to gain proximal vascular control	Major trauma service
15	Interventional radiology for haemorrhage control	Major trauma service
16	Application of a pelvic binder	Rural and remote facilities, Regional trauma service, Major trauma service
17	ALS/ACLS for a patient in a peri-arrest situation	Rural and remote facilities, Regional trauma service, Major trauma service
18	Neurosurgery for the evacuation of an intra-cranial haematoma	Major trauma service
19	Craniotomy/burr hole insertion	Major trauma service
20	Spinal nursing for a suspected spinal fracture	Rural and remote facilities, Regional trauma service, Major trauma service
21	Administration of a seizure-terminating medication	Rural and remote facilities, Regional trauma service, Major trauma service
22	Active/passive rewarming for initial core temp <35°C	Rural and remote facilities, Regional trauma service, Major trauma service
23	Correction of low blood glucose	Rural and remote facilities, Regional trauma service, Major trauma service
24	Administration of chemical antidotes	Rural and remote facilities, Regional trauma service, Major trauma service

Rural and remote facilities Regional trauma service Major trauma service

This process is designed to be used in circumstances when the receiving hospital is over-whelmed with casualties from a major incident i.e. in times of SURGE and when individual patients cannot be met by individual treatment teams. Casualties arriving at the hospital may not have undergone a pre-hospital triage process.

Under normal circumstances, casualties from a major incident will have undergone a pre-hospital triage process to determine their priority for treatment. On arrival at hospital, they will be met by individual and designated treatment teams.

The aim of this process is to rapidly identify those casualties in need of life-saving interventions. It can be completed by providers with all levels of experience in under 30 seconds.

The physiological assessments within the process are evidence-based (adapted from the MPTT-24)[2] and have the greatest sensitivity for identifying those in need of life-saving interventions within both the civilian and military environments.

As a consequence of this, a greater proportion of casualties will be categorised as 'High Priority' including a number of those who do not require life-saving interventions. At the earliest opportunity, and within a permissive setting, early secondary assessment by a senior decision-maker is required to review those categorised as 'High Priority'.

References

1 Vassallo J, Smith JE, Bruijns SR, Wallis LA. Major incident triage: A consensus based definition of the essential life-saving interventions during the definitive care phase of a major incident. Injury. 2016 Sep;47(9):1898–902.

2 Vassallo J, Smith J, Bouamra O, Lecky F, Wallis LA. The civilian validation of the Modified Physiological Triage Tool (MPTT): an evidence-based approach to primary major incident triage. Emergency Medicine Journal. 2017 Dec;34(12):810–5.

Emergency Department triage (paediatric ‹16 years)

Introduction

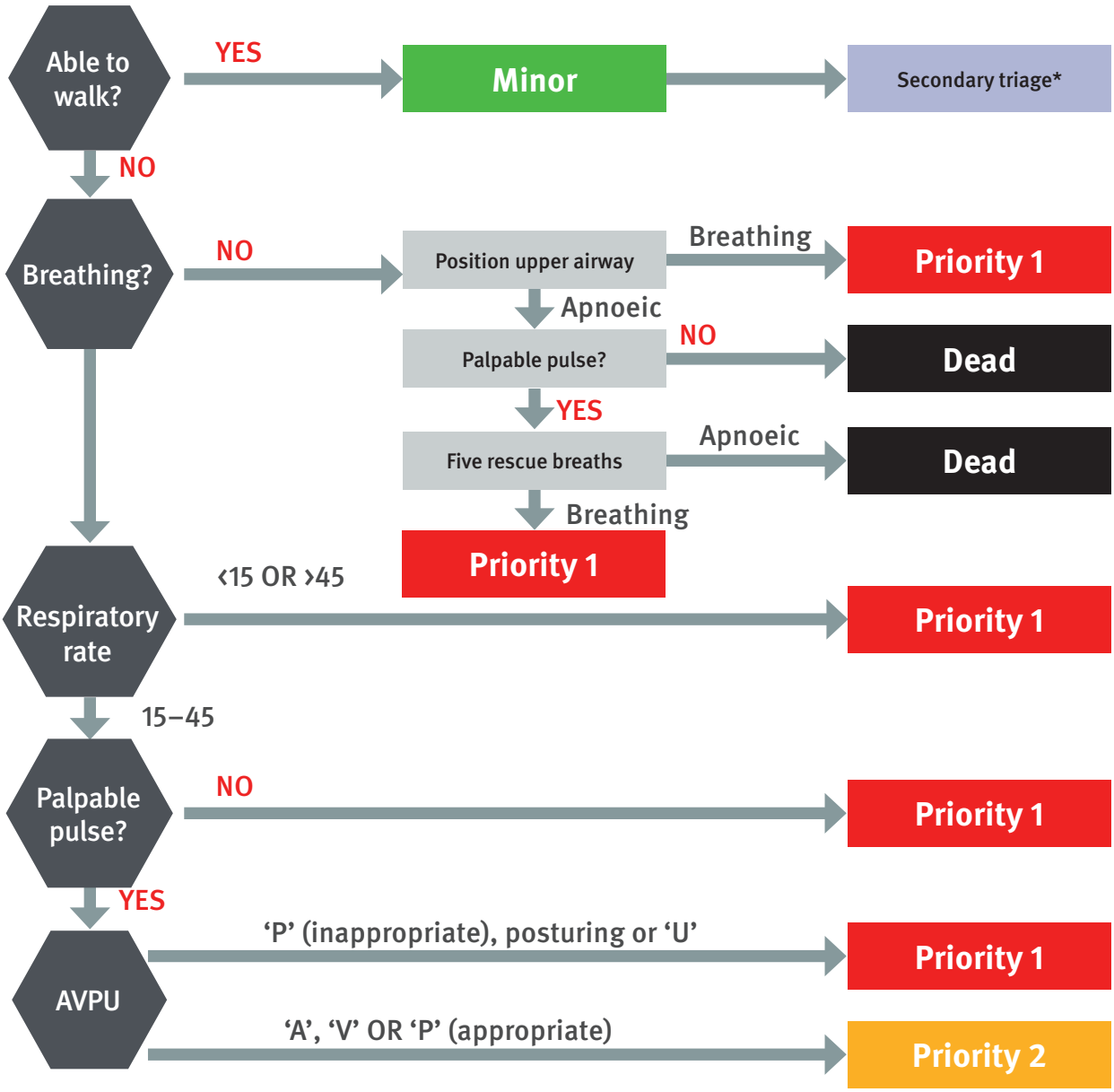
In conventional triage, the objective is to sort and prioritise patients; to do the best for each individual. However, the objective of **triage in a mass casualty situation is to do the greatest good for the greatest number**.

If a health unit or facility prefers to adopt their business-as-usual triage model during disasters this is encouraged as acceptable practice (e.g. Australasian Triage Scale).

There are options for utilising other triage systems for children during disasters. JumpSTART© is a system designed specifically for triaging children in disaster settings. Infants are seen first, followed by anyone who is or appears to be a child aged 16 years or younger.

- Allows paediatric casualties to be assessed based on physiology and should not prioritise paediatric casualties above sicker adult casualties
- Provides an objective framework for stressful and emotional decision-making

Though JumpSTART© was developed for use in children from infancy to age 8, where age is not immediately obvious, it is used in any patient who appears to be a child (patients who appear to be young adults are triaged using START or other adult triage systems). Other paediatric triage tools may be used, including Paediatric Triage Tape (PTT), which is based upon a modification of the triage sieve.



* In the JumpSTART© system, infants are evaluated first, using the entire JumpSTART© algorithm. Other children who cannot walk on their own (but are carried to the treatment area) are evaluated next.

Key points

- If a casualty appears to be a child, use this algorithm
- If a casualty appears to be an adult, use the Adult Triage tool ED Triage – Emergency Department triage (adults)

Speciality information

- Reflects unique aspects of paediatric physiology
- Can be completed within 30 seconds

Emergency Department triage (paediatric <16 years)

Primary triage

- Typically performed at the scene of the incident
- Helps to prioritise patients for evacuation/transport
- Can occur at a hospital

Secondary triage

- Performed to re-evaluate a patient after primary triage has been completed
- Typically done once the patient arrives in hospital
- Can also be done at an alternative care site, casualty clearing station or if time on scene is prolonged

Priority 1	**Immediate**	Severely ill/injured but treatable and able to be saved with relatively quick treatment and transport e.g. severe bleeding, sepsis, open chest or abdominal wounds, severe respiratory distress, emotionally uncontrollable.
Priority 2	**Delayed**	Injured/ill and unable to walk on their own; potentially serious injuries/illnesses but stable enough to wait a short while for medical treatment e.g. burns with no respiratory distress, spinal injuries, moderate blood loss, conscious with a head injury.
Priority 3	**Minor**	Minor injuries/illnesses that can wait for a longer period of time for treatment e.g. minor fractures, minor bleeding or minor lacerations.
Priority 4	**Expectant**	Dead or obviously dying. May have signs of life but injuries are incompatible with survival e.g. cardiac arrest, respiratory arrest with a pulse*, massive head injury. It can be psychologically difficult to tag a child as expectant/deceased. Resist the tendency to assign a higher triage category to paediatric patients just because they are children. Using an objective triage tool during a major incident can provide emotional support for staff forced to make these decisions for children. ** In children, typically respiratory failure precedes circulatory failure. If a child is apnoeic but has a pulse, a brief trial of ventilations, may 'jumpstart' their respirations (trial: five rescue breaths).*

Main differences between adult and paediatric triage

1. In children, if positioning the airway does not restart ventilation, then give a trial of ventilation, as this may restart spontaneous ventilation. In adults, there is no trial of ventilation and the casualty is tagged expectant or dead.
2. In children, only peripheral pulses should be used to assess circulation.
3. In children, AVPU is used to assess mental status, not ability to follow commands.

Non-ambulatory children include:

- infants (who can't walk yet)
- children with developmental delays
- children with acute injuries or chronic conditions prior to the incident that prevented them from walking.

The JumpSTART© paediatric triage MCI triage tool (usually shortened to JumpSTART©) is a variation of the simple triage and rapid treatment (START) triage system. Both systems are used to sort patients into categories at mass casualty incidents (MCIs).

https://www.childrens.health.qld.gov.au/qpec-paediatric-resuscitation-tools/

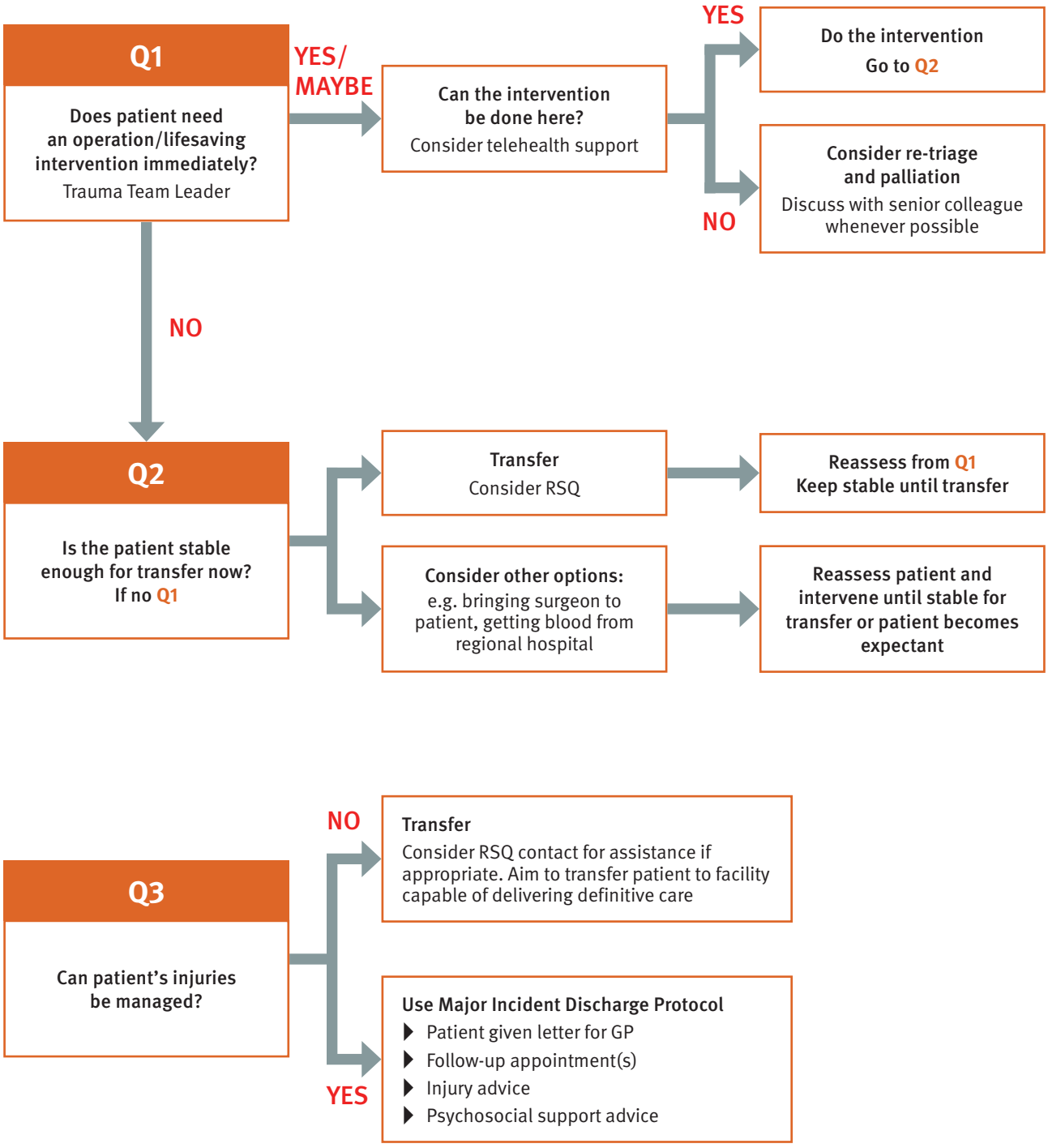
Emergency Department outcomes, discharges and follow-up advice in a major incident

In a major incident, decisions regarding the sickest patients need to made quickly and decisively, so that these patients reach their treatment destination first time and without delay.

Less severely injured patients may be managed and discharged from ED with further management or follow-up plans in place, if their wounds and physiological status allows this, to protect theatre and bed capacity for other more urgent cases.

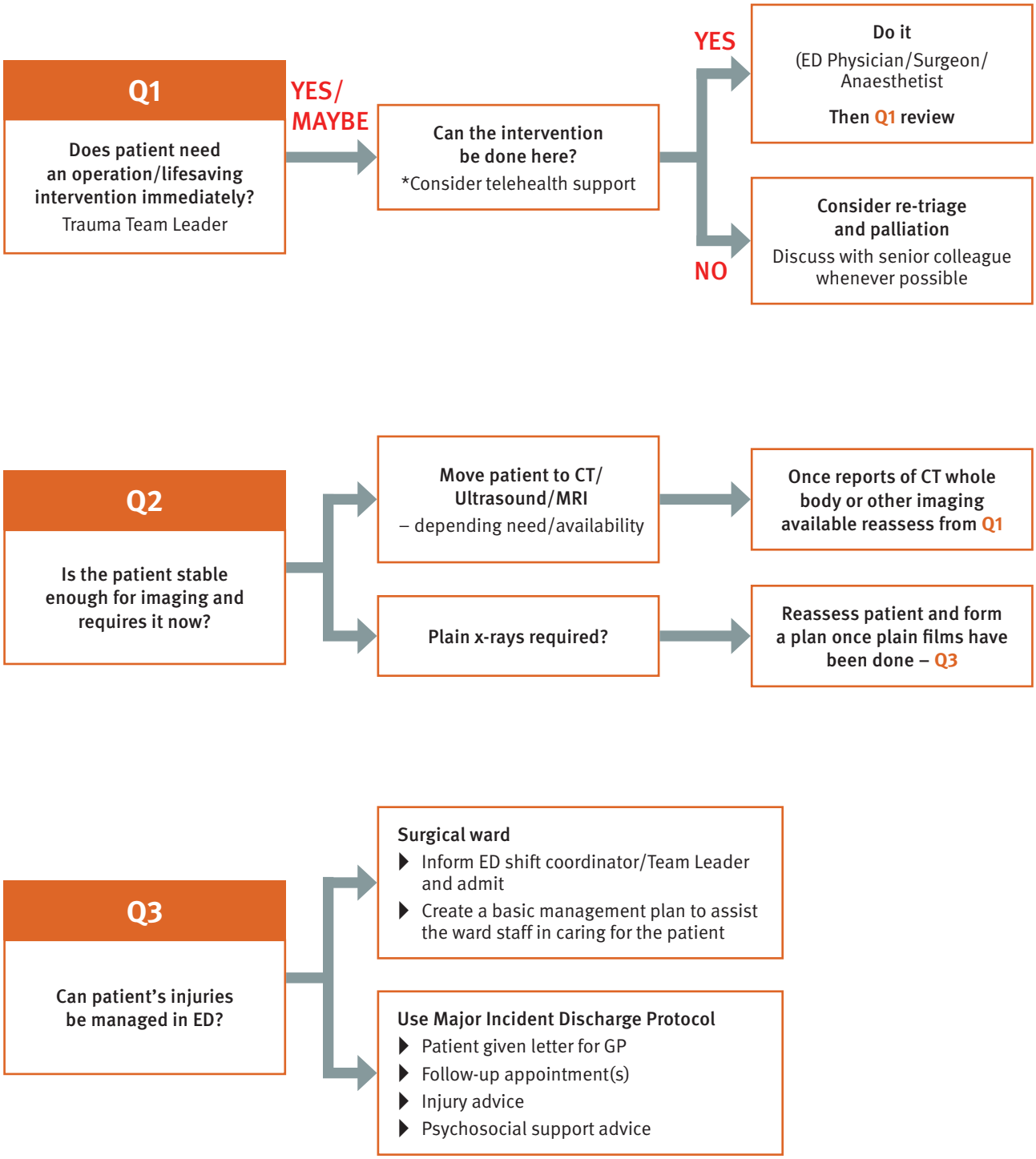
- This algorithm suggests rapid ED outcomes that are acceptable in a major incident, or mass casualty event.

Rural and remote facilities



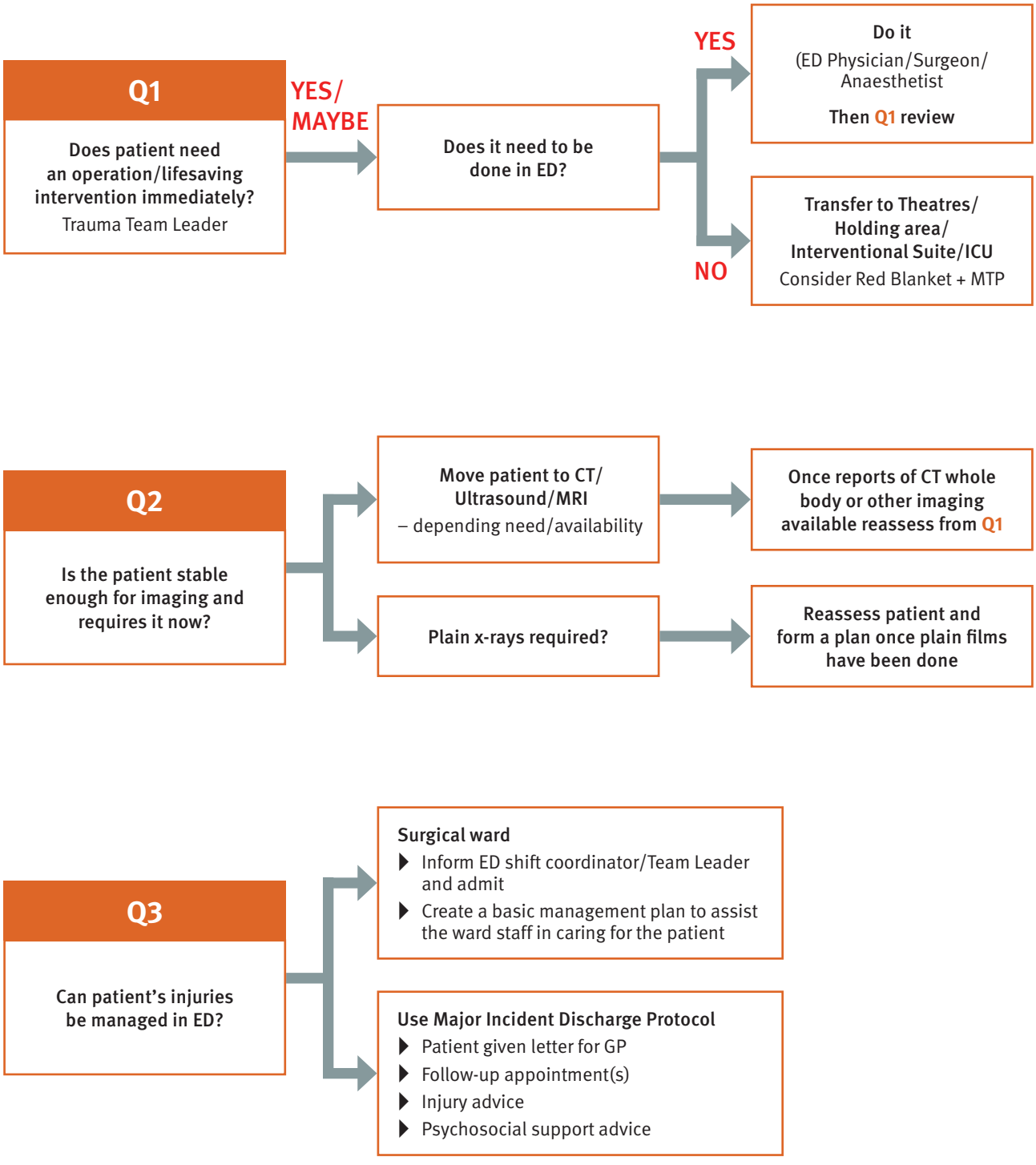
Emergency Department outcomes, discharges and follow-up advice in a major incident

Regional trauma centre



Emergency Department outcomes, discharges and follow-up advice in a major incident

Major trauma centre



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Mass Casualty Incidents

ED Reception and Resuscitation

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Trauma team roles in a major incident

The usual ED trauma team response may not be possible. This guide suggests the essential roles and jobs to resuscitate and receive a trauma patient. Some roles can be quickly assigned to clinical staff who are not usually part of the trauma team and contains job lists for those roles.

Ideal trauma team roles

Consider:

- Team role identification with labels or tabards/ vests (if available)
- Personal Protective Equipment – gloves, gowns, protective eyewear, lead aprons

Airway Nurse

Pre-arrival:

- Equipment check
- Collect emergency drugs

On arrival:

- Monitoring On
- Checks C-Spine collar correctly applied
- Assists Trauma Anaesthetist – AIRWAY
- Assists A-Line insertion
- Checks equipment ready for move to CT/theatre/other destination

Assessment Doctor

Pre-arrival:

- Preps thoracotomy tray
- Switch on USS/FAST
- Scissors for clothing removal

On arrival:

- Remove casualty's clothing
- Primary survey CABCDE
- Informs TTL and Scribe of findings
- Other procedures e.g. FAST, ICDs, as required/able
- When appropriate, conducts secondary survey

Senior Resus Nurse/ Coordinator

- Receives METHANE updates
- Coordinates and supports nursing staff response

Scribe

- Keep writing/recording everything you see and hear in the bay
- Stay in one place

Airway Doctor

Pre-arrival:

- Equipment check with Airway Nurse

On arrival:

- Assess Airway and report to TTL & Scribe
- Rx and gives O_2, fluids and drugs
- RSI if required
- Analgesia
- Maintains C-Spine immobilisation for log roll
- Takes control of the log roll
- AMPLE (if patient conscious)
- TXA
- A-line insertion once airway secure
- Remains with patient until final destination (Theatre/ICU/Ward)

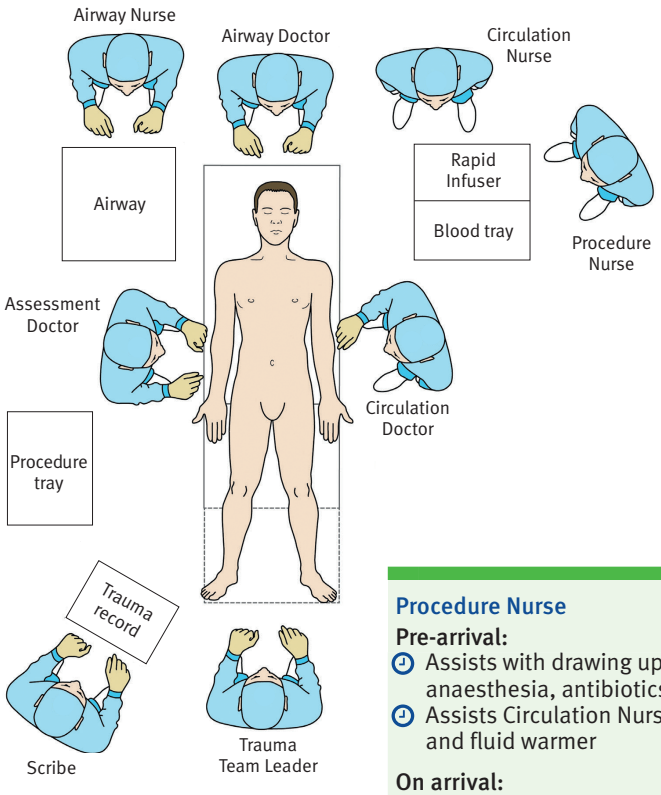
Circulation Nurse

Pre-arrival:

- Prepares monitoring – including $EtCO_2$
- Primes IV line
- Prepares fluid warmer/rapid transfusion device

On arrival:

- Attaches monitoring
- Checks patient's temperature, BGL and pain score
- Assists Circulation Doctor with vascular access, blood collection and analgesic administration



Circulation Doctor

Pre-arrival:

- Preps cannulation, blood sample bottles, Imaging request form

On arrival:

- Gains IV access and takes trauma bloods
- Confirms that the imaging request has been made and CT is ready to scan
- Assists with other procedures as required, e.g. urinary catheter insertion

Procedure Nurse

Pre-arrival:

- Assists with drawing up of drugs – analgesia, anaesthesia, antibiotics, etc.
- Assists Circulation Nurse with priming IV lines and fluid warmer

On arrival:

- Removes patient clothing (ensuring preservation of personal items)
- Assists with control of catastrophic haemorrhage
- Assists with application of emergency splinting (including pelvic splints)
- Assists Circulation Nurse with massive transfusion if required
- Ensures patient passive/active warming is commenced if patient temperature ≤35°
- Assists Assessment Doctor as required with procedures

Trauma Team Leader (TTL)

Controls Trauma Call, Stay with Scribe and stays **'Hands Off'**

Pre-arrival:

- Assembles the team
- Universal precautions/ ID bibs/lead aprons for all
- Deliver ATMIST report and give likely diagnoses/ injuries to need immediate management

On arrival:

- Call silence for handover
- Control and manage the resuscitation
- Should prioritise and clearly articulate interventions and investigations required and the order that they should occur

Trauma team roles in a major incident

The usual ED trauma team response may not be possible. This guide suggests the essential roles and jobs to resuscitate and receive a trauma patient. Some roles can be quickly assigned to clinical staff who are not usually part of the trauma team and contains job lists for those roles.

Essential trauma team roles

Minimum trauma team roles

Consider:

- Team role identification with labels or tabards/ vests (if available)
- Personal Protective Equipment: gloves, gowns, protective eyewear, lead aprons

Minimum trauma team roles:

Planning at a local level is encouraged. Example team role minimum requirements are indicated in **RED.**

Limited staff available and staff may have one or more roles.

Consider asking QAS or RSQ to bring extra staffing resources to assist.

Assessment Doctor

Pre-arrival:

- Preps thoracotomy tray
- Switch on USS/FAST
- Scissors for clothing removal

On arrival:

- Remove casualty's clothing
- Primary survey CABCDE
- Informs TTL and Scribe of findings
- Other procedures e.g. FAST, ICDs, as required/able
- When appropriate, conducts secondary survey

** this role might be performed by Surgical, Anaesthetic or ICU team if available*

Procedure Nurse

Pre-arrival:

- Prepares procedural insertion trays as indicated.
- Prepares intubation equipment

On arrival:

- Removes patients clothing
- Assists with control of catastrophic haemorrhage
- Assists with other procedures as required e.g. intubation
- Ensures passive/active warming is commenced

Airway Doctor

Pre-arrival:

- Equipment check with Airway Nurse

***Airway Doctor may also perform the Assessment and Procedural roles**

On arrival:

- Assess Airway and report to TTL & Scribe
- Rx and gives O_2, fluids and drugs
- RSI if required
- Analgesia
- Maintains C-Spine immobilisation for log roll
- Takes control of the log roll
- AMPLE (if patient conscious)
- TXA
- A-line insertion once airway secure
- Remains with patient until final destination (Theatre/ICU/Ward)

Airway Nurse

Pre-arrival:

- Equipment check
- Collect emergency drugs

On arrival:

- Monitoring On
- Checks C-Spine collar correctly applied
- Assists Trauma Anaesthetist – AIRWAY
- Assists A-Line insertion
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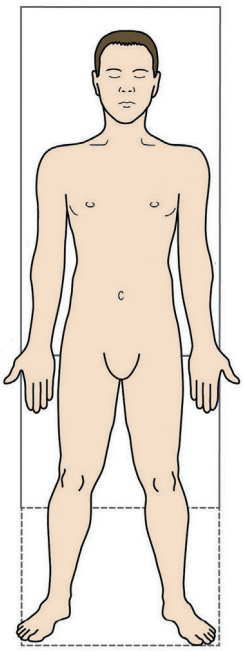


Trauma Team Leader (TTL)

Controls Trauma Call, Stay with Scribe and stays **'Hands Off'**

Pre-arrival:

- Assembles the team
- Universal precautions/ID bibs/lead aprons for all
- Deliver ATMIST report and give likely diagnoses/ injuries to need immediate management

On arrival:

- Call silence for handover
- Control and manage the resuscitation
- Should prioritise and clearly articulate interventions and investigations required and the order that they should occur

Essential trauma team roles:

Planning at a local level is encouraged. The clinical team receiving the patient may be larger than at Rural Facilities. Example team roles are indicated in YELLOW.

Circulation Nurse

Pre-arrival:

- Prepares monitoring
- Primes IV line
- Preps cannulation equipment, blood tubes
- Prepares fluid pump and warmer

On arrival:

- Attaches monitoring
- Gains IV access and takes trauma bloods
- Assists with other procedures as required

Circulation Doctor

Pre-arrival:

- Preps cannulation, blood sample bottles, Imaging request form

On arrival:

- Gains IV access and takes trauma bloods
- Confirms that the imaging request has been made and CT is ready to scan
- Assists with other procedures as required, e.g. urinary catheter insertion

Scribe

- Keep writing/recording everything you see and hear in the bay
- Stay in one place

Trauma team roles in a major incident

Major incident trauma team

As part of the major incident LEAN FORWARD and STAND UP action, theatres, critical care, blood bank, surgical specialities and imaging will have also been informed and making ready to receive casualties.

- The MI Trauma Teams can focus on making their resus bay ready to receive a casualty
- Relatives should be managed by other hospital teams and should not come direct to ED Resus
- If required, the Resus Nurse Coordinator should manage any overcrowding in Resus

Key roles explained

Coordinators

- Clinical staff who provide oversight of the department and pre-hospital situation and forward communications with imaging, theatres, critical care and the wards

ED Resus Consultant

- Oversees all Resus activity and prioritises patients for resus bays or move out to majors
- Maintains hospital and pre-hospital situational awareness via regular hospital updates and METHANE reporting

Resus Nurse Coordinator

- Coordinates the nursing response in ED
- Ensures that a scribe and a suitable nurse are available for each trauma team/resus bay
- Informs hospital control of staffing needs and patient numbers
- Liaises with Site manager/Bed manager when destination identified for patient
- Responsible for crowd control (staff and relatives) in Resus

Coordinating Trauma Consultant

- Usually senior/experienced trauma surgeon or trauma intensivist/anaesthetist
- Supports TTLs and prioritises patients for theatres and imaging
- Liaises with Imaging, Theatres and Intensive Care for casualty demands
- Also known as Surgical Triage Commander, Resus Surgeon Commander

Medical Imaging Coordinator/Duty Anaesthetist/ Intensive Care Coordinator/Bed Manager (for Wards)

- Interface with Coordinating Trauma Consultant to understand ED situation and need for imaging, theatres, critical care, ward beds, and to inform them (and Hospital Emergency Operations Centre) of capacity in their respective areas

Trauma team roles in a major incident

Trauma Team Leader (TTL)

Pre-arrival

- **Assemble team and ensure universal precautions are worn**
- **Relay ATMIST to team and identify possible injuries to prep for**
- **Checks that the Resus Surgeon Commander/Speciality teams are aware of patient's details**
- **Confirms with Trauma Team that equipment is ready and have they identified any issues**

Checklist:

- ☐ Airways and emergency drugs
- ☐ Rapid Transfuser primed
- ☐ O Neg blood ready (O Pos if male)
- ☐ Thoracotomy set ready
- ☐ Cannulation for IV access (plus alternative e.g. EZIO), blood bottles, A/VBG
- ☐ Trauma Documentation incl CT imaging request form
- ☐ Identifies bags for clothing and forensic specimens
- ☐ **ALL** casualties from an MI/MCE should remain under their hospital trauma number until in ICU/Ward and no further blood transfusion is required

On arrival:

- **SILENCE for pre-hospital handover to team (ATMIST) Controls and manages the trauma resuscitation**
- **Remains 'Hands Off' during the resuscitation**
- **Makes critical decisions and prioritises investigations, interventions and treatment**

Checklist:

- ☐ Any catastrophic haemorrhage controlled
- ☐ Massive Transfusion activation and sitreps
- ☐ Make a management plan with Airway Doctor
- ☐ Is Airway secure/breathing optimised/IV access gained?
- ☐ Is patient unstable/transient responder? – inform Resus Surgeon Commander, patient may need to go direct to theatre
- ☐ Hypothermia mitigation
- ☐ Checks patient details on blood samples
- ☐ Is patient ready for CT Wholebody imaging?
- ☐ Obtain CT HOT REPORT
- ☐ Inform Resus Surgeon Commander of your findings and plan for destination after Resus
- ☐ Ensure Tetanus prophylaxis PAEDS, IV antibiotics, TXA are considered and prescribed
- ☐ Ensure all documentation including decision-making, blood products and drugs are documented/prescribed clearly

Photocopy & cut

Scribe

Pre-arrival

- **Familiarise yourself with MI documentation**
- **Assist by obtaining blood imaging request forms**
- **Locate yourself next to the TTL**

On arrival:

- **Keep writing!**
- **Record times and details of decision-making and any issues, as well as what happens to the patient**
- **Don't be afraid to speak to confirm findings/information**

Photocopy & cut

Airway Doctor

Pre-arrival

- **Check all essential equipment with your assistant Conduct RSI WHO checklist**
- **Ensure RSI drugs, analgesia and TXA are available**
- **Prep for any potential needs (as suggested by TTL)**
- **You are expected to stay with the patient until an appropriate handover after Resus (Theatres/ICU/Ward)**

On arrival:

- **Coordinate the safe transfer of patient from pre-hospital trolley**
- **Secure the airway (after discussion of airway findings with TTL)**
- **Give O_2, airway interventions and RSI if required**
- **Maintain C-Spine immobilisation and control the log roll**
- **Take an AMPLE history if patient is awake**
- **Prescribe all fluids and drugs given to the patient**
- **Discuss and finalise the management plan with TTL**

Trauma team roles in a major incident

Airway Nurse

Pre-arrival	On arrival:
▶ Set up and check airway equipment ▶ Collect drugs from cupboard and fridge ▶ Ear thermometer ▶ Trauma ID tag ▶ Prep monitoring equipment	▶ Assist Airway Doctor with advanced airway interventions ▶ Check C-Collar is correctly fitted ▶ Take temperature on arrival ▶ Attach Trauma ID on arrival ▶ Attach monitoring, BP cuff and pulse oximeter ▶ Prepare and administers drugs as required ▶ Ensure equipment and drugs are gathered for a safe transfer from Resus to destination (e.g. CT)

Photocopy & cut

Assessment Doctor

Pre-arrival	On arrival:
▶ Preps thoracotomy tray ▶ FAST ▶ Scissors for clothing removal ▶ Confirms with TLL which skills they have, procedures they are comfortable with and if any support may be required.	▶ (C) Identify any catastrophic bleeding and manage accordingly ▶ (A) Confirm with Airway Doctor that airway is clear and secure ▶ BCDE (Primary Survey) as usual ▶ Relay finding clearly to TTL and Scribe ▶ Perform other procedures/investigations as required (e.g. FAST, IV cannulation/access depending on skills and training) ▶ When appropriate, proceed to secondary survey

Photocopy & cut

Circulation (Doctor/Nurse)

Pre-arrival	On arrival:
▶ Prepare to secure IV access and obtain blood samples including venous/arterial blood gas ▶ Prepare the blood request forms ▶ Scissors – prepare to unclothe patient, but be mindful of dignity, hypothermia and exposure	▶ Secure IV Access: minimum 2 x large IV access, IO/Venous cutdown access, according to skill set ▶ Obtain blood for: A/VBG, FBC, U&Es, LFTs, Amylase, Clotting screen (INR, aPTT, Fibrinogen), Crossmatch, Group & Save, CK, pregnancy test if female ▶ Place urinary catheter post CT (if no pelvic trauma and required) Assist Assessment Doctor (Procedures such as ICD insertion etc.)

Major haemorrhage management

Pre-hospital management will aim to prevent Trauma Induced Coagulopathy by:

- Prevention of further blood loss with use of splints, tourniquets, pressure dressings and pelvic binders
- Prevention of hypothermia
- Judicious aliquots of packed red blood cells or isotonic crystalloid fluids aiming for maintenance of a radial pulse.

In-hospital management will aim to provide as close to gold standard level of care as possible **within the clinical and logistical limitations of a Hospital and Health Service's capabilities.**

Damage control resuscitation principles will apply:

- Expedite definitive care
- Maintaining adequate perfusion:
  - Radial pulse in non-head injured patient
  - SBP›90mmHg in patients with head injury
- Minimise ongoing haemorrhage
- Prevent Coagulopathy
  - Blood and component therapy with minimal crystalloid use
  - Prevent hypothermia
  - Administration of TXA within 3hrs of injury.

ED Resus

When severely injured patients are expected:

- Assess hospital blood stock if multiple patients or regional/remote setting
- Request 4 units pRBCs for each P1/Red casualty expected (where available)
- Consider basing transfusion staff in ED to support multiple transfusions
- A runner should be assigned for blood product and sample delivery between ED and Blood Bank
- Anticipate early discussion with RSQ and referral to trauma centre.

Major haemorrhage management

Catastrophic haemorrhage

Priority 1: If possible, apply direct pressure to site of bleeding

Priority 2: Expedite definitive care

Aim for definitive care

Is it likely this patient's care requirements will exceed this hospital's clinical and logistical capability?

YES → **Notify retrieval services Queensland as soon as possible**

NO

Treat significant bleeding

Suspect if: HR>110 OR Systolic BP <90

Ongoing assessment and resuscitation

CABC approach

- Secure IV Access
- Ensure patient has a hospital number and ID band
- Take blood samples for:
  - Cross-match – notify age and sex
  - VBG
  - CHEM20, FBC, Coagulation
  - ROTEM or TEG (likely to overwhelmed)
  - Other POC tests – INR, istat

Find and stop the bleeding

- **Control external haemorrhage**
  - Apply pressure dressing +/– topical hemostatic agents
  - Apply tourniquet proximal to the bleed
- **Identify and control concealed haemorrhage**
  - Pelvic binder
  - Primary and Secondary survey
  - USS and plain XR
- **Limit ongoing haemorrhage**
  - Minimise movement
  - Keep warm
  - Identify and treat Coagulopathy

Massive Transfusion Pathway

If bleeding does not stop plan for theatre or definitive care

Major haemorrhage management optimal situation (Laboratory support available)

MASSIVE TRANSFUSION PATHWAY

Give TXA if <3hrs since injury

PACK 1

- **2–4 units O Neg RBC** (may use O Pos in males and females >50 years)
- **4G Fibrinogen Concentrate or 10–15 U Cryoprecipitate**
- **1–unit plasma** (Group A or AB)

Reassess patient

- ☐ Is there suspected continuing ongoing haemorrhage?
- ☐ Repeat VBG
- ☐ Maintain Ca^{2}+ >1mmol/L
- ☐ Trend BE or Lactate to assess trend in perfusion
- ☐ Repeat CHEM20, FBC, Coags **OR ROTEM/TEG**
- ☐ Keep warm
- ☐ Limit crystalloid

If significant bleeding continues progress to PACK 2

PACK 2

- **2–4 units RBCs**
- **2 units FFP**
- **1 dose Platelets**
- **1 pool of cryoprecipitate**

After PACK 2 given, aim for LAB or ROTEM DIRECTED THERAPY

Consider restricting further transfusion in situations of low blood stock and multiple casualties

Other considerations

- **Is group specific blood now available?**
  - Aim for goal directed therapy using group specific blood
- **Has TXA bolus been given?**
  - If <3hrs after injury, give TXA 1g IV bolus over 10mins
  - Then, TXA 1g IV infusion over 8hrs
- **Anticipate low Calcium**
  - 10mls of 10% Calcium Gluconate IV bolus over 2–3mins after every unit of RBC or FFP or as guided by VBG

Post resuscitation goals

- **Hb 80–100g/L**
- **Platelets >75 x 109/L**
- **INR <1.4**
- **Fibrinogen >2g/L**
- **Ca2+ >1mmol/L**
- **Temp >36°C**

If lab results are now available

Use group specific blood if available

Goal directed therapy

- Hb <80 → give PRBC (Group specific if available)
- Fibrinogen <1.5g/L → give Cryoprecipitate (2 pools)
- Platelet count <75 x 109/L → give Platelets 1 dose

Lab bloods not yet available

- Continue to Transfuse RBC:FFP:Platelets ratio 1:1:1
- 10U Cryoprecipitate (Fibrinogen concentrate may be available)
- Chase lab results to enable goal directed therapy

Major haemorrhage management optimal situation (Laboratory support available)

Special notes

Limited stock of blood products

If blood products are limited, or require rationing due to number of patients:

- Group O RhD and K Negative red cells should be prioritised for children and women under the age of 50
- Aim to minimise the administration of crystalloids in patients with haemorrhage, but it may be necessary to administer aliquots of crystalloids (e.g. 5mL/kg up to 250mL bolus of 0.9% NaCl every 10min) or 4% Albumin to replace intravascular volume aiming for a palpable radial pulse
- After initial bolus of fluid commence vasoactive agents (e.g. Noradrenaline/Adrenaline infusions) titrating for radial pulse

Laboratory not available or overwhelmed

In mass casualty or rural/remote settings, laboratory services may be overwhelmed or not available. The use of point of care (POC) testing may aid in detecting coagulopathy (e.g. POC INR›1.3 as a surrogate marker of clinically significant hypofibrinogenaemia).

Additionally, it may be appropriate to empirically replace calcium or clotting factors if clinically appropriate.

Traumatic cardiac arrest

If hypovolaemia is the cause of traumatic cardiac arrest, most resuscitations are futile. In traumatic cardiac arrest it is essential to identify and treat reversible causes:

- Ensure tension pneumothorax have been identified and treated
- Ensure adequate ventilation (a supraglottic airway or bag valve mask ventilation with oropharyngeal airway are adequate)
- Control external haemorrhage
- Administer crystalloid fluids up to 2L, unless haemorrhage controlled or return of spontaneous circulation where blood products are preferred if available

Paediatric dosages (‹50kg OR ‹16 years of age)

PRBC/FFP: 15mL/kg

Cryoprecipitate: 5ml/kg

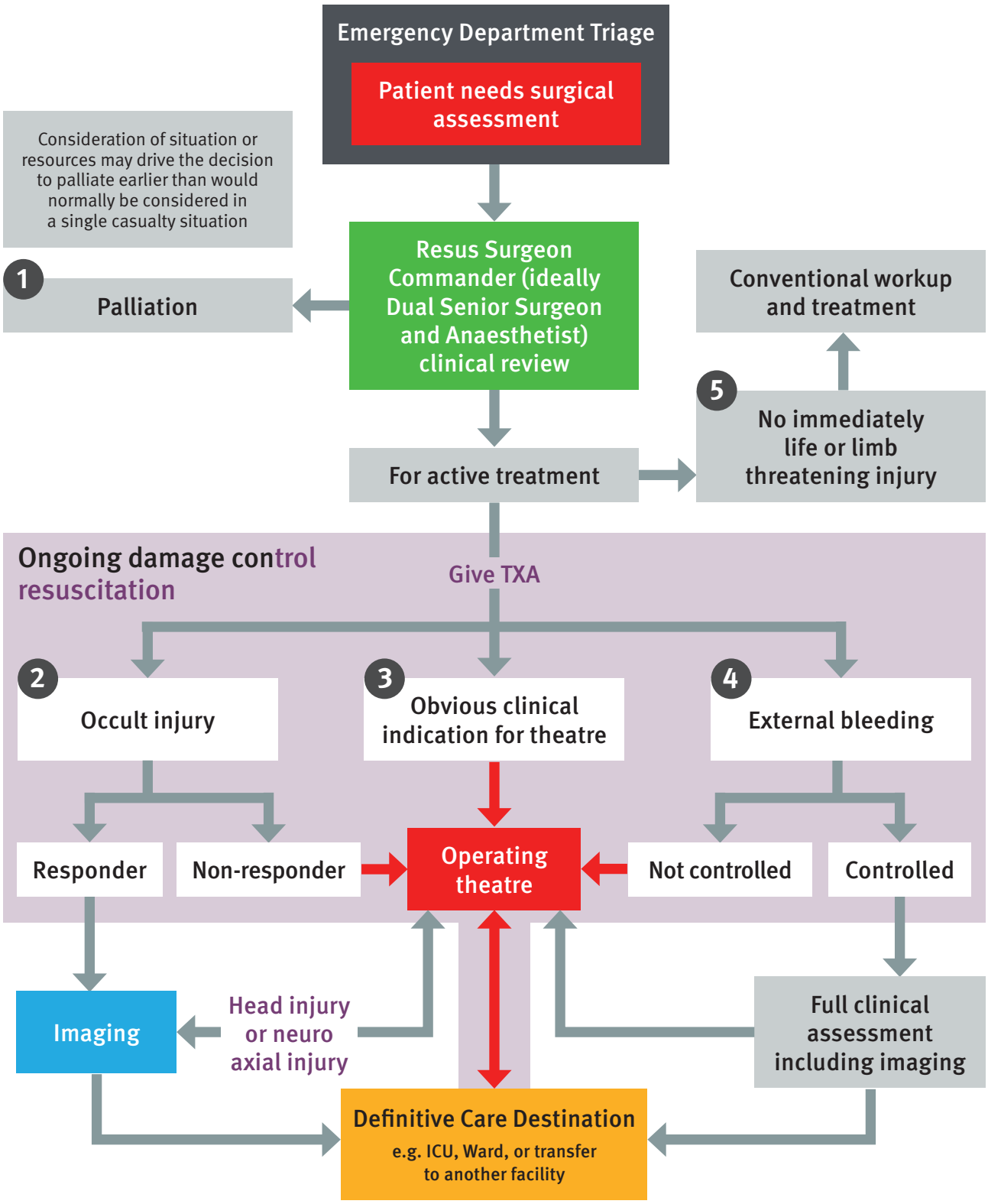
TXA: 15mg/kg bolus, 15mg/kg over 8hrs

Fibrinogen concentrate: 50mg/kg

Ca Gluconate: 0.11mmol/kg

MI senior clinical decision-making

- Dual senior decision-making is preferred
- Reassess casualties often. Consider palliation or upgrading care if the casualties condition changes or if the situation changes (for example delays to transfer)
- Use POC thromboelastography (TEG/ROTEM) to guide resuscitation if available
- Consider Interventional Radiology if capability is available locally (without need to transfer) and if theatre space is limited
- Use E-FAST USS imaging to triage multiple patients; to assist prioritisation of patient to imaging or theatre.



MI imaging (plain film and CT whole body)

Imaging is an essential tool to help triage trauma patients, guide assessment and for surgical planning. The initial plain film trauma series includes chest x-ray and pelvic x-ray followed by CT scanning as clinically required and if available.

- After the initial trauma imaging series plan for interval serial imaging over the next few weeks as injuries evolve, complicated trauma and blast injuries in particular.
- Use E-FAST USS imaging to triage multiple patients; to facilitate decision on who needs CT, how urgently and who needs to go directly to theatre.

Patients can be resuscitated during a CT scan unless critically unwell, in which case the patient probably should go directly to theatre.

CT whole body takes 2mins. Patient preparation, transport and transfers to the CT scanner is the time-consuming component. Regular team training will reduce patient transfer time. Radiation exposure is approximately 0.72mSv for plain film chest and pelvis, approximately 18mSv for CT whole body depending on the model of CT scanner used.

Neck

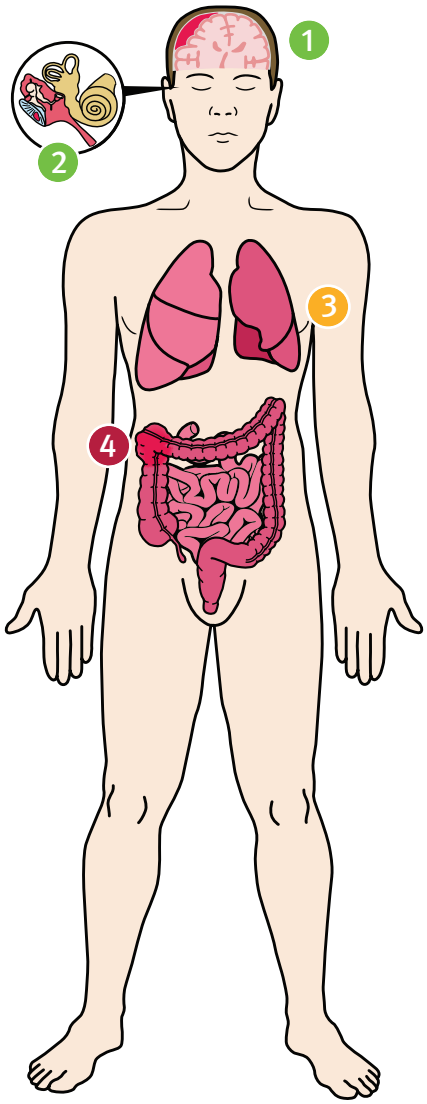
- Oedema
  - Foreign bodies
- Larynx and oesophageal
  - penetration
  - rupture
- Cartilage Fracture
  - Larynx
  - Thyroid
  - Hyoid
- Tracheal Injury

Abdomen and pelvis

- Hollow viscus rupture 4
- Solid organ injury
  - Repeat imaging for: Suspected delayed hollow or solid organ injury
- Foreign bodies

Vascular injury

- Haemorrhage or embolus
- Aneurysm or pseudo-aneurysm
- Dissections/transections
- Foreign body proximity to vascular structures



Head

- Haemorrhage 1
  - intra-or extra-axial
  - petechial foci
  - at bone margins
- Middle ear effusion
  - +/– ossicular disruption 2
  - – otic capsule injury

Thorax

- Pericardial, mediastinal and great vessel injury
- Tracheobronchial injury
- Pneumothorax/haemothorax
- Lung parenchyma 3
  - contusions
  - infiltrates
  - emboli
  - ARDS may develop over next 24–72hrs
- Foreign bodies

Bones

- Spinal fractures and mal-alignment
- Upper and lower limb fractures
- Long bone fracture – fat embolus
- Pelvic ring injury
  - SIJ integrity
  - sacral fractures

Key points

Avoid MRI in acute phase

- **Assume all frag/metallic foreign bodies are ferromagnetic until proven otherwise**
- **Pistol rounds tend to be non-ferrous but there are exceptions**
- **MRI likely to be safe after six weeks with caveats**

Paediatric considerations

- **procedural sedation may be required to facilitate plain film imaging and CT scanning.**

CT whole body

- Low threshold to image in mass events and in blast (blast radius can be large)
- CT whole body means head to ankles. Extremities as clinically indicated
- IV contrast portal venous CT (multiphase options) optimal
- Intraoperative CT can be done after successful haemorrhage control
- Repeat, delayed imaging at 5–7 days should be considered if hollow viscus or solid organ injury is suspected

Department planning

- Consider senior consultant in ED to coordinate imaging flow (if available)
- Use USS in ED to triage to CT

Injury management in ED

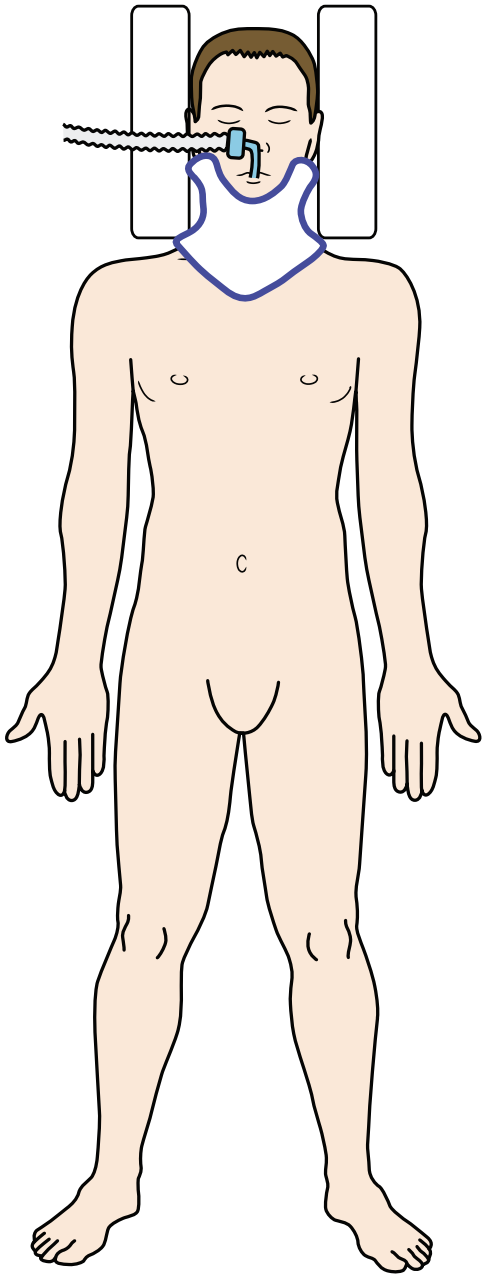
MI Spine trauma

The most common mechanism for spinal injury is high impact, rapid deceleration. The principle aim is to avoid secondary neural injury to either the spinal cord or nerve roots. This is best achieved by adequate resuscitation, spinal immobilisation and prompt transfer to a tertiary institution.

Spine injury causing neurological injury is **time critical**. Prompt transfer to a tertiary institution should be sought at the earliest possibility.

Risk factors

1. High impact deceleration mechanism
2. Asymmetry of limb movement: right v left or top v bottom (upper limbs v lower limbs)
3. Priapism
4. Haemodynamic shock
5. Severe spinal pain



A

Collar is not indicated as it will potentially result in further manipulation of the cervical spine to fit, and potentially obstruct the airway.

B

As per standard. High cervical injury can result in no voluntary breathing due to paralysis of the phrenic nerve. Rapid intubation may be required. Neck manipulation during this takes precedence over cervical spine immobilisation. It is rare for further injury to be caused during this type of manipulation.

C

As per standard. Spinal cord injury can result in neurogenic shock and aggressive BP support may be required.

D

Asymmetry of movement strongly suggests spinal cord injury. This should be assessed right v left and top v bottom. If there is asymmetry, then the patient has a spinal cord injury until proven otherwise. Treatment is supportive (*ABC). The patient requires urgent transfer to a tertiary institution for prompt radiological and surgical assessment.

AVOID:

- **Steroids**
  - This does not improve outcome and delays treatment
- **Hypotension or hypoxia**
  - This will potentially worsen neurological outcome in a spinal cord injury patient
- **Sensory examination**
  - This is not reliable and delays treatment
- **Attempts at determining neurological level of injury (NLI) or calculating ASIA score**
  - This is not useful in the acute setting and delays critical transfer to tertiary institution

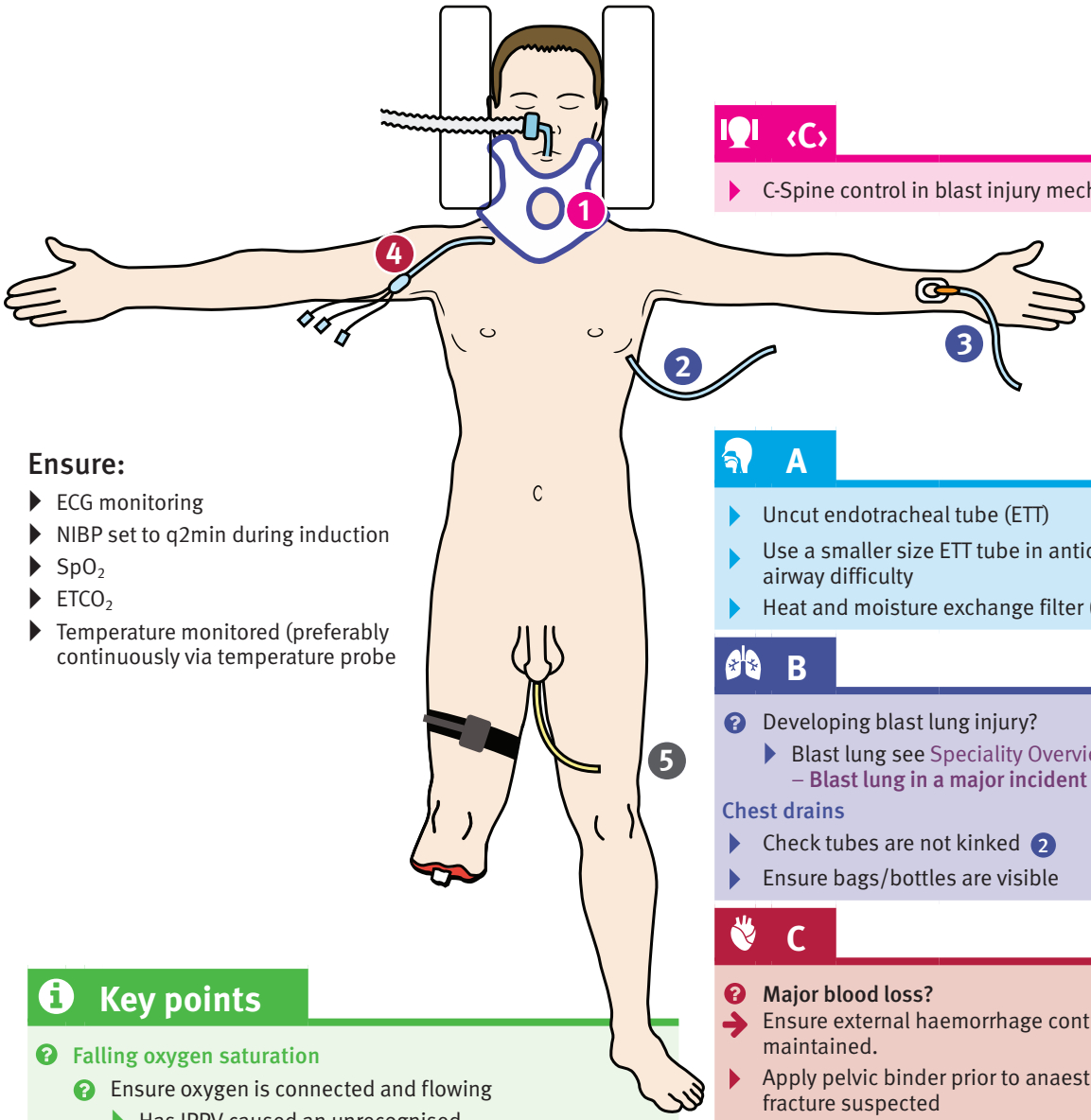
MI anaesthesia (for P1/Resus casualties)

Anaesthesia induction

- RSI checklist – decide and designate responsibilities/tasks
- Patient position is optimal

Communication

- Confirm roles, planned sequence and actions in events of complications.



Ensure:

- ECG monitoring
- NIBP set to q2min during induction
- SpO_2
- $ETCO_2$
- Temperature monitored (preferably continuously via temperature probe

‹C›

- C-Spine control in blast injury mechanism 1

A

- Uncut endotracheal tube (ETT)
- Use a smaller size ETT tube in anticipated airway difficulty
- Heat and moisture exchange filter (HME)

B

- Developing blast lung injury?
  - Blast lung see Speciality Overview – **Blast lung in a major incident**

Chest drains

- Check tubes are not kinked 2
- Ensure bags/bottles are visible

C

- **Major blood loss?**
- Ensure external haemorrhage control maintained.
- Apply pelvic binder prior to anaesthesia if pelvic fracture suspected
- Consider 8.5°F central access for rapid transfusion and/or large peripheral line 4

- **Hypovolaemia**
- Reduce doses of induction agents
- Consider using Ketamine
- Monitor urine output

Arterial line for: 3

- blood samples
- blood pressure

Do not let insertion attempt(s) distract from situational awareness. Delay arterial insertion until palpable pulse or clear ultrasound image.

E

- Warm patient: blanket mattress, warm fluids, theatre temperature, esp. if temp ≤ 35°c

Key points

- **Falling oxygen saturation**
  - Ensure oxygen is connected and flowing
    - Has IPPV caused an unrecognised pneumothorax to develop into a tension pneumothorax?
  - Is there developing lung contusion or 'blast lung'?
  - Could there be emboli?
- **Circulation**

  In 'non-supine' patient positions (e.g. lateral), is the patient position impeding:
  - diaphragm movement?
  - chest movement?
- **Circulation**

  Unexplained drop in blood pressure NOT due to hypovolaemia. Consider:
  - tension pneumothorax?
  - cardiac tamponade?
  - Occult spinal cord injury/drug effects/excessive PEEP

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MI neurotrauma (brain injuries)

The principal aim is to prevent or reduce secondary brain injury. Ideally a patient with a brain injury would be transferred to a neurosurgical centre, however in a major incident this may not be possible, or other injuries may dictate that a patient should be cared for at another specialist centre.

These guidelines are to assist in recognising which patients need to be transferred for surgery (once transfers are possible) and how to optimise their care prior to that transfer.

Most common blast brain injuries are diffuse axonal injury (DAI), cerebral contusions and subdural haemorrhage.

Assessing for brain injury

Conscious level
- **AVPU** Good for basic assessment
- **GCS** Preferred for monitoring patient and detecting subtle signs of deterioration
  Mild GCS 14–15, Moderate GCS 9–13, Severe GCS <8
  Please use the E4, V5, M6 breakdown when discussing with neurosurgeons

Pupil response
- Pupillary response is a lateralising sign and can indicate the side of the injury

Limb weakness
- Simple documentation of a patient's movements at each assessment, starting on scene is very important i.e. patient able to move all four limbs

Signs of injury
- Document any lacerations, bruising, open/closed/depressed skull fractures, extruding brain
- However, mild traumatic brain injury (mTBI) and simple contusions often occur without any external signs of injury

A

- Does the patient require intubation to secure the airway?
- Intubate early if patient is aggressive or combative or has a low GCS
- Intubate to protect the airway and allow safe transfer to CT Scan

B

- Manage chest injuries to optimise ventilation and reduce risk of hypoxic brain injury

C

- Control haemorrhage and correct hypovolaemia
- Maintain systolic blood pressure >100mmHg
  - Volume replacement should be with blood until bleeding as a cause of hypovolaemia is ruled out.
  - Hypertonic saline may improve outcome, especially in TBI patients with GCS<8
- Anticoagulants should be reversed (unless there is an overriding medical reason not to)

D

If ICP raised, there are some simple techniques to reduce ICP, including:
- Remove cervical collar (it may be strangling the patient)
- Avoid moving the patient (except for pressure relief)
- Nurse head-up (at 30°)
- Sedate and give analgesia. Most forms of sedation will reduce BP
- Control ventilation. Aim for normocapnia and keep PEEP <12 H_2O
- Mannitol (Diuretic action): (0.5–1g/kg IV dose is given, which can be repeated if required)
- Hypertonic saline (6mL/kg of 5%, up to 350mls max dose)

Other medical management

Keppra (Levetiracetam)
- Loading dose 1g then 500mgs OD for 7/7 should be used to prevent fitting in any patients with intracranial haemorrhage
- **Paediatric dosage:** loading dose 60mg/kg IV

Pneumococcal vaccine
- Should be given in open cranial fractures and if there is any evidence of intra cranial gas

Avoid:

Steroids
- Increased mortality at two weeks associated with steroid use in head injury (GCS<14) and should be avoided

Nimodipine
- No evidence to support its use in cranial trauma

Magnesium
- No evidence to support its use in cranial trauma

Antibiotics
- No evidence that antibiotics prevent infection in skull based fractures, with or without CSF leak

MI neurotrauma (brain injuries)

Types of brain injury

Primary brain injury
- If patient requires surgery, it is unlikely that any medical intervention will replace surgical management. However, prevention of secondary injury is essential

Secondary brain injury

Hypoxia
- A single episode of hypotension between injury and resuscitation doubles mortality and morbidity
- Protect airway, high flow oxygen with re-breathe mask during resuscitation

Ischaemia
- Poor cerebral perfusion secondary to hypovolaemia causes raised intracranial pressure: treat hypovolaemia early

Raised intracranial pressure
- Intracranial haematoma or oedema can raise intracranial pressure (ICP). This also reduces perfusion and causes ischaemia
- Normal ICP is 5–15mmHg. When ICP›20mmHg, contact the neurosurgical centre for advice on escalation of treatment

Acidosis Coagulopathy
- Injury at cellular level causes lactic acid production and coagulopathy: reduced cerebral blood flow results in accumulation and further cellular damage

Abnormal blood glucose
- Lack of glucose in the presence of oxygen results in neuronal necrosis; this is even more significant in hypoxia

Others
- Including cytotoxic cascade, vasospasm

Classification and significance of brain injuries

Extradural (epidural) haematomas (EDH)
- Small EDHs can be managed conservatively, however most will require neurosurgical evacuation

Subdural haematomas (SDH)
- Usually associated with significant primary brain injury, and therefore outcome is usually worse than EDHs
- May be due to an acute or chronic bleed
- Acute bleeds must be recognised, as they may cause mass effect/midline shift and are likely to need neurosurgical intervention

Subarachnoid haemorrhage
- Unlikely to require surgical treatment and can be managed with good supportive care.
- Will need to have a non-urgent CT Angio to exclude aneurysmal cause

Contusions and intracerebral haematomas
- Discrete contusions and haematomas may coalesce and evolve. Tends to peak 48–72hrs post injury. Intracranial pressure may need to be monitored
- Oedema and associated rise in ICP may make these minor cerebral injuries life threatening and difficult to treat

Diffuse injuries
- Full spectrum of injuries from mild concussion through to severe diffuse axonal injury. Little scope for surgical intervention and these patients are usually managed in regional severe brain injury centres

Signs of basal skull fractures

CSF rhinorrhea
- Use BM stix/urine dipsticks to test for Glucose (present in CSF but not in mucus)

Bilateral Peri-orbital haematomas (Raccoon/Panda eyes)
- Associated with fractures of the anterior cranial fossa (present in 50–60% of cases)
- May take 1–3 days to develop

Subconjunctival haemorrhage
- May indicate blood tracking from the orbital cavity

CSF otorrhea
- May be due to ruptured tympanic membrane (?CSF leak) or blood from an external ear laceration

Bruising over the mastoid(s) (Battle's Sign)
- May take 24–48hrs to develop

MI surgical/proximal haemorrhage control

Immediately apply direct manual pressure or a tourniquet

If catastrophic haemorrhage cannot be stemmed by direct pressure or a tourniquet, so called 'uncompressible haemorrhage', it is essential to obtain control by surgical access. This is normally most rapidly achieved by exposing vessels proximal to the immediate zone of injury. To control retrograde filling, vessels distal to the injury should also be exposed.

- Interventional radiology is not recommended for genuine catastrophic haemorrhage in an unstable, non-responding patient.
- In the profoundly hypovolaemic patient a palpable pulse may not always be present so finding the vessels relies on knowledge of anatomical landmarks.

Primary (Rapid Access) Incisions:

1. Longitudinal incision along anterior border of the sternocleidomastoid muscle (ABSCM)
5. Clam shell thoracotomy
6. Supraclavicular for proximal control of arm vessels
17. Lower midline laparotomy for pelvic packing (can be extended to 15)
19. Longitudinal groin incisions for proximal control of leg vessels

Neck

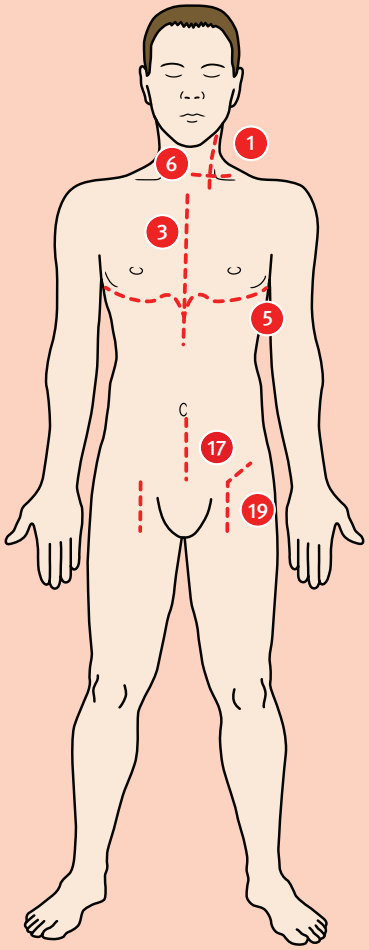
- Oblique longitudinal incision 1 along the ABSCM
  - for access to the **carotid tree and internal jugular vein** in Zones 2 and 3
- Median sternotomy may be required for proximal control of Zone 1 injuries 3

Thorax

- 4th intercostal space clamshell incision 5
  - for **all large thoracic vessels**
- 4th intercostal space anterolateral thoracotomy
  - cardiac tamponade
  - internal cardiac massage
  - control of the descending thoracic aorta

Abdomen

- 4th space anterolateral thoracotomy
  - **Rapid proximal control in high abdominal injuries and peri-arrest situations**
- All other approaches to the aorta and common iliacs should be via a midline laparotomy.
- If solid organ injury, rapid control is achieved by packing



Primary (Rapid Access) Incisions

Upper limb

- Medial supraclavicular incision running parallel to the clavicle
  - control of the **subclavian vessels** as they cross the first rib
  - most proximal part of the **axillary artery**
- Lateral horizontal infraclavicular incision
  - access to the majority of the axillary artery
- Axillary incision and extending longitudinally down the arm in the medial bicipital grove
  - for the most distal part of the **axillary artery** and **upper brachial artery**
- Control below the upper part of the brachial artery is achieved with a tourniquet

Pelvis

- For rapid haemorrhage control by pelvic packing
  - extraperitoneal approach via a lower mid-line incision
  - by direct packing via a laparotomy 17

Lower limb

- Control of external iliac vessels by
  - laparotomy
  - Rutherford-Morrison , extraperitoneal exposure via lateral extension of vertical groin incision 19
- Control by tourniquet if distal to **superficial femoral artery**

Key points

- Always achieve proximal/distal before entering haematoma or zone of injury
- Use extensile incisions

MI surgical/proximal haemorrhage control

The following approaches are for rapid access to achieve life saving vascular control. They are not necessarily the best approaches for planned vascular surgery. Practical training is available through participation in DSTC or ABSETT courses.

Surgical approaches to control catastrophic haemorrhage in the following regions:

Neck

- **Zone 1 injuries** may require proximal control of the great vessels via a median sternotomy. If necessary, divide the left brachiocephalic (innominate) vein to improve access
- The **carotid tree** and **internal jugular vein** can be accessed in Zones 2 and 3 by an oblique longitudinal incision along the anterior edge of the sternocleidomastoid muscle. The sternal head, omohyoid and facial vein can be divided as needed. Preserve the hypoglossal nerve. Extend distally as required

Thorax

- **All large vessels in the thorax** can be accessed via a 4th intercostal space clamshell incision
- A 4th intercostal space anterolateral thoracotomy alone can be used for diagnosis, r**elief of cardiac tamponade,** internal cardiac massage and **control of the descending thoracic aorta.** It does not give easy access to other vessels
- The **left subclavian artery** is more easily accessed via a median sternotomy

Abdomen

- For large vessel injury rapid control is achieved by supra-coeliac compression immediately below the diaphragm or infra-renal compression at the root of the mesentery
- For solid organ injury, try rapid control is achieved by packing
- Probable high abdominal injuries and peri-arrest situations may be addressed more quickly by control of the descending thoracic aorta via a 4th space anterolateral thoracotomy
- Access to the main vessels is achieved by entry into the retroperitoneum either directly at the root of the mesentery or by medial visceral rotation from the left or right

Upper limb

- If at all possible, use a tourniquet
- Control of the **subclavian vessels** as they cross the first rib and the **most proximal part of the axillary artery** can be achieved via a medial supraclavicular incision running parallel to the clavicle. This requires division of the clavicular head of sternocleidomastoid and then the anterior scalene muscle with preservation of the phrenic nerve. The trunks of the **brachial plexus** are in close proximity
- The majority of the **axillary artery** – lateral horizontal infraclavicular incision, fibres of pectoralis major split horizontally, then pectoralis minor muscle divided through its tendon. The axillary vessels and cords of the brachial plexus are contained in a fat pad
- **Distal axillary artery** and **upper brachial artery** approached via an axillary incision and extending longitudinally down the arm in the medial bicipital groove. Infraclavicular and bicipital groove incisions can be joined; divide pectoralis major tendon at insertion

Pelvis

- First try packing the true pelvis using an extraperitoneal approach/lower mid-line or via laparotomy
- Common and internal iliac vessels direct dissection via laparotomy

Lower limb

- **External iliac vessels** can be controlled by direct dissection via a laparotomy or by an extraperitoneal approach by laterally extending a vertical groin incision and dividing the inguinal ligament lateral to the deep ring
- The common femoral artery to beyond its bifurcation and the lower part of the external iliac vessels are accessed via a longitudinal groin incision centred over the mid-inguinal point
- Control distal to the upper part of the superficial femoral artery is achieved with a tourniquet

MI surgical/proximal haemorrhage control (Operative detail)

- Always achieve proximal/distal before entering haematoma or zone of injury
- Use extensile incisions [reference to Henry's Extensile Exposure]

Pelvis

Incision: lower midline laparotomy into extra peritoneal plane to level of SI joints 17

- allows pelvic packing with an extensile incision

Example wound for use: pelvic injury without requirement for laparotomy

Incision: supra inguinal 18

2cm above and parallel to the inguinal ligament, extending from the lateral rectus sheath to a point 2cm cephalad to the anterior superior iliac spine

- allows extra peritoneal control of proximal external iliac vessels

Incision: longitudinal groin 19

Over the femoral pulse with one-third of the incision above the inguinal ligament and two-thirds below inguinal ligament

- if no palpable pulse then incision should extend longitudinal through mid point between pubic symphysis and ASIS

Proximal control: distal external iliac vessels

Distal control: common femoral vessel bifurcation

Example wound for use:

- *exposure of injured femoral segment in conjunction with more proximal and distal control*
- *proximal control for thigh injury*

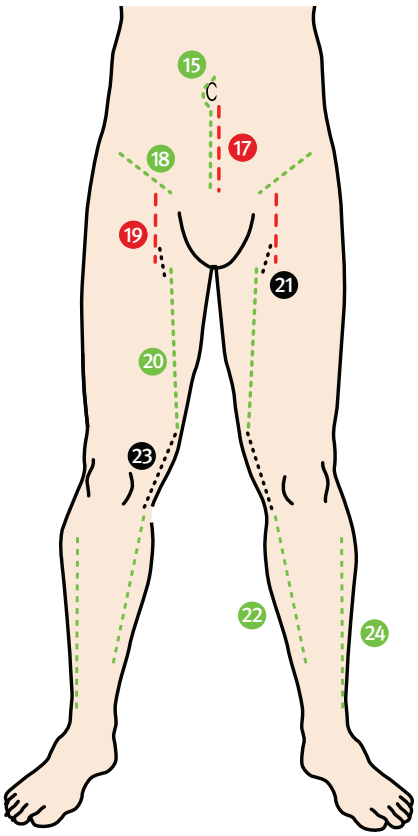
Abdomen

Incision: midline laparotomy from xiphisternum to pubic symphysis 15

Proximal control: supra coeliac aortic supra coeliac and intra abdominal IVC. Visceral vessels

Distal control: distal external iliac vessels and proximal internal iliac vessels

Example wound for use: penetrating or blunt



Lower limb

Incision: thigh – parallel to the antero-lateral border of the sartorius muscle 20

Proximal control: femoral and profunda femoris vessels

Distal control: proximal ⅓ popliteal vessel segments

Example wound for use: proximal control for popliteal artery injury

Improve exposure: connect groin and thigh incisions 21

- allows full exposure of common femoral and femoral vessels

Incision: 1cm behind the posterior border upper half of tibia 22

- incorporate into leg fasciotomy wounds where used

Proximal control: distal ⅓ popliteal vessel segments

Distal control: origin of anterior tibial artery, tibial peroneal vessels and proximal posterior tibial and peroneal vessels

Improve exposure: Connect thigh and leg incision 23

- allows exposure of middle ⅓ popliteal vessel segments through division of dividing the tendons of the semitendinosus, gracilis, and sartorius muscles

Incision: Anterolateral leg 24

- incorporate into leg fasciotomy wounds where used

If no fasciotomy then a longitudinal incision is made in the anterolateral leg halfway between the tibia and fibula over 10–15cm

- allows exposure of mid anterior tibial artery

Key

Primary (Rapid Access) incisions:

17. Lower midline laparotomy for pelvic packing (can be extended to 15)
19. Longitudinal groin incisions for proximal control of leg vessels

Alternative incisions for Vascular Access:

15. Midline laparotomy incision
18. Supra inguinal incision
20. Anterior-lateral thigh
22. 1cm behind the posterior border upper half of tibia
24. Anterior-lateral leg

Extensions:

21. to extend/connect 19 and 20 to allows full exposure of common femoral and femoral vessels
23. to connect 20 and 22 to improve exposure of popliteal vessels

MI surgical/proximal haemorrhage control (Operative detail)

Neck

Incision: longitudinal incision along the anterior border of the sternocleidomastoid muscle (ABSCM), extending from the clavicular head to the retromandibular region 1

- should be curved slightly and extended just inferior to the lobe of the ear at its distal end.

Proximal control: Common carotid artery to root of neck

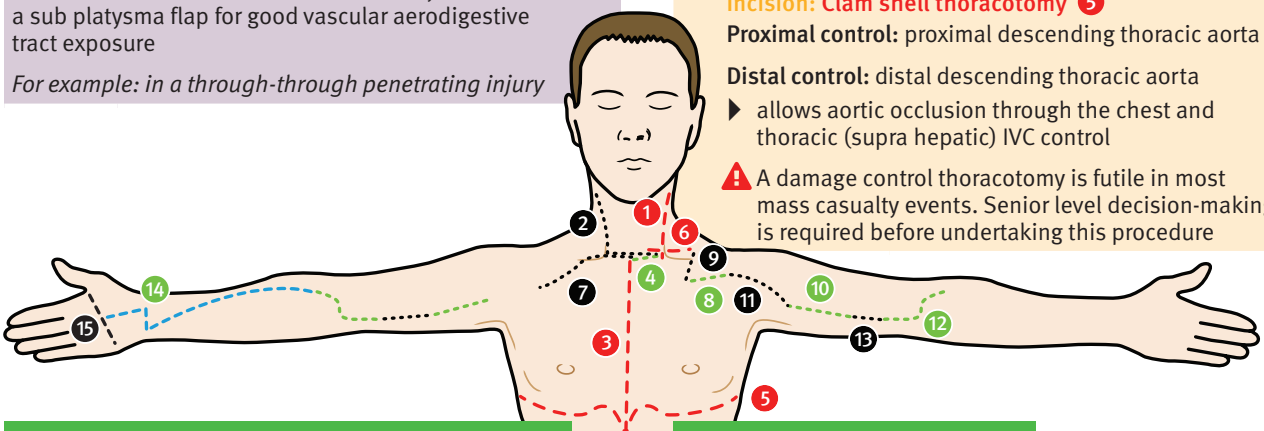
Distal Control: Internal carotid artery to base of skull

Example wound for use: Zone 2 carotid vessel injury

Improve exposure 2

Connect bilateral ABSCM incisions distally and lift a sub platysma flap for good vascular aerodigestive tract exposure

For example: in a through-through penetrating injury



Thorax

Incision: Median Sternotomy 3

2cm above sternal notch to 2cm below xiphoid process

Proximal control: origin of aortic branch vessels Distal control: distal extent of intra thoracic aortic branch vessels

Example wound for use: Zone 1 carotid vessel injury

Improve exposure

Connect median sternotomy incision to ABSCM incision 4

- allows junctional exposure of wound once proximal/distal control has been achieved

Incision: Clam shell thoracotomy 5

Proximal control: proximal descending thoracic aorta

Distal control: distal descending thoracic aorta

- allows aortic occlusion through the chest and thoracic (supra hepatic) IVC control

⚠ A damage control thoracotomy is futile in most mass casualty events. Senior level decision-making is required before undertaking this procedure

Shoulder and proximal upper limb

Incision: supraclavicular 6

An incision is made 1cm above and parallel to the clavicle, beginning at the clavicular head and extending approximately 8cm laterally

Proximal control: extra thoracic subclavian vessels, vertebral artery

Distal control: extra thoracic subclavian vessels

Example wound for use: shoulder/upper limb junctional wound

Improve exposure 7

Connect supraclavicular (+/– division of clavicle), median sternotomy and 5th space left anteriolateral (trap door)

- allows improved exposure to root of neck and left intrathoracic apex

Incision: infraclavicular 8

A horizontal skin incision is made 2cm below the middle ⅓ of the clavicle, extending for approximately 8cm) Proximal control: proximal ⅓ axillary vessels

Distal control: middle ⅓ axillary vessels

Example wound for use: shoulder/upper limb junctional wound

Improve exposure 9

Connect supraclavicular and infraclavicular incisions with division of clavicle

- allows improved exposure of proximal ⅓ axillary vessels

Upper limb – forearm

Incision: along groove between biceps and triceps 10

Distal control: brachial vessels/brachial bifurcation

Example wound for use: mid-distal brachium wound

Improve exposure 11

Connect to infraclavicular incision

- allows junctional exposure of axillary vessels through delto pectoral approach

Incision: medial to lateral lazy S across anti-cubital Fossa (M-LLSACF) 12 – from biceps/triceps groove to mid forearm, 2–3cm above and below elbow crease Proximal control: Distal brachial vessels/brachial bifurcation

Distal control: Distal brachial vessels/brachial bifurcation

Example wound for use: proximal and mid forearm wound

Improve exposure 13

Connect biceps/triceps groove incision to M-LLSACF incision

- allows full exposure of brachial vessels

Incision: use/adapt forearm volar fasciotomy incision 14 where possible (M-LLSACF to radial mid forearm to distal ulna, transverse at wrist crease to line of radial border of ring finger to Kaplan's cardinal line) 15

Proximal control: Distal brachial vessels/brachial bifurcation

Distal control: mid forearm radial vessels, distal ulnar vessels

- allows exposure of forearm vessels without additional volar fasciotomy incision

MI vascular trauma

Do the minimum surgery to preserve life and limb, in that order

Remember:

- Non-vascular specialists may need to undertake vascular interventions due to casualty numbers
- Temporary vascular shunts and vessel ligation will be the mainstay of treatment for vascular injury and not reconstruction. Amputation rate may be high. Recognise futility in limb reconstruction; decision to amputate should be made by two surgical consultants
- Interventional radiology has a limited role in mass casualty situations,however IR could be utilised for diagnostics to provide the most effective targeted interventions in theatre, such as thoracic aortic stenting or IVC filter placement

Catastrophic haemorrhage

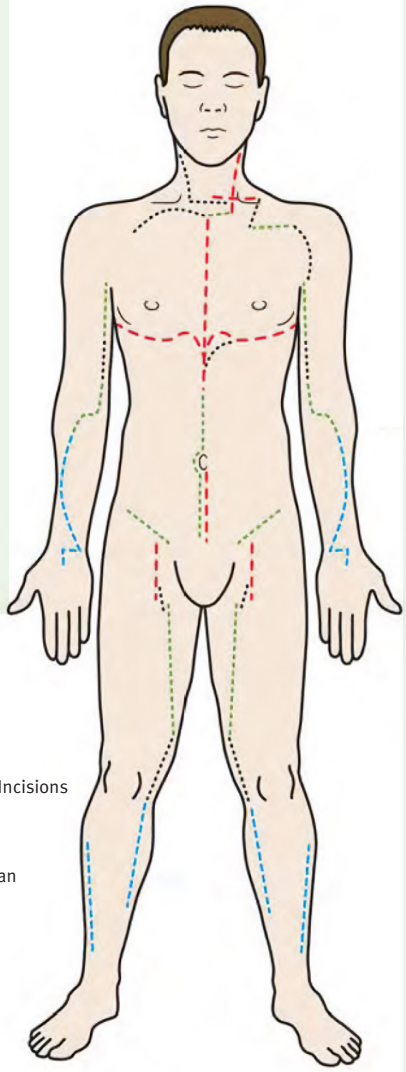
- gain proximal control and **stop the bleeding**
- In uncontrollable haemorrhage, patient should go direct the theatre and can have CT imaging once the bleeding is controlled

Initial management

- Orientate force to compress wound against the underlying axial skeleton
- Small wounds can be managed with a single gauze swab and digital pressure
- Larger cavities can be managed with internal gauze packing (e.g. kurlex) and palmar pressure

Apply tourniquet for limb threatening bleeding

- Manage pain with IV opiate analgesia concurrent with any wound manipulation
- Avoid application of haemostats to any visible vessels
- Transfer to theatre as soon as possible



Temporary vascular shunts

Indications

Shunt is only indicated in situation of severe limb ischaemia with limb threat

- All axial vessels above knee/elbow
- If a shunt is used, apply prior to application of external fixator:
  - ensure you account for movement created by orthopaedic surgeon when you choose length of shunt
  - be at the table when the orthopaedic surgeon is placing the external fixator

Consider ligation for Distal axial vessels

What to use

- Vascular shunt (e.g. Pruitt, Javed or Sundt if available)
- Sterile plastic tube of appropriate size for vessels (IV tubing/N/Nasopharyngeal tubes – whatever is available and appropriate)

How to use

- Confirm inflow and back bleed (thrombolectomy with a Fogarty catheter may be required)
- Fill shunt with Heparinised saline (5000U in 500ml saline) and clamp
- Place shunt in uninjured vessel above and below zone of injury
- Secure with tie around vessel and shunt
- Shunt can remain in place for up to 48hrs

Document

- That a shunt has been placed
- Frequency of distal limb checks (e.g. every 30mins)
- Actions if shunt falls out away from theatre (where to press/which vessel loops to pull)

Key points

Stop the bleeding

- Proximal/distal control
- Shunt or ligate to stop further blood loss
- Consider simple repair (if possible) to restore blood supply
- Temporary vascular shunt as a bridge to definitive repair
- Liberal use of fasciotomy (should be default)
- Anticoagulation is not needed for shunts
- Antibiotics and Tranexamic acid as per standard guidelines

Clinical features of vascular injury

Hard signs:	Soft signs:
Pulseless cold pale limb	History of active bleeding
Expanding haematoma	Non-expanding haematoma
Palpable thrill or audible bruit	Neurological deficit
Active bleeding	Penetrating injury close to major vessel

MI vascular trauma

Surgical planning

Plan

- Use a (truncated) WHO checklist
- Communicate injuries identified
- Damage control plan (priorities)
- Equipment required
- Cavity or cavities to be opened
- Communicate to staff that plan may change at short notice e.g. open an additional cavity
- Set parameters to alert surgeon (blood product use threshold) – recognise intraoperative futility; resources may be best invested elsewhere – communicate early through coordinators; arbitration from senior clinician may be required.

Intraoperative phase

- Place in cruciform position
- Prepare to enter multiple cavities
- Must have access to be able to gain proximal and distal control
- Gain control through the access you are most comfortable with (e.g. laparotomy for junctional control of the iliac artery if unfamiliar with Rutherford Morrison approach; median sternotomy for Zone 1 neck injury
- Plan regular communication between anaesthetist and surgeon. You must all be aware of: physiological status, inotrope requirements, transfusion situation and evolving operative plan (set alarm and update each other every 15mins)
- Use of Doppler is key in assessing flow
- On table angiography may be indicated if flow is not restored despite appropriate manoeuvres (vascular dissection)
- Limb viability should be assessed by two surgeons, prior to revascularisation or amputation (where possible).

Postoperative phase

- Document operative details carefully, anticipate relook surgery may be performed by another team or even in another hospital
- List antibiotics/anticoagulation/psychological parameters for return to theatre/actions for major bleeding
- Plan to return the patient to theatre for reconstruction when stable (typically 24–48hrs) and when vascular specialist available (liaise with your regional Network coordinators who can arrange for a specialist surgeon to come to you).

MI thoracic trauma

Do the minimum necessary surgery to save life: keep on-table time as short as possible.
At 1hr, operating should be finished or finishing.

In a mass casualty context, surgery should be complete within 1hr. Clam-shell thoracotomy is the incision of choice. 1
Surgery should be physiological not anatomical (for non-anatomic resection use gastrointestinal staplers, and consider pulmonary tractotomy for penetrating lung injury before attempting lobar resection).

A damage control thoracotomy is futile in most mass casualty events. An assessment of casualty numbers, injuries and resources, and senior level decision-making is required before undertaking this procedure.

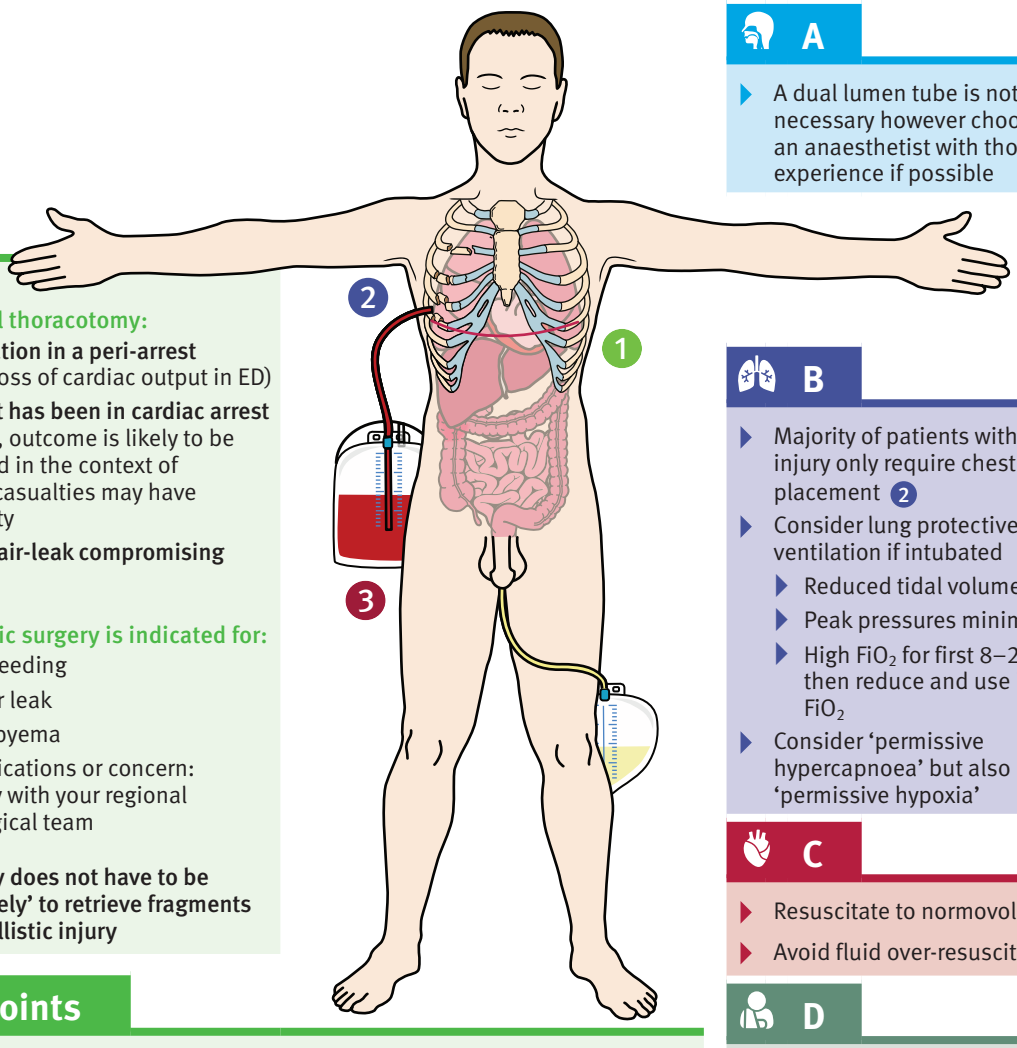
Fragments from blast and other ballistic projectiles do not respect anatomical boundaries:

- Be prepared to operate on junctional area (e.g. neck) and enter adjacent body cavities e.g. laparotomy if there is evidence of co-existing abdominal injury.

Catastrophic haemorrhage

- Immediate return from chest tube of approx. 1.5 litres in an unstable patient 3
- On-going blood loss of approximately 200ml/hr

PAEDIATRIC – Initial volume of blood drained from ICC >10ml/kg. On-going losses >4ml/kg/hr



Indications for damage control thoracotomy:

- **For resuscitation in a peri-arrest patient,** (or loss of cardiac output in ED)
- **If the patient has been in cardiac arrest pre-hospital,** outcome is likely to be very poor and in the context of a MCI other casualties may have higher priority
- **For massive air-leak compromising ventilation**

Delayed thoracic surgery is indicated for:

- Persistent bleeding
- Persistent air leak
- Thoracic empyema
- Other complications or concern: liaise closely with your regional thoracic surgical team

Thoracotomy does not have to be done 'routinely' to retrieve fragments following ballistic injury

A

- A dual lumen tube is not always necessary however choose an anaesthetist with thoracic experience if possible

B

- Majority of patients with chest injury only require chest tube placement 2
- Consider lung protective ventilation if intubated
  - Reduced tidal volume
  - Peak pressures minimised
  - High FiO_2 for first 8–24hrs then reduce and use lowest FiO_2
- Consider 'permissive hypercapnoea' but also consider 'permissive hypoxia'

C

- Resuscitate to normovolaemia
- Avoid fluid over-resuscitation

D

- Potential for fragment and air embolisation (from IPPV)

E

- Examine the back and posterior chest

Key points

Select appropriately-sized chest drains, as a rule of thumb:

- Adult: 24–32Fr

Paediatric considerations

- The size of an ICC for a paediatric patient should be roughly the ETT size x 4, however this is a flexible system. It is also important to clinically review the size of the patient's chest wall as part of this process.

- For every patient with chest injury:
  - ensure pain relief and chest physiotherapy
- Early antibiotics are essential; however, surgical antibiotic prophylaxis is not often required beyond chest drain insertion or the duration of the primary operation

MI thoracic trauma

Intra-operative Thoracotomy

Plan for a damage control operation (with planned re-look when the patient is stable)

- **Place patient supine with arms abducted** (crucifix position)
- For unilateral injury, a bolster bag (e.g. pressure infusor bag) behind the patient's chest on the injured side help but DO NOT formally turn the patient on their side as endo-bronchial bleeding from an injured lung can contaminate the (dependent) un-injured lung and turn a crisis into a disaster
- Double-lumen tubes are not often necessary
- **Prep patient's chest and abdomen to knees**; once prepped, patient can be draped appropriately and covered to maintain temperature
- **Make a clamshell incision:** limited left thoracotomy gives insufficient access
- Always open the pericardium to exclude or treat haemopericardium
- Remember to control the internal mammary vessels on the underside of the sternum; above and below your incision
- Non-anatomic resection of damaged lung can be done with gastrointestinal staplers.
- Pulmonary tractotomy should be done when possible to control bleeding and/or air leak from penetrating
- pulmonary injury rather than attempting major resection
- **Remember to check the diaphragms and think of abdominal injury**
- Use the vacuum-pack technique for temporary thoracic closure, attaching the dressing to wall suction at 120mmHg. Patients should be intubated and ventilated after trauma thoracotomy and managed in an ICU setting
- Maintain intra-operative dialogue with your anaesthetic team. You must be aware of:
  - physiological status including inotrope requirements
  - transfusion situation
  - how long you have been operating
- **Plan to take the patient back to theatre at 24–48hrs with a thoracic surgeon**; liaise with your regional Network coordinators who can arrange for a specialist surgeon to come to you

MI abdominal trauma

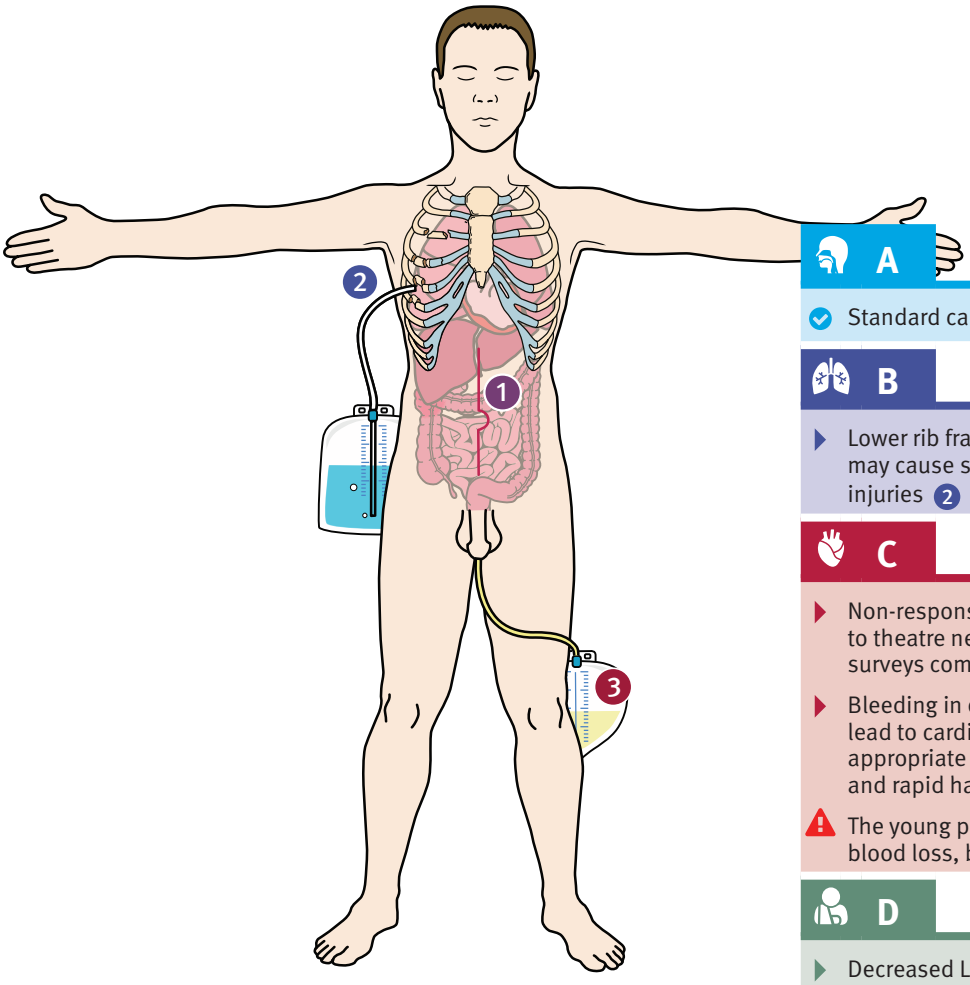
Do the minimum necessary surgery to save life: think damage control.

Remember:

- Small holes create big problems
- Fragments from blast and other ballistic projectiles do not respect anatomical boundaries
- Look for 'paired' injuries in hollow organs
- Be prepared to enter adjacent body cavities e.g. you may need to do a sternotomy after exploratory laparotomy if the source of on-going bleeding is from the chest and blood is coming through a diaphragmatic injury.

Catastrophic haemorrhage

- Gain proximal control and **STOP THE BLEEDING**
- Non-fluid responsive bleeding patients go directly to theatre. CT comes later



A

- Standard care

B

- Lower rib fractures from blunt trauma may cause significant hepatic or splenic injuries 2

C

- Non-responsive patients who go directly to theatre need primary and secondary surveys completed after haemostasis
- Bleeding in older patients can quickly lead to cardiovascular collapse. Institute appropriate blood and fluid resuscitation and rapid haemorrhage control
- The young patient will tolerate significant blood loss, but then deteriorate rapidly

D

- Decreased LOC requires exclusion of head injury, but could be due to haemorrhagic shock

E

- Examine the back and posterior chest
- **Serial abdominal examinations** are indicated in suspected hollow viscus perforation
- **Regular blood gases** to monitor condition
- **Early urinary catheter** is advised, as UO is a sensitive measure of end organ perfusion and resuscitation status of patient 3
- Actively look for missed injuries
- A full MDT review of imaging and a top-to-toe survey is mandatory

Key points

- Have "two consultant" operating where possible
- Make a full midline incision 1
- The priorities are:
  - First: stop the bleeding
  - Then: control contamination
- Do not do definitive intestinal repairs or stoma formation
- Make a temporary abdominal closure and plan for re-look at 24–48hrs
- Get the patient off the table as soon as possible: at 1hr you should be finished or finishing
- Maintain a dialogue between surgery and anaesthesia and don't get 'task fixated' on complex reconstructive surgery

MI abdominal trauma

Damage Control Laparotomy

Maintain intra-operative dialogue with your anaesthetic team. You must be aware of:

- physiological status including inotrope requirements
- transfusion requirements
- the time your surgery is taking (regular updates from anaesthesia will improve situational awareness)
- wider context of demands on theatres and the evolving major incident (are new patients still arriving?)

Pre-laparotomy

- Antibiotics are essential prior to your incision; however, you do not need to continue surgical antibiotic prophylaxis beyond the duration of the primary laparotomy
- The WHO Checklist should be used
- 'Two consultant' operating is very helpful, if staff are available
- If possible, have a senior surgeon moving between operating rooms to maintain oversight of departmental activity, to act as point of contact for incident commanders and to act as arbiter for difficult surgical decisions (such as transfer to palliation)

Patient positioning

- Place patient supine with arms abducted (crucifix position)
- Prep patient's chest and abdomen to knees. Once prepped, patient can be draped appropriately and covered to maintain temperature

The operation

- Make a full midline incision: xiphisternum to pubis
- Firstly, aim for haemorrhage control. In a very unstable patient – your assistant should digitally occlude the aorta at the hiatus while the surgeon evacuates blood and clot and then finds the source of blood loss and controls it
- Next goal is control of contamination: do not attempt definitive intestinal surgery (i.e. with repair, resection and anastomosis or formation of stoma). If there are multiple bowel injuries in one segment, or destructive injury, use stapling devices to resect damaged bowel and leave the bowel ends 'stapled in discontinuity' in the abdomen. Minor injuries can be simply over-sewn with sutures
- Do a thorough exploration once you have control of bleeding and contamination.
- Beware the following areas:
  - Diaphragm, left and right
  - Proximal stomach around OGJ
  - Lesser sac
  - Mesenteric border of intestine
  - Retroperitoneal colon
- Think about extraperitoneal rectal injury; on table sigmoidoscopy (flexi if possible) may help you make the diagnosis
- In a patient with continuing instability despite apparent control in the abdomen, think about adjacent cavities: chest/pericardium. A pericardiotomy can be done via your laparotomy incision
- Look for 'paired' injuries in hollow organs; think about the retroperitoneum, be prepared to operate on junctional area and enter adjacent body cavities e.g. thoracotomy after laparotomy if the source of on-going bleeding is from the chest and coming though diaphragmatic injury

⚠ **Un-paired holes in the bowel are a marker of missed injury**

⚠ **Fragments from high velocity GSW cause easily missed small perforations to hollow viscus organs**

Temporary abdominal closure

- Leave the abdomen open and use a negative pressure wound therapy device
- Patients can be woken and extubated with this form of temporary abdominal closure but ensure the dressing is properly applied, as there is an increased risk of evisceration in an awake patient compared to a patient intubated in an ICU setting

Planned re-look

- Plan to take the patient back to theatre at 24–48hrs. At first re-look laparotomy: do a thorough exploration of the entire abdomen and pelvis to exclude missed injury
- **Over-sewn intestinal injuries should be taken down and re-done. There is always a 'zone of injury' with penetrating injury and so the bowel should be debrided to healthy, vascularised bowel and then re-repaired.** The extent of the debridement will vary according to the energy associated with the mechanism (minimal for knife or low energy fragment, more extensive for GSW or destructive fragment).If appropriate at the first re-look, restoration of bowel continuity by anastomosis is an option. Formation of a stoma is indicated in the severely injured with massive transfusion, on-going inotrope requirement, acidosis, lactaemia etc.
- **Form a defunctioning colostomy for patients with penetrating rectal injury**; repair the injury if you can access it. Manually remove faeces and washout the rectum. Don't mature the colostomy at the first operation – divide colon with stapling device and leave ends inside

Additional considerations

- CT is not mandatory; rely on your clinical indications for laparotomy; reserving scarce CT scan resources for patients who need them (patients can always be scanned later in their clinical course if necessary)
- Thoughtful clinical examination and surgical judgement is required; remember the abdomen has a posterior aspect, examine the back thoroughly during the log roll, do a PR
- Look carefully for penetrating injury
- Catheterise early, blood in the urinary tract is a helpful physical sign
- Evisceration of bowel and or omentum is relatively common after blast injury
- If a patient has had CT: remember blast-injured patients may have pneumo-peritoneum without visceral injury; look for corroboration (clinical status or associated evidence of organ injury on CT-such as free fluid) before operating

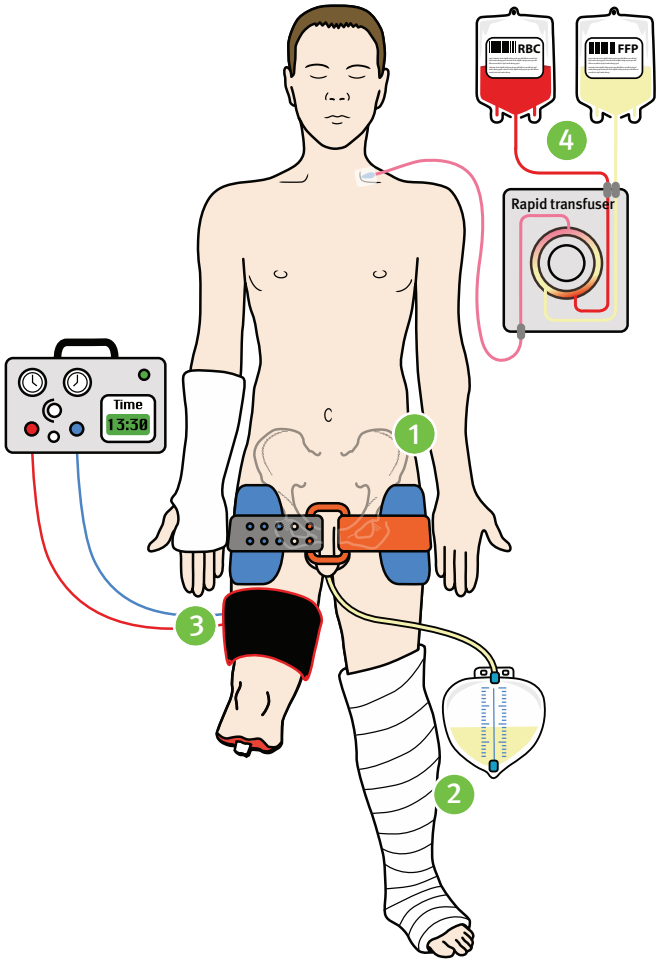
MI pelvic and long bone injuries

Key considerations

- Could the casualty have a pelvic injury?
- In limb injuries, is the wound open or closed?
- Is there uncontrolled haemorrhage?

Catastrophic haemorrhage

- Actively resuscitate with red cells and plasma. If possible, avoid crystalloids, give platelets early
- Get MTP 1* (4U blood and 4U FFP)



Pelvic injury

- Apply pelvic binder, 1 reassess and x-ray
- **Aim to keep binder time <36hrs with 12hrly skin checks**
- **Could the pelvic bleed be managed by IR?**
  - Transfer to IR Suite
- **Does patient need to go to theatre? If so:**
  - Pack against binder not ex-fix
  - Anticipate coagulopathy
  - Perform coagulation studies and treat aggressively with platelets and fibrinogen
  - Confirm urethral continuity
  - Catheterise

Closed limb injury

Have you excluded compartment syndrome?

- **Can the patient simply be splinted?**
  - Realign limb
  - Apply POP backslab 2
  - Use skin traction or pre-fabricated splints if suitable
  - Consider ex-fix for long bone fractures
- Regular distal neurovascular checks
- Perform fasciotomies
- Peripheral nerve block required?
- **Does the patient really need to go to theatre now? Can it wait?**

Pre-laparotomy

- Repeat primary survey
- Give TXA (bolus or infusion as appropriate)
- Give regular antibiotics
- Keep patient warm
- Give blood proactively – plan for one MTP* per destroyed lower limb 4
- Carry out the coagulation studies available in your unit

**MTP 1 – or blood products available in your facility to commence a massive transfusion protocol*

Actively bleeding limb

- Apply pressure dressing and
- Change pre-hospital tourniquet to a pneumatic tourniquet 3 **inflate it and note tourniquet start time**
- Realign limb and splint it
- **Does patient now need to go to theatre to stop the bleeding?**
  - Get proximal control
  - Ligate distally
  - Fasciotomise
  - (shunt only if needed)
  - Repair vessel – only if time
- Do not operate longer than 60mins

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MI immediate wound management

Aim: to make a diagnosis for each wound to a sufficient degree that priority for surgery and need for specific specialties can be correctly informed.

- All wounds must be examined so all dressings must come off. Be methodical. Don't forget the back
- Photograph or review with a surgeon present to avoid unnecessary re-looks, especially in complex wounds and for vascularity issues 4
- Consider examining sequential areas rather than the whole body in a single go.

Catastrophic haemorrhage

⚠ **Junctional and intra-cavity ongoing bleeding is an indication for surgery (or IR).**

→ If the situation is calm then do not rush for tourniquets. Try a pressure dressing with elevation (if practicable) first

- Use tourniquets if that fails

→ Give TXA as soon as possible

A **Age**
Young – may have significant blood loss but normal physiology

Older patients have impacting comorbidities and medications e.g. β-blockers or anticoagulants

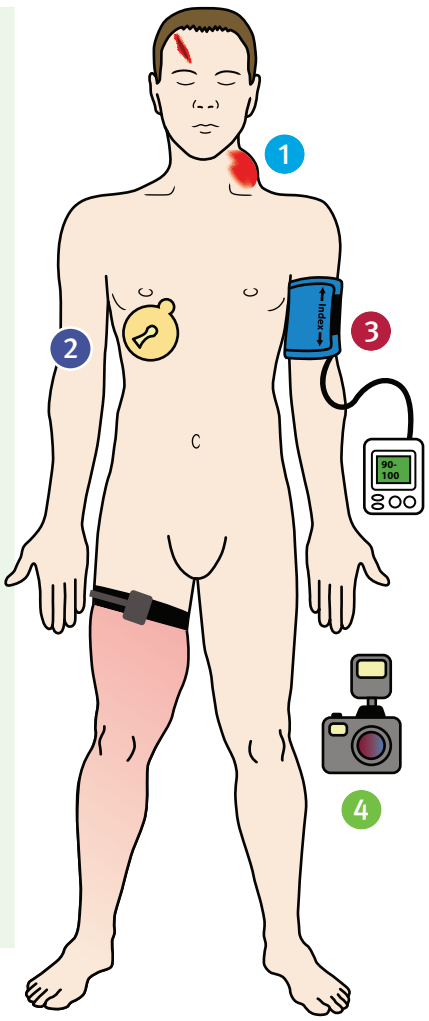
T **Time**
May be a risk of compartment syndrome or pressure effects if prolonged tourniquet use, entrapment or unknown LOC

M **Mechanism**
Initially treat the patient, then the wound – do not treat the weapon. Be aware of the mechanism but do not be distracted by it

I **Injuries**
Look for more wounds than were handed over

S **Signs and symptoms**
Listen to the patient. Note the pre-hospital observations

T **Treatment given**
Any tourniquets/pressure dressings/haemostatic dressings? Know the tourniquet time. Any pre-hospital drugs? e.g. TXA, ABx



Specialty checklist

- ✓ Administer systemic antibiotics as per local or State microbiology guidelines.
- ? Are there any obvious wounds that require the patient to go immediately to theatre without further assessment?

  Uncontrollable haemorrhage is probably the only indication
- ? Are there any wounds that require immediate attention to prevent deterioration?
- ? Any exposed viscera/brain? → Place a saline soaked gauze on these, do not use antiseptic solutions
- In all types of blast and ballistic wounding, a CT 'whole body' scan should be performed

A

- ? Airway risk: any face or neck wounds that might have on-going bleeding or emerging swelling? 1
- If practicable and appropriate, sit the patient up

B

- Adhesive chest seal dressings are good for:
  - any initial wound management 2
  - chest and abdominal wounds

C

Bleeding, even from significant wounds may have been controlled. Beware of over resuscitation because of reports of 'large blood loss' at scene.

- Continued significant bleeding, refer to management of catastrophic haemorrhage
- Fluid replacement should be by blood products and based on patients physiology, their response and coagulation profile 3

D

- Reduced level of consciousness that doesn't fit with the pattern of wounds
  - alcohol/drugs, head injury, hypoxia
  - missed injury, hypovolaemia
  - chemical/biological weapon?

Exclude hypoglycaemia

E

- ✓ Keep the patient warm

MI immediate wound management

Examination of wounds

Aim: to diagnose each wound to a sufficient degree such that the decision and priority for surgery and the need for specific specialties can be correctly identified.

- All wounds must be examined so all dressings must be removed. Beware of unnecessarily prolonged exposure resulting in hypothermia
- Do this in a methodical and thoughtful manner
- Don't forget the back
- Consider doing it with a surgeon present to avoid unnecessary re-looks. Particularly relevant in complex wounds and for vascularity issues
- Consider doing sequential areas rather than the whole body in a single go
- If there is a risk of significant haemorrhage when removing a dressing, consider doing under tourniquet control

- Note the general state of the patient in terms of clothing (torn? shredded? burnt?) and dirt (dust? soil? soot?). Non-specific but helps with the overall assessment. A patient covered in dirt has a higher risk of dirty wounds

- Are there any patterns to the wounding?
- Aim to get as much information as possible without exploring the wound. By simple observation it is normally possible to ascertain:
  - Is there obvious contamination with foreign bodies?
  - Is it obvious that the deep fascia has been breached?
  - Is bone exposed?
- Then formally examine for vascular, nerve and tendon deficits

⚠ **Probing the wound with instruments or fingers provides no further useful information and is potentially harmful**

Documentation and planning

- Once the wounds have been fully assessed the findings must be documented
- Take quality photographs if it is at all possible
- Have pre-agreed (in the plan!) who has responsibility for documenting the forensic description of the wounds (precise anatomical location, exact size and structures involved) because it must be done at some-point. Probably best done by the surgical team in theatres supplementing the CT findings
- The findings must be presented to the relevant clinical coordinator for planning of next steps. This will generate a priority list for timings to theatre and dictate where the patient will be held until it is their turn
- If there is any penetration of a body cavity or deep fascia, exposed bone or open fractures or alteration in normal function there is requirement for the wound to be formally explored. This should be done in an operating theatre

Timing of wound management

- For patients likely to go to theatre within the **next 12hrs**:
  - Place a saline soaked swab on the wound and secure with an outer dressing. Irrigate wound when possible
- In significant mass casualty situations, patients with soft tissue wounds may not get to theatre in the first 12hrs
- The presence of **grossly contaminated wounds** should be part of the surgical triage assessment, and these patients prioritised **for theatre before 12hrs where possible**
- Administration of systemic antibiotics as early as possible has been shown to reduce the proliferation of contaminating bacteria and so does buy time. Application of a saline soaked swab will suffice
- For those with **superficial wounds** (where there is no evidence of damage to deeper or important structures and the degree of contamination is such that formal debridement in theatre is not considered necessary)
  - These wounds can be cleaned according to usual practices under appropriate analgesia

⚠ **No ballistic wounds should be primarily closed**

- Provision must be made for follow-up of the patient to ensure appropriate delayed closure occurs

Non-surgical control of haemorrhage

- General oozing from the wound can be controlled with a **pressure dressing** and/or elevation
- There are several types of topical haemostatic agents available. These are primarily designed for pre-hospital use to mitigate for a lack of surgical capability where tourniquets and pressure dressings prove inadequate, such as in junctional areas. Once within a hospital, where surgeons and operating theatres are available, the approach to continuously bleeding wounds should be formal surgical control. The use of haemostatic dressings within hospital should be limited to extreme situations only
- If the patient has a **tourniquet** in place either from pre-hospital or applied on arrival during the primary survey this should be evaluated before the wound is addressed. An inflated tourniquet makes a patient a priority for theatre
  - If the tourniquet is a simple windlass type, as is common for pre-hospital use, this should be replaced by a **pneumatic tourniquet**, as soon as is practicable
  - This can be placed proximal to the windlass but not inflated initially nor applied too tightly such that it restricts venous outflow. The windlass can then be released and the wound observed
  - If there is no significant haemorrhage then the pneumatic tourniquet does not need to be inflated immediately but should remain in place as a precaution or for use during debridement. At this point an assessment of distal vascularity can be made
- If on releasing the windlass tourniquet there is significant bleeding, then inflate the pneumatic tourniquet and formal surgical vascular control should be obtained as a priority

⚠ **If the initial tourniquet has been on for significantly more than 2hrs, discussions about managing the patient's general condition, overall distal viability and potential need for fasciotomies should be had, before the tourniquet is released**

MI universal fasciotomies

Universal fasciotomies have been designed to **decompress compartments** and allow **adequate vascular access,** without compromising **future soft tissue reconstruction.**

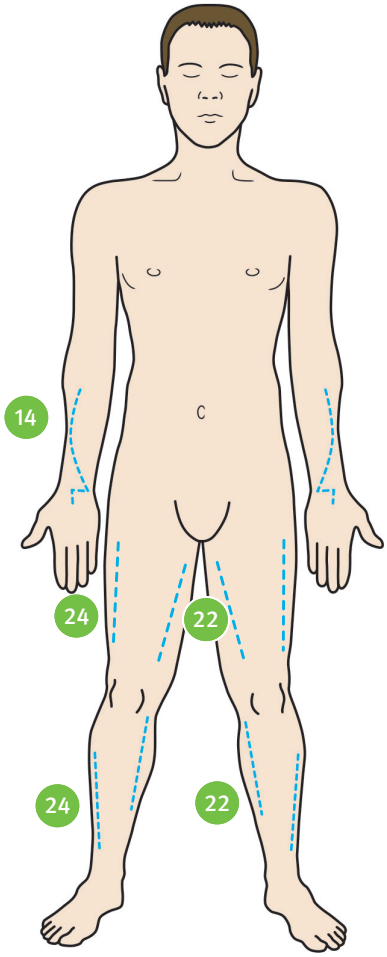
- Use extensile incisions
- Incision can incorporate wound line as required
- Aim to achieve proximal/distal control outside of any haematoma or zone of injury

Fasciotomy incisions

Volar forearm fasciotomy 14

Medial leg fasciotomy 22

Lateral leg fasciotomy wound, allows exposure of mid anterior tibial artery and decompression of lower leg compartments 24



Two incision, four compartment fasciotomy for the lower leg

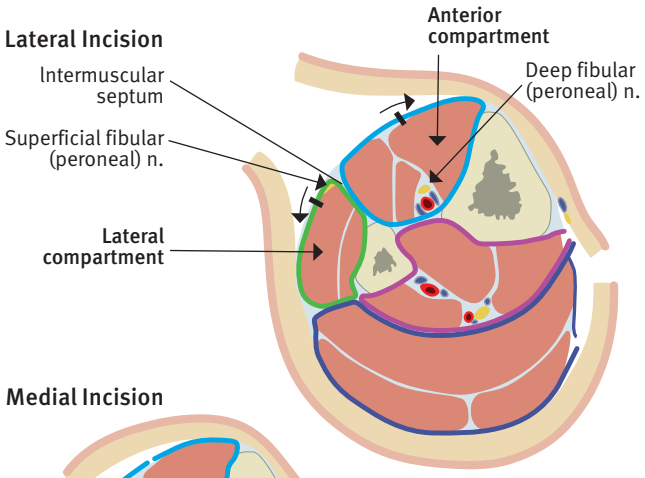
Use a skin marker to draw the surface markings of the medial and anterior borders of the tibia.

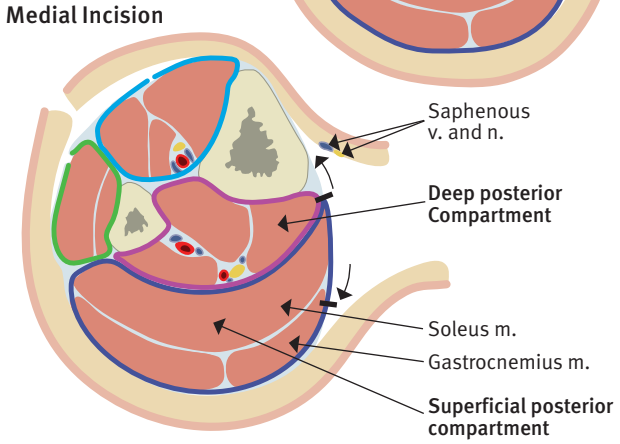
Release of superficial and deep posterior compartments:

1. Make an incision through skin 2cm posteromedial to the marked medial border of the tibia from the tibial flare down to behind the medial malleolus.
2. Deepen the incision without undermining the skin and then incise the fascia along the whole length of the skin incision. This will have fully released the superficial posterior compartment.
3. Identify the posterior tibial neurovascular bundle, most easily done distally, and incise the thinner fascia over it. This will have gained entry into the deep posterior compartment.
4. Extend this along the whole length of the skin incision to fully release the compartment.
5. Access to the more proximal part will require dissecting the soleus muscle off the tibia.

Release of the anterior and lateral compartments:

1. Make an incision through skin 2cm anterolateral to the marked anterior border of the tibia from the tibial flare down to just in front of and above the lateral malleolus.
2. Deepen the incision without undermining the skin and then incise the fascia along the whole length of the skin incision. This will have fully released the anterior compartment.
3. Sweep the exposed muscle bellies medially and follow the deep aspect of the fascia laterally until the fibular is felt. This will have revealed the intramuscular septum.
4. Incise this along the whole length of the skin incision to fully release the lateral compartment.





Specialty overviews

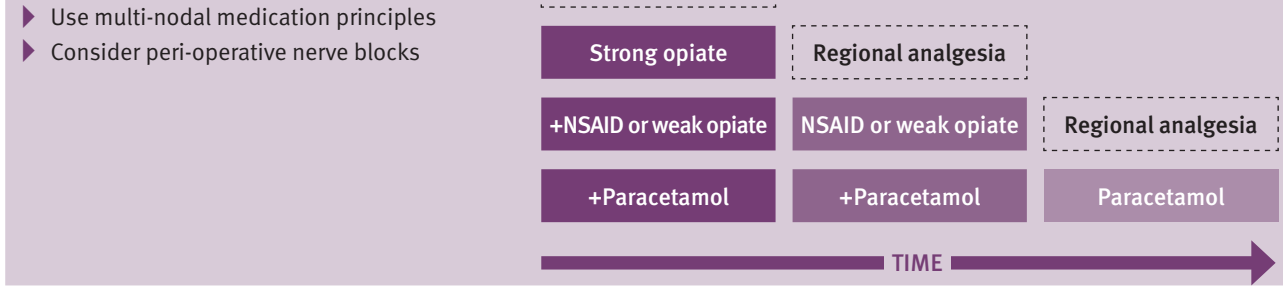
Pain management in a major incident

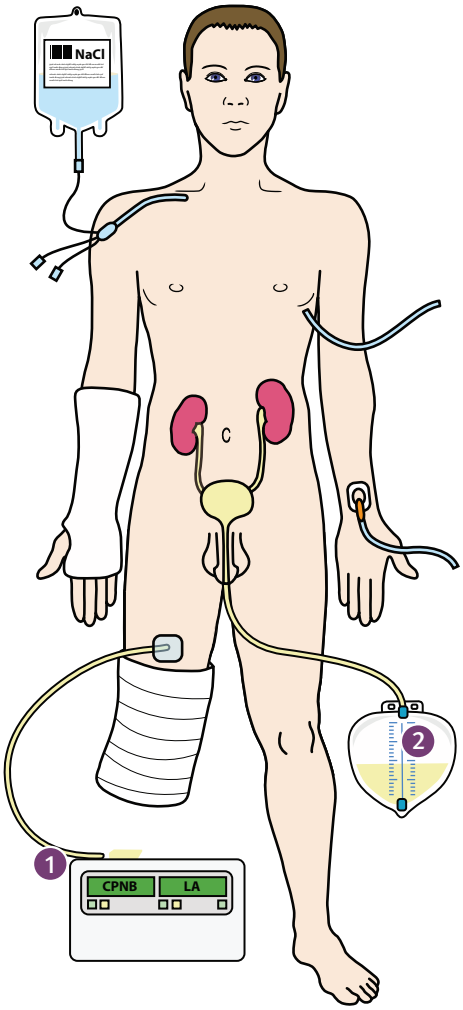
'Reverse' the WHO pain ladder in complex injury and establish effective pain control early; then reduce and stop pain medications as appropriate

- Start analgesia as soon as possible
- Use multi-nodal medication principles
- Consider peri-operative nerve blocks

'Reverse' WHO pain ladder

- De-escalate as pain improves
- Consider RA/EA at each stage





Chest injury

- Intercostal nerve blocks
- Serratus plane blocks

Abdominal injury

- Transverse abdominus plane (TAP) block
- Epidural Analgesia or LA (Lignocaine) infusion

Limb injury

- Single shot nerve block
- +/– Indwelling nerve catheter for continuous infusion 1

Regional or epidural analgesia

Consider regional analgesia at every step

- Single shot block +/– continuous nerve blockade
- If spinal and epidural analgesia
  - Urinary catheter may be required 2

Beware:

- Hypovolaemia
- Coagulopathy
- Distorted spinal anatomy e.g. crush fractures in explosive injury

Direct or anticipated nerve injury

- Pregabalin
- Tricyclic anti-depressants

Key points

- Start analgesia as soon as possible
- Use multi-nodal medication principles
- 'Reverse' WHO pain ladder
- Consider peri-operative nerve blocks

Pain management in a major incident

Establish pain control early and stop medications as appropriate.

Pharmacology

Multi-modal analgesia using the reverse WHO pain ladder *(overleaf)*

I. Opioids e.g. Morphine

- Morphine is 'most familiar'. Multiple routes available but in acute situation is best given by intravenous bolus: 1–5mg as bolus and then additional 1–2mg doses , every 2–5mins, titrated to effect
- Relatively large doses may be required in young athletic casualties and analgesia is slow in onset
- Fentanyl is a quicker alternative. 50 micrograms i/v as a bolus and repeat doses of 25–50 micrograms every 2–5mins
- Degree of sedation more closely related to acute overdose than respiratory rate
- Accidental overdose requires intravenous naloxone. Take one ampoule (0.4mgs) and dilute to 8mls with water for injection. Inject 1ml (0.05mgs) and repeat until sedation reversed and respiratory rate ≥ 8
- Effect is short acting – observe casualty closely

II. Weak opioids e.g. Tramadol, Codeine

Tramadol

- Synthetic weak opioid with noradrenergic and serotonergic effects
- Alternative to codeine
- Recognised role in neuropathic pain

III. Non-opioids

NSAIDs

- Avoid with acute haemorrhage/coagulopathy or critical illness
- Side effects more likely in elderly patients. Ibuprofen (200–400mgs tds, po, pr) or diclofenac (50mgs tds, po, iv, pr) commonly used

Paracetamol

- 1g iv/po/pr QDS (500mgs if body weight less than 50kgs)
- Few contraindications
- Will have some opioid sparing effect

Adjuncts – Co-analgesics

A. Ketamine

- 10–20mg intravenous aliquots can be used de novo or to supplement opiate analgesia. Particularly effective prior to patient movement or splint procedures
- Effect will persist for 10–15mins
- Consider adding Midazolam 1–2mg when using Ketamine
- Administrator should be resuscitation proficient as anaesthesia possible with inappropriate dosage

B. Tricyclic antidepressants

- Neuropathic injury: start as soon as possible. Reassess need at two weeks
- Amitriptyline often assists sleep at night: a useful effect
- Start amitriptyline dose at 25mg and titrate to effect

C. Gabapentinoids e.g. Pregabalin

- Start as soon as possible: reassess need at two weeks
- Initial dose = 75mg bd
- Review every day, increasing dose if necessary and tolerated
- Dose range is 150 to 600mg per day PO given in either two or three divided doses

D. Clonidine

- Anxiolytic/analgesic.
- PO 50 – 600mcg 8 hourly (150–200mcgs per 24hrs typical co-analgesic dose)
- IV bolus – 50–150mcg over 1–10mins. May be repeated eight hourly
- Infusion in HDU/critical care: 1–2mcg/kg/hour

E. Lignocaine

- Can assist in difficult situations: alternative to epidural in abdominal surgery
- 1–2mg/kg iv bolus over 30mins
- Infusion: 0.5–2mg/kg/hr

Input from hospital acute pain services

Patient Controlled Analgesia (PCA)

- Encourage use of PCA when appropriate
- PCA can be employed prospectively before surgery

Pain management in a major incident paediatric considerations

Establish pain control early and stop medications as appropriate.

Fentanyl

Consider intra-nasal route

Intranasal DOSE 1.5mcg/kg administered via Mucosal Atomiser Device (MAD).

Vial concentration 50mcg/mL – add 0.1mL to initial dose to accommodate dead space of the MAD

Max dose 100mcg

Can repeat dose after 5–10mins

Ideally administered via a nasal atomiser

The dose of IV Fentanyl should be halved if the patient is under 12 months of age

Morphine

DOSE: 0.05–0.1mg/kg IV

The dose of IV Morphine should be halved if the patient is under 12 months of age

Ibuprofen

DOSE: 10mg/kg oral q6h prn max dose 400mg maximum
3 times a day

Paracetamol

DOSE: 15mg/kg oral/IV q4h prn max 1g max
4 times a day

Oxycodone

DOSE: 0.1–0.2mg/kg oral q4h prn max
4 doses per day (would recommend start with 0.1mg/kg)

Ketamine

ANALGESIC DOSE: 0.1–0.3mg/kg IV; 0.5–1mg/kg IM

SEDATION DOSE: 1–2mg/kg IV; 2–4mg/kg IM

Ketamine should not be administered to patients under 6 months of age

Naloxone

Sedation due to therapeutic opioid use

DOSE: 1–5mcg/kg max initial dose 100mcg start at low end and titrate up.
Repeat every 2–3mins if required.

Acute opioid overdose (resuscitation): 10mcg/kg max 400mcg

Age	Weight
Birth (term)	3.5kg
1 month	4kg
2 months	5kg
3 months	6kg
4 months	7kg
6 months	8kg
9 months	9kg
1 year	10kg
2 years	12kg
3 years	14kg
4 years	16kg
5 years	18kg
6 years	20kg
7 years	22kg
8 years	25kg
9 years	28kg
10 years	30kg
11 years	35kg
12 years	40kg
13 years	45kg
14 years	50kg

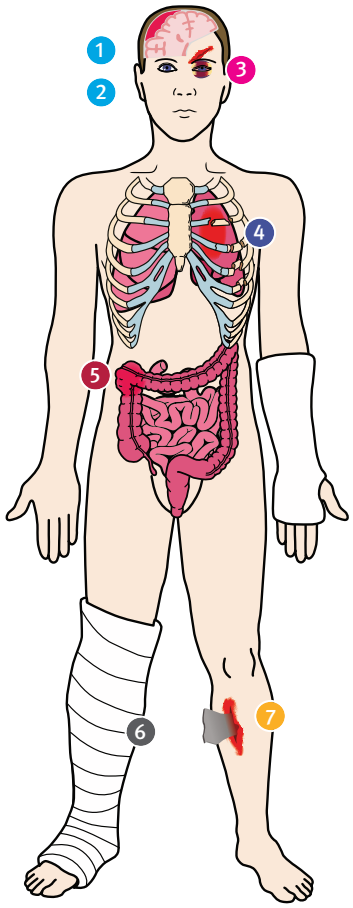
https://www.childrens.health.qld.gov.au/qpec-paediatric-resuscitation-tools/

Antimicrobial prophylaxis

Introduction

Blast wounds are extensive and contaminated (and will remain so even after extensive debridement, or will rapidly become recolonised); whereas **gunshot wounds (GSW) are relatively clean.**

- Give your microbiologist as much information as possible
  - How was the injury sustained?
  - What was the environment in which it was obtained?
  - Any organic contamination or water exposure?
- **Keep to simple measures and antibiotics**
- Recognise your patient will have a huge inflammatory response and it may not be due to an infection



⚠ **If patient is known to be colonised with MRSA, CPE, ESBL+ve, or other resistant organisms: Discuss with an Infectious Diseases Physician**

CSF leak post skull fracture 1

- No antibiotics required
- Give **Pneumovax**

Penetrating CNS injury 2

- **Ceftriaxone 2g bd iv + Metronidazole tds iv**
- ⚠ *Non-severe Penicillin allergy: Meropenem 2g tds iv*
- ⚠ *Severe Penicillin Allergy (Anaphylaxis): Ciprofloxacin 400mg bd iv + Vancomycin 1g bd iv + Metronidazole 500mg tds iv*
- All courses three day duration

Penetrating eye injury 3

- **Ciprofloxacin 400mg IV Q8H for 3-days**
- Ciprofloxacin 750mg PO BD for 3-days

Penetrating chest trauma 4

- Cephazolin 2g IV Q8H (add Metronidazole 500mg IV Q12H if wound is heavily contaminated)
- ⚠ *Penicillin allergy: Lincomycin 600mg IV Q8H*
- If minimal delay to effective surgical management only 24hrs of antibiotics required. Longer duration of 1 week may be indicated for extensive injuries.

Penetrating abdominal trauma 5

- **Amoxicillin-clavulanic acid 1.2g TDS IV** or Cefazolin 2g IV Q8H and Metronidazole 500mg IV TDS Q12H
- ⚠ *Penicillin allergy: Lincomycin 600mg IV Q8H*
- If minimal delay to effective surgical management only 72hrs of antibiotics required. Longer duration of 1–2 weeks may be indicated for extensive injuries,and gross contamination

Open fracture limb/hands 6

- **Cephazolin 2mg IV Q8H** (add Metronidazole 500mg IV Q12H if wound if heavily contaminated)
- ⚠ *Penicillin allergy: Lincomycin 600mg IV Q8H*
- Feet injuries require anti-pseudomonal treatment
- Piperacillin-tazobactam 4.5g IV Q6H
- ⚠ *Penicillin allergy: Ciprofloxacin 400mg IV Q12H plus Lincomycin 600mg IV Q8H*
- Until soft tissue cover or 72hrs, whichever is earlier

Penetrating soft tissue injury 7

- **Cephazolin 2g IV Q8H** (add Metronidazole 500mg IV Q12H if wound is heavily contaminated)
- ⚠ *Penicillin allergy: Lincomycin 600mg IV Q8H*
- Until first surgical debridement/washout

Key points

Bacterial infection in blast or ballistic injury, is the same as other wounds but don't just treat the microbiology report.

- ? Consider if this is colonisation or infection?
- Close liaison with an Infectious Diseases Physician within the multidisciplinary team is essential
- Common things occur commonly, but be on alert for an unusual clinical picture
- Tell the lab about the unexpected findings or unusual clinical picture, as diagnostic labs are set up to look for common pathogens and may overlook others
- Be aware or suspicious of wounds with evolving (unexpected) necrosis
- ? Post event transfers: Infection Prevention and Control (IPC) teams need advance notice of patient movements and suspect organisms if possible, to ensure the receiving unit is prepared and can mitigate risk (i.e. there is a side room available?)

Antimicrobial prophylaxis

Prevention of blood borne virus transmission (Hepatitis B, C and HIV)

Follow postexposure prophylaxis against bloodborne viruses.

Obtain blood sample from patient

- As soon as possible, a blood sample from the patient should be stored for baseline

Hepatitis B Vaccination

- Start vaccination course within 48hrs of injury if not immune
- Give accelerated vaccine schedule
- Store blood and check for seroconversion at 3 and 6 months
- Will have some opioid sparing effect

Hepatitis C Vaccination

- No vaccine/antiviral strategy possible
- Store blood and check for seroconversion at 3 and 6 months

HIV

- Post exposure prophylaxis not routinely recommended.
- Store blood and check for seroconversion at 3 and 6 monthsTetanus

Tetanus

The need for tetanus-containing vaccine in people with a tetanus-prone wound, with or without tetanus immunoglobulin, depends on the nature of the wound and the person's vaccination history.

Adolescents and adults who have never had a tetanus-containing vaccine are recommended to receive 3 doses of tetanus-containing vaccine with at least 4 weeks between doses, and booster doses at 10 years and 20 years after the primary course.

If immunisation history is unclear, then tetanus-containing vaccine is recommended.

Tetanus Immunoglobulin should be given via the intramuscular route to:

- All people with a humoral immune deficiency if they have a tetanus-prone wound. This is regardless of the time since their last dose of tetanus-containing vaccine
- All people with HIV if they have a tetanus-prone wound. This is regardless of the time since their last dose of tetanus-containing vaccine and their CD4 count
- Anyone who has no documented history of a complete primary vaccination course (3 doses) with a tetanus-containing vaccine and who has a tetanus-prone wound. Such people should receive all missing doses and must receive tetanus immunoglobulin

The Australian Immunisation Handbook defines a tetanus-prone wound as "Any wound other than a clean, minor cut".

All tetanus-prone wounds must be disinfected and, where appropriate, have surgical treatment. Do this even if the person has up-to-date tetanus vaccinations.

Antibiotics do not prevent or treat tetanus.

Further details on doses and administration should be obtained from the Australian Immunisation Handbook: https://immunisationhandbook.health.gov.au/

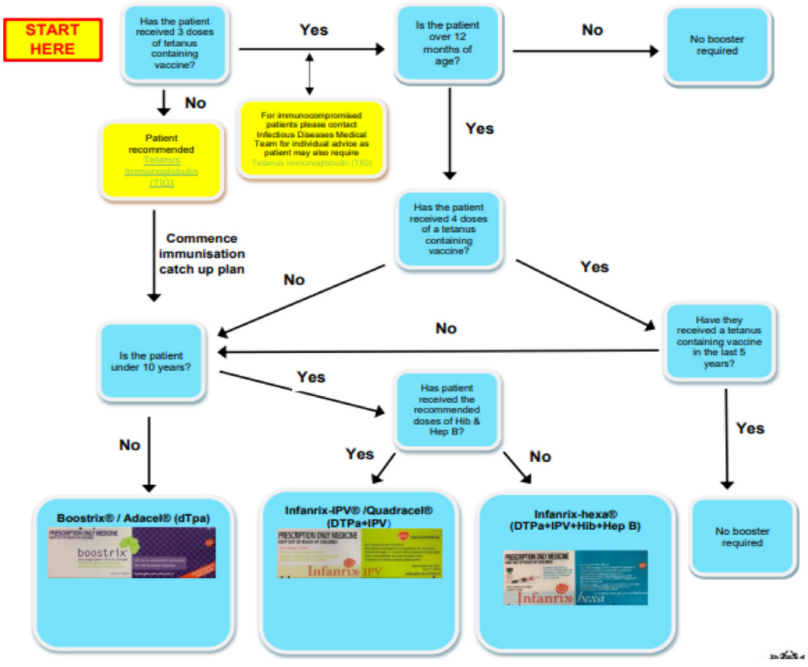
ALERT – use flowchart for those who are:

- **Unvaccinated (excludes under 6 weeks – seek advice from ID)**
- **Not vaccinated as per NIP**
- **9 years of age or older, previously vaccinated as per NIP**

ALERT

- **Please read Tetanus Vaccination prior to using this algorithm aid**
- **If due 18-month-old vaccine as per National Immunisation Program see Tetanus Vaccines**

Flowchart 1 - Algorithm to Aid in the Prescription of Tetanus Wound Prophylaxis



Refer to the ***Tetanus Prophylaxis in Wound Management Guideline CHQ-GDL-01023*** for further information.

Antimicrobial prophylaxis paediatric considerations

CSF leak post skull fracture

- Give PCV13 vaccination

Penetrating eye injury

- IV vancomycin 15mg/kg q6h (max 500mg per dose) AND
- IV ceftazidime 50mg/kg q8h (max dose 2g)

Penicillin allergy:

- IV cipro 10mg/kg, q12h (max 400mg per dose) AND
- IV vancomycin 15mg/kg q6h (max 500mg per dose)

Open fracture limb/hands

- IV cephazolin 50mg/kg (max dose 2g) q8h

Penicillin allergy:

- Lincomycin 15mg/kg q8h (max 1.2g per dose)

Severe tissue damage or contamination

- IV piptaz 100mg/kg q6h (max 4g piperacillin component)

Penicillin allergy:

- IV cipro 10mg/kg q12h (max 400mg per dose, and
- IV linco 15mg/kg q8h (max 1.2g per dose)

Other

- IV amoxicillin-clavulanic acid doses
- 0–3 months if ‹4kg 25mg/kg/dose (amoxicillin component) q12h; if ›4kg 25mg/kg/dose q8h
- Infants and children ›3 months 25mg/kg/dose q6h (max 1000mg amoxicillin component)
- Adolescents ›16 years and ›40kg 25mg/kg/dose q6h (max 2000mg/dose amoxicillin component)

Tetanus

A primary course of tetanus containing vaccine is given at 2, 4 and 6 months of age. Tetanus Boosters are required at 18 months, 4 years of age and in grade 7 of schooling.

Tetanus Booster

‹10 years of age:

- Infanrix-IPV (DTPa-IPV)
- Quadracel (DTPa-IPV)
- iInfanrix-Hexa (DTPa-IPV-HiB-Hepb)

≥10 years or older:

- Boostrix
- Adacel vaccine

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Acute acoustic trauma (AAT) and hearing loss after a major incident

Symptoms common to acute acoustic trauma include hearing loss, tinnitus, earache or vertigo. The ear is highly susceptible to injury after blast, and this is often missed as the trauma teams manage life threatening injuries first. Patients may self present days later, to the ED or GPs.

- Patients with hearing loss can be assessed with tuning forks and bedside test of hearing to exclude acute sensorineural hearing loss (SNHL), which may be an indication for early systemic steroids.
- All patients with suspected hearing loss should be referred for a formal audiogram + ENT outpatient review.
- Patients with purely conductive hearing loss (CHL) do not require urgent intervention but should have follow-up.

"I was near the blast and my hearing has been affected. I think I need a hearing test"

Do not wait!

Perform otoscopy, tuning fork and bedside test of hearing to assess for CHL vs SNHL

Refer for earliest available audiogram in the community or hospital audiology department

Hearing loss diagnosed

Referral to ENT outpatient clinic – phone call to ENT registrar on call can clarify urgency of referral and assist with interim management advice e.g. systemic steroids for sensorineural hearing loss (SNHL)

GPs/other non-hospital audiology providers

- Referral to local ENT and associated Audiology Department requesting formal audiogram. If audiology not available ENT can perform clinical assessment of hearing to discriminate SNHL from CHL
  - If gross disruption anatomy a CT temporal bones and ENT review is recommended

ENT and associated Audiology Department referrals

Please include

- Patients contact details
- Clinical examination findings including: status of ear canal, ear drum, middle ear effusion, facial nerve, hearing, vertigo
- Contraindications to high dosesteroids

Pre-hospital

In hospital

Formal audiogram confirms hearing loss

- If gross disruption anatomy a CT temporal bones and ENT review is recommended

Case not appropriate for steroids. Monitor patient as per local policy and provide hearing aids if appropriate

Pure conductive loss

Adult and Paediatric follow-up by ENT at local hospital or department

Sensorineural or mixed loss

Adults (Priority 1)

- Discuss risk and benefits of steroids
- Offer systemic steroids if no contraindications
- Recommendation for oral regime: Prednisolone 1mg/kg to a max of 60mg OD for 7 days, after appropriate consent
- Gastric cover with PPI and Gaviscon Advance
- Ensure patient has ENT follow-up after 7 days. Intratympanic steroids may be considered if contraindications to use of systemic steroids and as a salvage therapy

Paediatric <16 (Priority 1)

If hearing loss is suitable for management with steroids

- Contact Queensland Children's Hospital ENT team for advice and referral pathway
- Discussion with parents to exclude contraindications of steroid use in a young patient
- Offer oral steroids as adults
- Consider intratympanic steroids in older children or if having other procedures under GA
- Titrate dose by weight (Prednisolone 1mg/kg PO OD 7 days to a maximum dose as per local policy)
- Discuss use of gastric cover if appropriate

***AAT and steroid use**

See page 85 before prescribing

- If persistent sensorineural loss after 7 days of oral steroids, the ENT team may consider role for intratympanic steroids
- If persistent mixed loss, where conductive element is related to a perforated ear drum, contact ENT team for advice

Acute acoustic trauma (AAT) and hearing loss after a major incident

Acute hearing injury

There are many reasons for patients to perceive a reduction in the quality of their hearing following trauma. **The flowchart overleaf is designed to streamline the management of hearing injury without associated temporal bone fracture,** in the mass casualty situation. The evidence on which these protocols are based, is rapidly maturing and a pragmatic approach has been taken as evidence related to the rescue of sensorineural hearing loss (SNHL) associated with noise and blast exposure evolves.

Treatment options are severely time limited. For adults and children, with symptoms or proven hearing loss, hearing tests should be performed at the earliest available opportunity, which may be community audiology, at a local hospital or to a referral hospital.

- In the presence of a severe hearing loss however, early assessment and treatment is imperative and it is perfectly appropriate to test earlier
- For children, tests need to be age appropriate, however,standard 'adult' Pure Tone Audiometry can often be performed with children above the age of five. This should be considered if the numbers injured place pressure on paediatric audiology services or the location dictates and there is a wish to keep parents and children together

If hearing tests are normal, no immediate action is required. If tinnitus persists, then other therapies may be indicated, as per local ENT guidance.

If abnormalities are detected, results should be passed on **URGENTLY** to the local ENT Department for assessment. Early notification to the ENT team can aid in triage of referrals.

If the loss is purely conductive which may be due to:

- blood in the external auditory canal
- tympanic membrane perforation
- ossicular discontinuity
- ✔ No immediate action is needed
- ✔ Keep the ear dry
- ✔ Patients can be followed up routinely in outpatients at an interval appropriate to their pathology. Typically this is done at 6 weeks with an audiogram

If hearing loss is mixed or purely sensorineural steroids may be beneficial.

Systemic steroids are considered first line treatment for sudden sensorineural hearing loss (SNHL) within 2 weeks of onset.

Intratympanic steroid may be considered as concurrent treatment, salvage treatment or alone if systemic steroids are contra-indicated. Review by ENT specialist, if available, is recommended commencing intratympanic steroids:

- Patients can be prescribed oral Prednisolone, 1mg/kg to a max of 60mgs OD, for 7 days with PPI cover for 14 days, after appropriate consideration of contraindications and consent
- If there is no improvement in the sensorineural component of the loss intratympanic steroids should be considered as there is evidence of superiority when compared to oral steroids for hearing salvage

Updated advice (2017)

For young people and children – remember to:

- TITRATE STEROID DOSES to weight
- Be meticulous to explain the possible side effects. The information given on this, and other treatment options, must be documented for all patients
- Have a joint consultation if possible, ENT with a paeds consultant present is the ideal. ENT team advice can be sought through the facility or hospital switchboard or as per standard operating procedure
- Intratympanic steroid may improve outcomes, is low risk and is typically performed under local anaesthetic. In children may be performed opportunistically if having other procedures under sedation/GA

*AAT and steroid use

- **Intratympanic steroids may be considered as an adjunct, alternative (if contra-indications or declines systemic steroid) or in salvage setting.**
- **Consider steroid use if there is a strong suspicion patient has sensorineural loss and radiological evidence of inner ear trauma (i.e. otic capsule involving), but unable to subjectively test. e.g. intubated patient with severe scalp burns.**
- **In severe trauma, where objective evidence of SNHL or high suspicion exists but relative contraindications to systemic steroids are present, ITSI should be considered. If vision is lost, this consideration should be given a high priority.**
- **Suspicion for or signs of base of skull (BOS) fracture mandate fine-slice CT to exclude temporal bone fracture, which may be associated with SNHL, vertigo, facial palsy and rarely CSF leak or vascular injury, Case should be discussed with the ENT team. Fractures are classified as Otic Capsule-Sparing versus Otic Capsule-Involving, the latter being more frequently associated with inner ear and facial nerve injury. In rare instances operative intervention may be required. SNHL should still be treated with systemic steroids where possible.**

Blast lung in a major incident

Introduction

Casualties with a primary blast lung injury (PBLI) will probably be symptomatic by the time they reach hospital. Casualties with PBLI will develop varying degrees of respiratory distress with impaired gas exchange. They may require supportive care in a high dependency or intensive care environment and up to 80% will require mechanical ventilation.

⚠ **The combination of blast injury and haemorrhagic shock is particularly life threatening and requires rapid and aggressive treatment.**

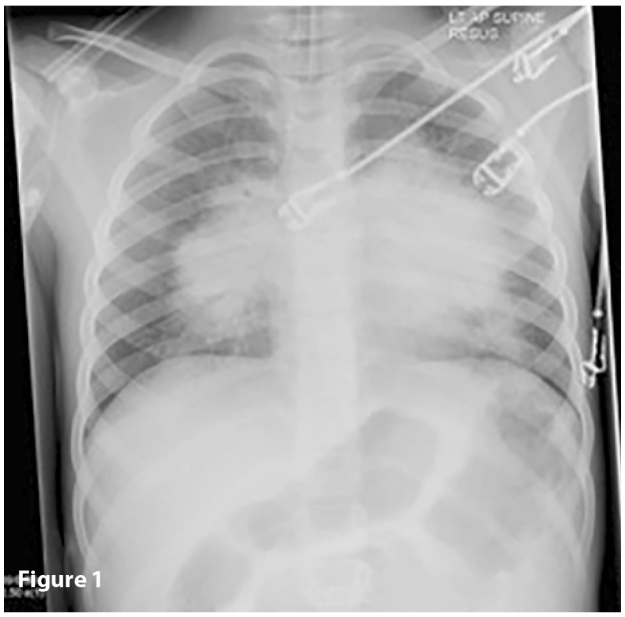


Figure 1

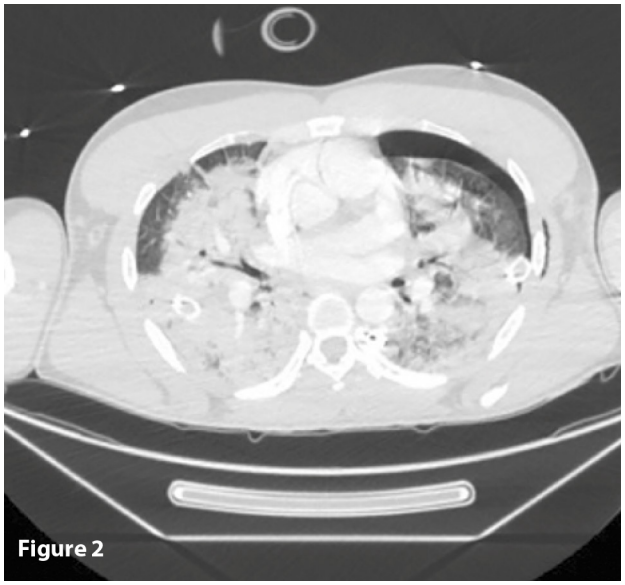


Figure 2

Catastrophic haemorrhage

- Catastrophic haemorrhage may result from a massive haemothorax
- ➔ Needs prompt recognition, haemostatic resuscitation and damage control surgery

A

- May have haemoptysis

B

Patient may present with:

- Mild to moderate respiratory distress
- Pneumothorax/pneumatoceles
- Broncho-pleural fistula in severe cases

? A CT chest to exclude pneumohaemothoraxany

No specific therapy for PBLI currently exists and patients should be ventilated as per current best practice for acute lung injury.

Intensive care management

- Ventilate in accordance with current best practice
- Early CPAP at 5cm H_2O, once pneumothoraces are drained
- Moderate PEEP levels on case by case basis if broncho-pleural fistula
- Use pAPRV and/or $ECCO_2R$ (local experience and resources permitting)
- Euvolaemic volume status
- Expect a good recovery

C

- Hypotension may be due to myocardial impairment and decreased SVR

? Consider vasopressor use to avoid excess administration of IV fluids

Key points

Casualty identification

- If asymptomatic at 2hrs, patient will not need mechanical ventilation
- If asymptomatic at 6hrs, significant PBLI is unlikely to occur

Risk factors

- Explosion in confined space
- Close proximity to explosion

Has patient been exposed to:

- Toxic industrial chemical exposure (e.g. Chlorine/Phosgene/Cyanide)
- Other toxic or smoke exposure

⚠ **Tympanic membrane rupture is not a sensitive or specific risk factor for PBLI**

Blast lung in a major incident

Background

Primary blast injury syndrome is a life threatening, multisystem disease, of which primary blast lung injury (PBLI) is normally the predominant injury. **PBLI is defined as "radiological and clinical evidence of acute lung injury occurring within 12hrs of exposure and not due to secondary or tertiary injury", and results from exposure to a supersonic explosive shockwave (Figure 1, page 86).**

Solid organs and the long bones may also be injured by the shockwave, however in the lung, significant damage manifests as alveolar and parenchymal rupture, haemorrhage, lung laceration, and pneumothoraces. **Immediate fatalities are the result of venous air embolism**.

The exponential decline in shock wave energy means that in an open air explosion, just a matter of a few metres can make the difference between suffering a fatal blast injury and suffering virtually no injury at all. However, when an explosion occurs in a confined space such as buildings or trains, the energy within the shock wave does not dissipate so readily, but self-propagates and augments itself in a chaotic manner. The stand-off distance in a confined-space explosive event is as a result less important and the risk of injury much greater.

Presentation and diagnosis

PBLI was seen in 63% and 54% of the critically injured casualties suffered in the Madrid and London train bombings, respectively.

Respiratory compromise and possibly haemoptysis, are early signs of PBLI.

- The absence of respiratory compromise 2hrs after injury suggests that the need mechanical ventilation due to PBLI alone is unlikely
- Patients who are asymptomatic 6hrs after exposure are unlikely to develop clinically important disease
- Tympanic membrane rupture is poorly correlated with PBLI but non the less should be sought for and identified
- The possibility of co-existing toxic lung injury (with cyanide or phosgene for example), gastric aspiration and pulmonary contusion from blunt injury should be considered

Casualties with PBLI require management in a high dependency or critical care environment and the majority will require mechanical ventilation.

CT scan is the imaging of choice:

- Clearly demonstrates the distribution and extent of alveolar haemorrhage and parenchymal haemorrhage
- Better demonstrates pneumatoceles and pneumothoraces which may not be apparent with plain film radiography.

Figure 2 (page 86), is an example of a CT scan in a patient with severe PBLI, shortly after injury.

Plain film radiography may demonstrate:

- Contusions, which may be denser on the side of the incident shock wave
- Characteristic 'bats-wing' distribution of consolidation may be seen, although this is not typical **Figure 1** (page 86).

Medical management

Casualties with PBLI require management in a high-dependency or critical care environment and the majority will require mechanical ventilation. The combination of blast injury and haemorrhagic shock is particularly life threatening and such patients should be triaged and prioritised accordingly.

- No specific therapy exists for the management of PBLI though this is an active area of research
- Tranexamic Acid and recombinant factor VIIa have been studied but demonstrated no benefit
- Hepatitis B vaccination must be considered when fragmentation injury with human tissue has occurred
- There is no current guidance regarding the value of prophylaxis against HIV infection in such circumstances and so a case by case consideration should be made locally

Burn injury in a major incident

In a MI event coordination will occur through Retrieval Services Queensland (RSQ).

Queensland Adult Burns Referral Centre:
- Royal Brisbane and Women's Hospital

Queensland Paediatric Burns Referral Centre:
- Queensland Children's Hospital

For each patient:
- Copy of patient notes
- Completed Lund and Browder chart
- All available test results, including all imaging uploaded to the receiving Hospital's imaging system
- Details of all other injuries (after secondary survey)
- Details of fluid requirements, fluid administered and urine output

A

Loss of airway patency can occur suddenly, especially in children. Oedema will increase rapidly once IV fluids given.

→ **Provide supplemental O_2 15L/min via non-re-breathe mask**

Consider intubation if:
- Impending upper airway obstruction
  - Pharyngeal oedema ..... Intubate now
  - Inspiratory stridor ..... Intubate now
  - Difficulty swallowing secretions ..... Intubate now
  - Intra-oral burns including tongue ..... Intubate
  - Intra-oral swelling. No stridor ..... Intubate
  - Burns around mouth or nose ..... Observe carefully
  - Soot in mouth or nostrils, singed nasal hairs ..... Observe carefully
- Respiratory distress
- Decreased LOC
- Ventilatory inadequacy caused by circumferential burns to neck, chest or abdomen
- Deep facial burns and circumferential neck burns
- Increasing swelling of head and neck. May be particularly obvious once fluid resuscitation commenced
- Other serious trauma/significant associated injuries

? Consider intubation for safe transfer

If in doubt, intubate. (**Do not** cut the ET tube)

B

- Recheck ET tube often, as easily 'displaced'
- Facial swelling may cause:
  - a cut ET tube to 'disappear' into the mouth
  - a tied ET tube to pull out, as face swells
- ET tube may migrate into the right main bronchus (more likely with uncut tubes)
- Consider blast lung Injury if lung contusions and haemo pneumothorax. See Speciality Overview – **Blast lung in a major incident**

C

→ Sit the patient up if possible. IV fluid resuscitation may cause rapid oedema formation particularly in patients lying flat

→ Place lines through unburned skin if possible (femoral site is often preserved)

→ Regularly review anchor sutures. May 'cut out' of burned or oedematous skin

- Expect tachycardia (HR x2 is common). Hypotension and cardiovascular instability are late signs. On-going hypotension mandates exclusion of other forms of shock e.g. haemorrhagic, neurogenic, cardiogenic etc.
- Consider using long lines for IV access. Indwelling lines may migrate as a result of tissue oedema

D

- Decreased LOC can be caused by hypoxia, carbon monoxide and cyanide poisoning, trauma, drugs. Consider CT head
- Circumferential full thickness burns can cause limb ischaemia

? Is escharotomy required?

→ Immediate active cooling of the burn for 20 mins is beneficial.

Take a good history quickly from the patient (patient may need early intubation).

Having a burn does not exclude other injuries!
- Have low threshold for trauma CT scan
- If there are other injuries requiring blood product resuscitation, ignore the burn formula and give blood and blood products according to the patient's physiology

Key points

- If in doubt, intubate
- Don't cut the ETT
- Don't forget C-Spine
- Don't include simple erythema in estimation of burn wound size
- Hypothermia kills
- Don't forget tetanus

Burn injury in a major incident

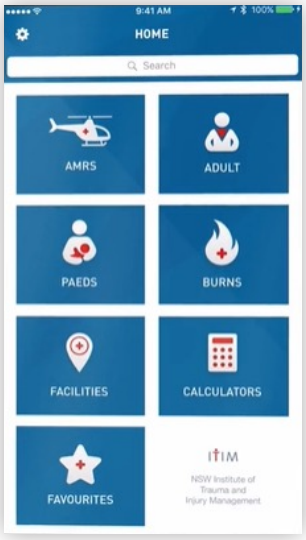
E

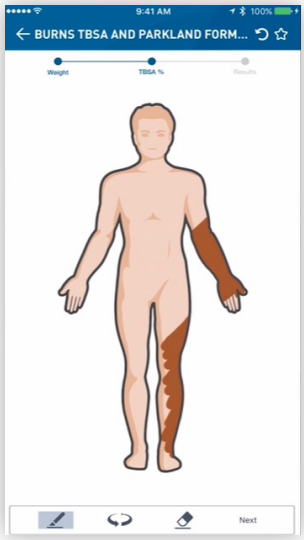
- Complete the secondary survey
- Prevent hypothermia
- Keep the patient covered
- Warm the fluids and the environment if possible
- If possible, measure core and peripheral temperature
- Start fluid replacement as soon as possible to prevent ‘Burn Shock’

Assessing burns

A useful method for assessing the size of small burns is using the palmar surface of a patient's hand (including fingers), which approximates 1% of total body surface area (TBSA)".

For assessing larger burns, the ITIM NSW Trauma app (by the NSW Government Institute of Trauma and Injury Management Agency for Clinical Innovation) can be be used via compatible devices (see pictures on pages below)





All images sourced from the video at [NSW trauma app | Institute of Trauma and Injury Management].

Management of ‘Burn Shock’

Start fluid replacement as soon as possible to prevent ‘Burn Shock’.

- Crystalloid based IV fluids (e.g. Hartmanns, plasmalyte) is better than normal saline
- Calculate 3–4mls/kg/% TBSA (this is the total volume for the first 24hrs)
- Calculate fluid requirements from time of injury
- Give half of this volume in the first 8hrs, and the second half over the next 16hrs
- Titrate fluids to urine output - 0.5mL/kg/hr (adults) and 1mL/kg/hr (paediatrics)
- REDUCE fluid input if urine output exceeds this amount

Palliation of unsurvivable burns injury

Local non-burns specialists staff should not make decisions on survivability of burns injuries without discussion with the Burns Specialist.

Burn injury in a major incident

Special circumstances

⚠ Carbon monoxide poisoning suspected

- Affinity of Carbon Monoxide (CO) for Hb is 240x that of oxygen
- COHb causes a functional anaemia and displaces the oxygen dissociation curve to the left, worsening tissue hypoxia
- Signs and symptoms
  - essentially those of reduced oxygen delivery to the tissues i.e. shock
- Pulse oximeter is unreliable in the presence of COHb. Use a co-oximeter
- Review Airway Management
- CO dissociates from Hb very slowly. Half-life in air >4hrs. Half-life in 100% oxygen 40mins. Use 100% oxygen until COHb <5%

⚠ Cyanide poisoning

- Cyanide gas (HCN) is 20 x more toxic that carbon monoxide
- Suspect in all cases of smoke inhalation, but particularly in patients with significant lactic acidosis and raised venous oxygen
- Review Airway Management
- Consider treatment with hydroxocobalamin

Hypermetabolism

- Burn injuries of more than 20% TBSA result in a hypermetabolic response
- Cardiac output and heart rate can often increase by 150–200%. The patient will also typically have a hyperglycaemic insulin resistant state and often require insulin supplementation
- Manage in a thermoneutral environment. Early excision of deep burns where possible
- Signs and symptoms
  - hyperdynamic circulation, increased body temperature, catabolism and inefficient energy substrate cycling

Infection

- Burns patients are vulnerable to infection in the early stages due to loss of the protective skin layer and immunosuppression secondary to major trauma
- The massive SIRS response in major burns makes diagnosis of sepsis challenging. A high index of suspicion is essential
- Isolation in a single cubicle and an ante-room is the gold standard
- Stringent infection control precautions cannot be over emphasised. All clinical staff should follow hospital standards for hand washing and wear aprons and gloves as a minimum

Hyperpyrexia

- When core temperature greater than 39°C
- Patients with major burns are often hyperthermic
- A short period of very high temperature can cause significant morbidity
- Temperatures of 41.6 to 42°C can cause irreversible cell damage in as little as 45mins
- Management of core temperature >39°C
  - Septic screen, check U&E, CK
  - Antipyretics
  - Open burn wound dressings (discuss with burn surgeon first if possible)
  - Consider ice packs to axilla and groin
  - Refrigerate NG/NG feed and flush
- Management of core temperature >40°C for more than 6 consecutive hours
  - As above (>39°C) plus
  - Consider immediate active cooling e.g. CVVHDF, oesophageal cooling, coolguard
- Management of core temperature >41°C for more than 2 consecutive hours
  - As above (>40°C) plus
  - Consider additional active cooling methods e.g. CVVHDF, oesophageal cooling, coolguard

⚠ **Stop active cooling measures when the core temperature reaches 38.5°C. Core temperature of up to 38.5°C can be considered normal, secondary to the massive SIRS response to thermal injury**

ANZBA referral guideline:

- Burns greater than 10% Total Body Surface Area (TBSA)
- Burns greater than 5% TBSA in children
- Full thickness burns greater than 5% TBSA
- Burns of special areas – face, hands, feet, genitalia, perineum, major joints and circumferential limb or chest burns
- Burns with inhalation injury
- Electrical burns
- Chemical burns
- Burns with pre-existing illness
- Burns associated with major trauma
- Burns at the extremes of age – young children and the elderly
- Burn injury in pregnant women
- Non-accidental burns

Burn injury in a major incident paediatric considerations

Immediate active cooling to burn area/s for 20mins (monitor for signs of hypothermia)

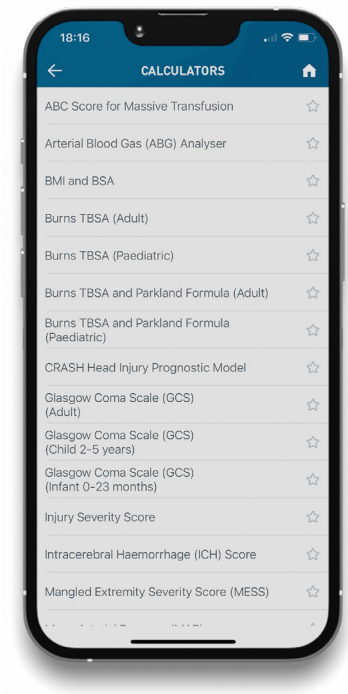
All paediatric burns should be referred to Queensland Children's Hospital. Not all paediatric burns are transferred, but they may need telehealth advice or follow-up.

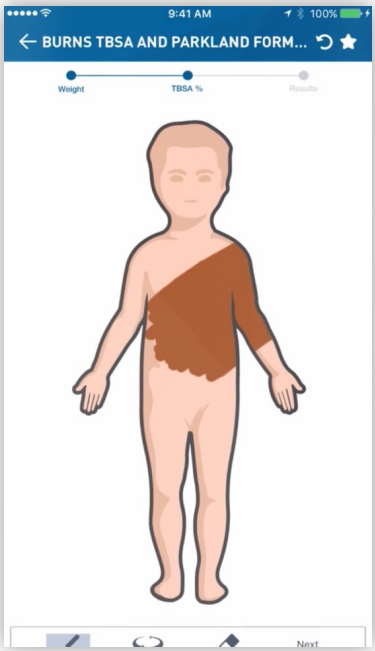
Other burns centres in Queensland include the Royal Brisbane and Womens Hospital, Gold Coast University Hospital and Townsville University Hospital. Townsville University Hospital should receive patients from north of Mackay (and including Mackay)

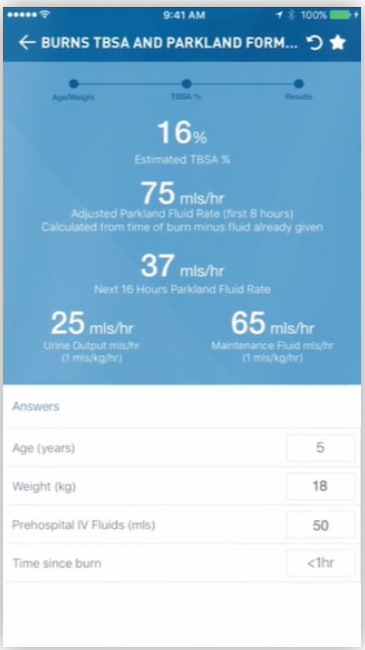
Fluid resuscitation formula
3–4mls Hartmanns' x Body Weight (kg) x TBSA burn
PLUS (+)
Maintenance fluid of Hartmanns and 5% Dextrose

Maintenance formula
- 100mls/kg up to 10kgs PLUS
- 50mls/kg fluid for each kg between 10–20kgs PLUS
- 20mls/kg for each kg over 20kg

- Insert IDC. Aim for urine output 1ml/kg/hr
- Give Tetanus Vaccine







All images sourced from the video at NSW trauma app | Institute of Trauma and Injury Management.

Head, face and neck injuries in a major incident

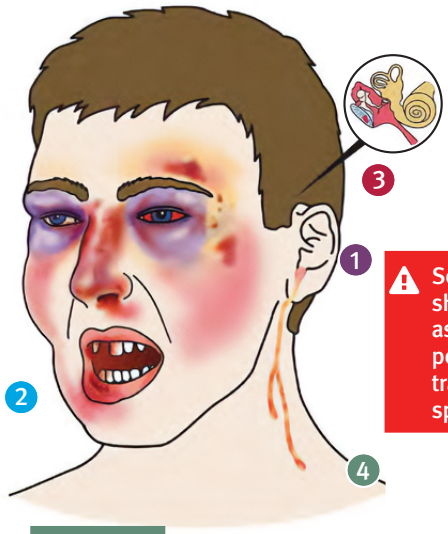
Severe trauma to the head, face and neck rarely results in exsanguination despite appearances, and facial injuries are only addressed during the primary survey if bleeding is impacting on airway or circulation.

Bleeding and/or swelling can lead to acute or progressive airway compromise which may be life threatening.

However, important significant life changing disability can result if injuries to visual, auditory, gustatory, vestibular and olfactory systems are not recognised and the psychological impact of facial disfigurement can be devastating.

Catastrophic haemorrhage

- Excessive bleeding from a scalp laceration
  - Tight compression bandage
  - Within the hairy scalp, haemostats, staples or deep silk sutures can be used tamponade the bleeding
- Facial arterial bleeding. If direct pressure fails, consider applying pressure proximally
  - Chin, lip, midface, nose (facial artery). Apply pressure to the lower border of the mandible, just anterior to masseter muscle. Do not blindly place haemostats due to risk of damaging the facial nerve
  - Scalp above the ear (superficial temporal artery). Apply pressure to the scalp, just anterior to the crux of the pinna



Severe facial trauma should be regarded as an indicator of potential intracranial trauma or cervical spine injury. (1)

A

- C-Spine clearance often requires radiology due to distracting injuries
- Airway should be inspected with lighting and suction used to clear debris
  - If safe patient should be sat head-up and leaning forwards, especially if any nasal or oral bleeding to protect the airway
- Distally displaced loose maxilla (Le Fort fracture) causing obstruction of the airway
  - Mid-facial fractures may need to be reduced to restore airway patency and this may also reduce bleeding. Place two fingers on the soft palate to bring forward the depressed maxilla in one manoeuvre
- Comminuted mandible fractures
  - De-rotate the mandible fragments to clear the oropharynx
- Tongue obstructing airway
  - Mandible fractures may lead to tongue malposition and airway obstruction. Tongue can be protruded out of the mouth with fingers on gauze or with McGills forceps
- Other causes of airway obstruction:
  - Missing dentition should be assessed for as inhalation may cause lower airway obstruction (2)
  - Inspect for congealed blood and vomit

B

- As per standard trauma resuscitation

C

- As per standard trauma resuscitation

D

- Active haemorrhage not controlled with direct pressure
  - Operative intervention if available
  - Consider balloon tamponade with foley catheter as bridge to surgical management
- Bleeding controlled or no active bleeding
  - Do not disturb clot
  - Assess for 'hard signs' which mandate immediate airway management and operative exploration
  - Perform complete HN exam including cranial nerves
  - Consider CT head and neck with angiogram (if available) to assess for free air, vascular injury
  - Consider oral contrast swallow study to exclude occult pharyngeal/oesophageal injury
- Oral or Nasal haemorrhage
  - Airway management
  - Consider tranexamic acid 1–1.5g IV

Nasal haemorrhage

- Consider topical adjuncts. Cophenylcaine (phenylephrine/lignocaine) nasal spray or soaked cotton wool (e.g. 1/10,000 adrenaline)
- Consider nasal packing with ribbon gauze or nasal tampon
- Posterior nasal haemorrhage may require both posterior and anterior nasal packing (i.e. Foley catheter 14Fr with additional anterior packing)
- Use caution in possible skull base fracture

Oral bleeding

- Rarely gentle direct pressure over ipsilateral carotid artery in the neck may be a bridge in ongoing haemorrhage
- Rarely gentle direct pressure over ipsilateral carotid artery in the neck may be a bridge in ongoing haemorrhage
  - Apply technique with caution as may cause cerebral hypoperfusion or baroreceptor response

Head, face and neck injuries in a major incident

Important injuries in the head and neck

Eyes

- Globe perforation
- Retrobulbar haemorrhage
- Foreign bodies (incl contact lens)
- Retinal detachment
- Children's white eye blow out
- → Check visual acuity

Ears

- Tympanic membrane rupture [3]
- Inner ear damage
- → Hearing test in the next few days

Nose/ears

- CSF leak or bleeding from the nose or external auditory meatus

Maxilla

- Distally displaced Mobile Le Fort fractures (airway obstruction)

Mandible

- Comminuted fractures, especially in the elderly, may allow airway obstruction
- The tongue may lose its anterior attachments and displace distally, obstructing the airway

Teeth

- Missing teeth – are they on the floor, in the lip or lung(s)?

Face

Soft tissue laceration with deep structure involvement

- ? Is there potential risk to the parotid duct or facial nerve?
  - Must be assessed prior to surgery/GA

Neck [4]

- ⚠ **Penetrating neck trauma is potentially fatal**
- Look for external haemorrhage or an expanding haematoma that may indicate a vascular injury
- Penetrating objects should not be removed
- Clot should not be removed

Zone 1

Clavicle to cricoid cartilage

- ? great vessels
- ? trachea
- ? oesophagus (dysphagia, haematemesis)
- ? lung apices
- ? brachial plexus

Zone 3

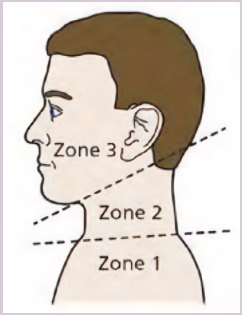
Cricoid cartilage to angle of the mandible

- ? carotid arteries
- ? internal jugular vein
- ? laryngopharynx (stridor, haemoptysis, surgical emphysema, hoarseness of voice)

Zone 2

Cricoid cartilage to angle of the mandible

- ? internal carotid artery
- ? internal jugular vein
- ? cranial nerves (IX–XII)



- Where possible CT neck with angiogram should be used to assess for visceral, vascular or sub-platysmal neck injuries.

How to pack anterior and posterior nasal cavities

- Insert Epistat catheter along the nasal floor until the tip passes the soft palate. Fill the posterior balloon with <10mls saline. Pull gently on the catheter until it meets resistance and then fill the anterior balloon with <30mls.
- A Foley catheter (14Fr) may be inserted along floor of nose until tip visible in mouth. Balloon can be inflated with 10ml saline to fill nasopharynx and gently withdrawn. Secure to nose and protect nasal skin (risk ischaemia). Anterior packing with ribbon gauze or tampon can be placed.

Paediatric casualties in a major incident

This guideline has been created for non-paediatric specialists. The paediatric groups are defined as:

Neonate 0–1 month, Baby 0–6 months, Infant 6–12 months, Toddler 1–2 years, Child >3 years.

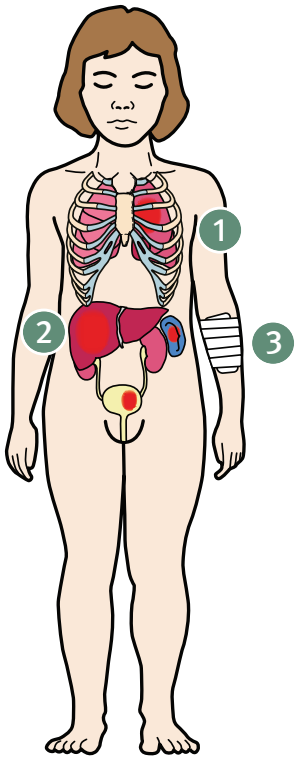
>16 years can cautiously be managed as an adult

History – take an AMPLE history

- **A** Allergies
- **M** Medications
- **P** Past medical history
- **L** Last food/liquids
- **E** Event

Extras

- Is child up to date with routine vaccinations?
- Birth History: as child becomes older, this is less significant
- In infants, postnatal respiratory difficulties may contribute to a condition worsening beyond what would be expected based on injury



‹C›

- A folded towel placed under the shoulders may facilitate the neutral position and prevent forward flexion of the head and neck
- Fulcrum of C-Spine is C1–2 (high C-Spine injury more likely)

A

- Smaller airway and softer cartilage is more easily obstructed by swelling, foreign bodies or poor positioning
- Infants are obligate nose breathers; tonsils are often enlarged
- Larynx is higher and more difficult to view during intubation
- A cuffed ET tube (microcuff ETT) is used for paediatric patients (half size smaller)

B

- Ribs are horizontal, therefore can only move up. Limited ability to increase tidal volumes
- Difficult to localise chest sounds on auscultation
- Decompress stomach via orogastric early to improve breathing. The diaphragm is an important respiratory muscle in infants and action may be compromised by a full stomach
- Children fatigue earlier than adults
- Normal respiratory rates vary greatly with age
- Infants become bradycardic when hypoxic
- Pulmonary contusions are common in children with chest injury (of those who are admitted to hospital >50% will have pulmonary contusions)

Age group	Heart rate (bpm)	Minimum Systolic BP (mmHg)	Respiratory Rate (bpm)
‹1 year old	100-159	‹75	21-45
1–4years	90-139	‹80	16-35
5–11 years	80-129	‹85	16-30
12–17 years	60-119	‹90	16-25

Sourced from Case-based discussions: Module 7 - Seizures and toxicology | Children's Health Queensland on QHEPS.

C

- Blood volume is relatively larger 80–90mls/kg (adult 65–70mls/kg)
- Record all blood loss (100mls in a 5kg child = 10% of total blood volume)
- Hypotension is a late sign
- If the vessels are small: consider IO, scalp veins and ext. jugular vein
- USS guided venous femoral line
- Watch IO closely for malposition particularly in young infants where the risk of tissuing seems particularly high; +/– definitive access will still be required
- Beware the child who is not tachycardic; most children will be tachycardic (and upset) and a relative bradycardia is a cause for concern

D E

Paediatric casualties in a major incident

D

Head

0–12 months have open sutures and fontanelles

- Bulging fontanelle = intracranial bleeding (↑ICP)

Chest

- The force transmitted may not fracture ribs but may still cause significant internal injuries 1
- Mobility of mediastinum increases the likelihood of a simple pneumothorax developing into a tension pneumothorax, or a mediastinal vessel transection
- >50% of children admitted to hospital will have pulmonary contusions

Abdomen

- Thin abdominal wall, with less muscle and sub-cutaneous fat, offers less protection to abdominal organs than in adults 2
- Increased likelihood of bladder, liver and spleen injury
- The child who is described pre-hospital as being grey or extremely pale who has now recovered still has a reasonable chance of a solid organ injury – maintain a high index of suspicion and low threshold for imaging

Musculoskeletal

- Fractures through growth plates may influence x-ray interpretation, however if missed can seriously affect future growth of the fractured bone 3

E

- Increased risk of multiple organ involvement from blunt trauma
- Monitor plasma glucose. Children have a higher metabolic rate and smaller glycogen stores than adults.
- Heat loss: large surface area to volume ratio therefore increased risk of heat loss. Remember the patient's exposed head
- A child may be quiet and non communicative as a result of pain, fear or serious injury

For treatment of paediatric patients, the Children's Resuscitation Emergency Drug Dosage (CREDD) can be used to calculate estimated weight-based medication dosing and ETT sizing. Detailed CREDD information can be sourced at https://www.childrens.health.qld.gov.au/for-health-professionals/queensland-paediatric-emergency-care-qpec/queensland-paediatric-resuscitation-tools. For all other equipment, the below table can be utilised as an estimate for size.

Weight	Microcuff ETT size (mm) +/- 0.5	Uncuffed ETT size (mm) +/- 0.5 (*typically only used for babies)	Oral length (cm) at the lips	LMA (size)	Laryngo-scope blade (size) (*straight or curved blade)	NGT size (Fg)
3.5kg	3.5	3.0	9.0 - 10.5	1	0	6 – 8
4kg	3.5	3.0	9.0 - 10.5	1	0	6 – 8
5kg	3.5	3.0	9.0 - 10.5	1	0	6 – 8
6kg	3.5	3.0	9.0 - 10.5	1	0	6 – 8
7kg	3.5	3.0	9.0 - 10.5	1	0	6 – 8
8kg	3.5	3.5	10.5 - 12.5	1.5	0	8
9kg	4.0	3.5	10.5 - 12.5	1.5	0	8
10kg	4.0	4.0	12.5	1.5	1	8
12kg	4.5	4.5	13	2	2	10
14kg	4.5	4.5	13.5	2	2	10
16kg	5.0	5.0	14	2.5	2	10
18kg	5.0	5.0	14.5	2.5	2	10
20kg	5.5	5.5	15	2.5	2	10 - 12
22kg	5.5	5.5	15.5	2.5	2	10 - 12
25kg	6.0	6.0	16	3	2	12
28kg	6.0	6.0	16.5	3	2	12
30kg	6.5	6.5	17	3	3	12
35kg	6.5	6.5	17.5	3	3	12
40kg	7.0	7.0	18	4	3	12
45kg	7.0	7.0	18.5	4	3	12 - 14
50kg	7.0	7.5	19	4	4	12 - 14
>50kg	7.0 - 7.5	7.5 - 8.0	19.5 - 20	4	4	14

Pregnant casualties in a major incident

‹20 weeks

Fundus below the umbilicus

- Obstetrics input

›20 weeks

Fundus above the umbilicus

- Obstetric team for Resuscitative CS
- Neonatal input for baby

Predict need for blood/fluids early

- **Maternal hypotension due to shock is a late sign of haemorrhage – associated with 80% foetal mortality**
- **Treating the mother gives the best outcomes for the child**

Primary survey

Standard CABC care as for any trauma patient

- O_2 ›95%
- 2 x IV Access
- Pelvic binder as usual (cut to fit if necessary)

RSI may be difficult

If ›20 weeks, 15 to 30 degrees left lateral tilt (right side up) or manual uterine displacement to avoid compression of IVC.

Secondary survey

- Secondary survey as usual

Plus observe for:

- uterine contractions
- vaginal bleeding
- rupture of membranes

- Obstetric team should do the vaginal exam

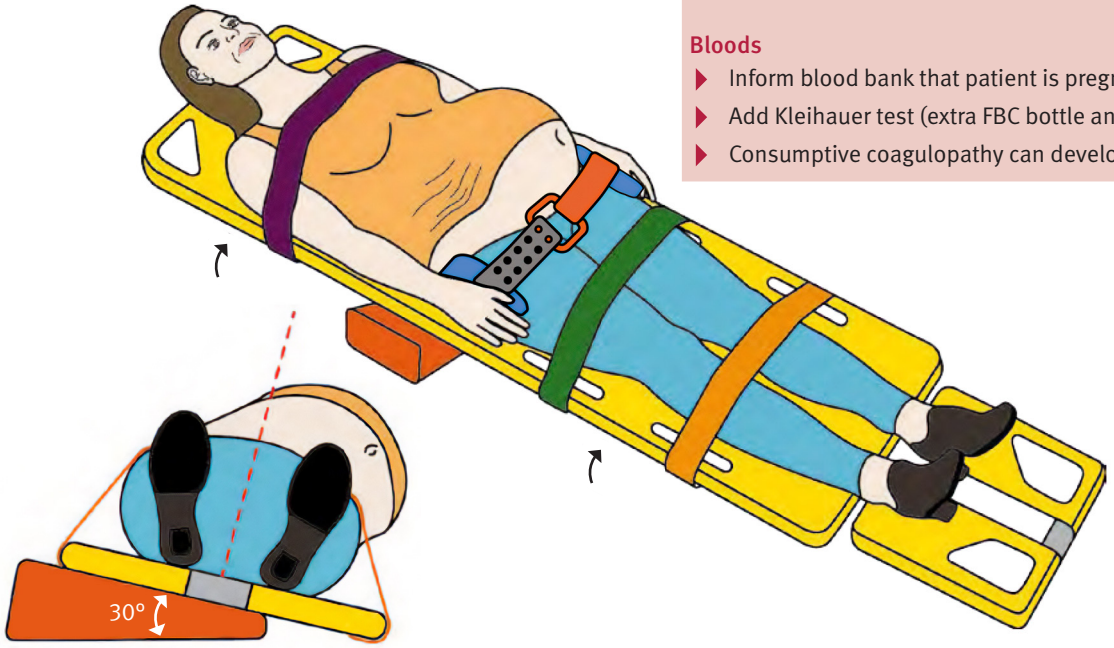
Trauma checklist

Tranexamic Acid (TXA)

- Give if strong suspicion of significant haemorrhage
- If emergency CS is planned, give after delivery of the child

Bloods

- Inform blood bank that patient is pregnant
- Add Kleihauer test (extra FBC bottle and G&S bottle)
- Consumptive coagulopathy can develop rapidly



Key points

- The mother takes priority during resuscitation
- Do requisite imaging for maternal salvage
- Involve obstetrics early in assessment and decision-making
- Have peri-mortem CS (resuscitative hysterotomy) equipment always ready in ED
- Recognise maternal haemodynamic compensation as signs of hypovolaemia will appear late
- Uterine blood flow shuts early in blood loss, so foetal monitoring early is important
- If mother is Rh D-ve, consider Rh Immunoglobulin. Discuss with Haematology. If needed, should be given within 72hrs
- Maternal bicarb is low in pregnancy
- Obstetric ward is not appropriate place for patient with other traumatic injuries that require monitoring e.g. TBI, burns, chest and complex orthopaedic injuries
- Collaborate with obstetrics team when deciding the best clinical environment for on-going care
- Refer to the Queensland Clinical Guideline, Trauma in Pregnancy

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Rehabilitation coordination and medical support in a major incident

High quality hyperacute rehabilitation methods can support the major incident response and optimise patient outcomes.

Roles of the hyperacute rehab team in a major incident:

- To assist in creating bed capacity by facilitating timely and safe transfer or discharge of appropriate patients
- To ensure appropriate acute rehabilitation for new patients

Ideas to create capacity:

- At any one time in tertiary-level hospitals, there will be a significant number of patients who are 'transfer ready'
- Usually there are multiple patients with medical clearance awaiting discharge requirements and patients with predominantly rehabilitation/subacute needs but partial medical clearance
- Regional facilities may have smaller numbers of medically stable or subacute patients with capacity to be transferred to another ward, facility, or rehabilitation program

When creating capacity:

- Ensure routine healthcare is not put on pause
- Understand that creating capacity takes time
- Too much capacity is the default position in a major incident

Estimate the scale of the response required and over-react!

Example: How the rehab team could support a major incident response

Step 1

- Liaise with the relevant Bed Management staff (dependent on facility/HHS) including the admitting SMOs to permit transfer of appropriate patients from priority beds – local and regional receiving hospitals
- Prioritise acute specialist beds for creating capacity – orthopaedics, ICU/HDU, general surgery and acute medical units in peripheral centres

Step 2

Form an urgent rehab response team, consisting of:

- an occupational therapist
- a physiotherapist
- a discharge liaison nurse or CHIP nurse, subacute (rehab) CNC, NUM, or CN; +/– Social Worker
- a Rehabilitation Medicine Physician (if available) or
- General Medicine physician with subacute care expertise

Step 3

Identify 'Transfer Ready' patients in priority wards first:

- Is there a community-based rehab option suitable for the patient?
- Is there a Hospital in the Home program option suitable for the patient?
- Can support be provided for families wishing to have patients at home?
- Can they be safely moved to an alternate bed within the hospital?
- Can the next care provider admit the patient now?
- Can any behavioural or care needs be met with the next provider?
- Are there any equipment issues? Can these be met by the next care provider?

Step 4

For each patient transferred:

- identify the level of medical clearance and if community follow-up is required
- ensure equipment, care and rehab plans have been arranged
- liaise with next providers and families.
- liaise with acute treating team re patient transfer requirements and administrative/handover requirements
- record discharge destinations and contact numbers centrally, for all displaced patients

If a regional response is required to meet the scale of capacity expected:

- Alert other regional rehab services to create/declare capacity
- Alert community team coordinators (including Community rehab teams, Hospital in the Home, Transition Care Program)
- Contact relevant Hospital and Health Service Executive: They may be able to release/prioritise funding for exceptional cases or additional capacity, including liaison with local Private Hospitals

Key points

- Front door processes – acute rehab optimises patient outcomes and supports the early major incident response
- Back door processes – urgent rehab response teams should assist in creating capacity in a major incident

Rehabilitation coordination and medical support in a major incident

High quality hyperacute rehabilitation methods can support the major incident response and optimise patient outcomes.

Acute and early rehabilitation considerations in trauma patients (in all cases contact specialist rehabilitation medicine or other appropriate specialist service if further advice needed)

For patients with:

Acquired Brain Injury

- Does the patient have a Traumatic brain injury (TBI) or Hypoxic-ischaemic brain injury (HIBI)?
- Classification of Injury (Diffuse axonal injury(DAI), mild traumatic brain injury(mTBI), minimally conscious state (MCS) or vegetative state (VS)
- Prognosis and Triage – futility?
- Differential diagnosis: drugs, toxins, fat embolism, metabolic causes

Spinal Cord Injury

- ASIA assessment within 72hrs post injury, consideration given to neurogenic shock in early SCI
- Establish early spinal clearance or spinal plan prior to transfer
- Early respiratory support – Cough Assist, diaphragmatic screening
- Commence neurogenic bladder/bowel regimens, VTE prophylaxis if not contraindicated, and skin cares (4th hourly turns and skin checks, pressure relieving equipment). Refer to QSCIS guidelines on QHEPS https://www.health.qld.gov.au/qscis/health
- Cervical collar prescription and application if appropriate – as per Orthopaedics/Neurosurgery
- Spinal cord injury (SCI) service (Princess Alexandra Hospital or Townsville Hospital) liaison and referral at time of admission

Plexopathy

- Early identification is key
- Imaging
- Peripheral nerve injury-surgical referral

Peripheral nerve injury

- Clinical and neurophysiology assessment
- Orthotics (i.e. futuro splint for wrist drop in brachial plexus nerve injury) – request priority review by Occupational Therapist and/or physiotherapist

Seizures and seizure prevention

Functional neurological disorder and dissociation

Amputation

- MDT Amputation planning including surgeons, rehab team and prosthetics
- Rigid Removable Dressing post operation (best practice)

Multi-trauma

- Clarify weight bearing status and/or activity restrictions for all injuries prior to commencement of therapy

Injuries to special senses

Vision

- Fundoscopy: Purtscher's retinopathy, eye trauma
- Orbital haematoma
- Visual field assessment

Hearing

- Assess for disturbances especially in blast injury

Pain

- Identify and treat neurogenic pain in addition to MSK pain

Agitation and Delirium

- Screen for delirium with appropriate assessment tool: 4AT
- Assess agitation: Agitated Behaviour Scale, Pittsburgh Behaviour Scale
- Exclude underlying causes and treat
- Utilise behavioural management strategies as first line e.g. Sunflower wall chart, family supports
- Liaison with the Statewide Brain Injury Rehabilitation Service (Princess Alexandra Hospital) or local Neuropsychology if available
- Identify environmental triggers and de-escalate. Manage in low stimulation environment for acute agitation related to Traumatic Brain Injury
- Treat to protocol with lorazepam/sodium valproate/ carbamazepine/olanzapine only if patient at risk of harm to self or others and non-pharmacological strategies unsuccessful

Movement disorder

Spasticity

- Identify and treat (Consider early antispasmodics: systemic, early botulinum toxin (BTX-A))
- Identify afferent stimuli acting as triggers
- Identify and treat paroxysmal sympathetic hyper-reactivity
- Positioning and splinting
- Prevention of heterotrophic ossification, joint ranging and protection

Allied health interventions

Orthotics and Prosthetics

- Collars and braces
- Pressure relief ankle foot orthoses (PRAFO)'s/Dorsi-Wedges

Cognitive Assessments

- Post Traumatic Amnesia (PTA) assessment
  - Classification and prognosis
  - Breaking bad news
  - Forensic and witness issues
- Functional Neurological disorder

Communication tools

- Open circuit ventilation (e.g. Phillips V60 + Passey Muir Valve)
- Pointing charts
- Partner assisted scanning charts
- Over-bed mirrors
- Adapted call switches

Coping with stress following a major incident

You may benefit from additional support if any of the following reactions persist over time (i.e. several weeks), there is no sign of them abating and/or they are impacting on your functioning in your personal or work life:

- You find that you are easily startled and more hypervigilant than you normally would be
- You are frequently experiencing agitation (i.e. feeling mentally uneasy, an inner restlessness)
- You experience intrusive thoughts or images during the day or night about the incident. You are feeling a heightened level of anxious arousal when exposed to environmental factors associated with the incident (e.g. smells, place, sounds)
- You are having sleeping difficulties that have commenced or worsened since the incident
- You are feeling overwhelming by your emotions and feel as though your existing coping strategies aren't proving as effective as they usually would be
- You are feeling frequently out of control of your emotions and/or reacting in a manner that seems disproportionate to the context of a situation at the time
- You have experienced a change in your mood for what seems like no obvious reason
- You feel hopeless
- Persistent feeling of emotional numbness or avoiding emotions
- You have increased your use of alcohol or other substances since the incident
- You are noticing difficulties concentrating, feel exhausted, anxious or on the verge of panic. You have noticed physiological changes (nausea, gastrointestinal changes)
- Your functioning in different areas of your life has been negatively affected. For example, your relationships seem to have suffered or your performance at work has declined since the incident. Someone who you are close to tells you they are concerned about you

How can I help myself or others to overcome these difficulties?

Do

- Take time out to get sufficient sleep (your normal amount), rest and relax, and eat regularly and healthily
- Consider who might be best to talk to or what activity you may be able to do to promote self-soothing in the event that you do notice emotions arise
- Tell people what you need. Talk to people you trust.
- Take care driving, riding bikes and with possible safety hazards in the home – accidents are more common after a traumatic event
- Where possible try to not take on extra responsibilities for the time being
- Make time to go to a place where you feel safe, restful and have privacy
- Check-in with colleagues around their wellbeing at the right time and place in a way that ensures their privacy and allows them to opt out of disclosing and continuing that thread of the conversation. Do review any improvements you could make between colleagues and as a team to support each other in the environment. Do use fun and humour, providing it is inclusive and respectful

Don't

- Protracted reliance on avoiding emotion can be unhelpful in the long run for your wellbeing. Avoidance can be an adaptive way of coping, however if you notice yourself avoiding things that you need to do, or it is preventing you from seeking help, that becomes problematic. When you are ready/as soon as you feel you can, consider a trusted person that you may be able to reach out to or a professional you could arrange an appointment with
- Don't "push" yourself or others to reflect on the event and/or convey emotions. People express emotions to different degrees and in different ways. There are individual differences in coping styles
- If you tend to dismiss your emotions and minimise your difficulties try to remember that it is normal to experience a range of reactions to a very stressful event and adopt some self-compassion

Coping with stress following a major incident

What reactions can I expect?

If you have been affected by a major incident and exposed to a potentially traumatic event it is normal to experience a range of reactions. In the majority of cases these reactions and changes to thoughts, feelings and behaviours will abate over time and typically not exceed beyond 4 weeks. A small proportion of people may find these reactions continue after one month which would be indicative of requiring further support.

Examples of reactions

- Sleep disturbance
- Feeling agitated or having a reduced tolerance for stress
- Physical complaints; gastrointestinal changes, stomach aches and headaches
- Feeling hypervigilant and more on edge than usual
- Change in appetite and/or eating more or less
- Increased use of alcohol and/or other substances is likely a warning sign that you would benefit from further support
- Feeling fatigued, finding it more difficult to concentrate
- Interpersonal conflict and difficulties in relationships at work or at home
- Ruminating thoughts on the incident and feeling either intense emotional reactions or emotionally numb
- Experiencing intrusive thoughts during the day or night (i.e. nightmares, thoughts around the incident that come up unexpectedly)
- Wanting to avoid places, people, or experiencing certain emotions associated with the incident
- Changes in mood, feeling more anxious than you normal would and/or getting angry or upset more easily

Children

- Children may become more clingy with parents and carers and complain of physical ailments. Moreover, they may temporarily loose abilities (e.g. feeding and toileting) and problems at school may arise or worsen

You may notice children blaming themselves for the major incident and experiencing overwhelming emotions of fear, sadness or shame that are disproportionate to every day situations.

Helping your child if they have been affected by the major incident:

- Try to keep things as normal as possible: keeping to your usual routine and doing normal activities as much as you can, will help your child feel safer more quickly
- Be available to talk to your child as and when they are ready. If it is difficult for you to do this, ask a trusted adult such as a family member or teacher to help
- Try to help your child understand what has happened by giving a truthful explanation that is appropriate for their age. This may help reduce feelings of confusion, anger, sadness and fear. It can also help correct misunderstandings that might, for example, lead the child to feel that they are to blame. They can also help reassure the child that although bad things can happen, they don't need to be scared all the time
- In the event of a death, particularly a traumatic one, it can be difficult to accept the reality of what has happened. It is important to be patient, simple and honest in response to questions about a death. Some children, for example, will seem to accept a death but then repeatedly ask when that person is coming back. It is important to be patient and clear when dealing with these questions: for example, it is better to say, "John has died" than "John has gone on a journey"
- **Consider the parents' wellbeing and reaction to a distressed child and refer for support as necessary**

What to do to take care of you

If you have any concerns about your wellbeing or your child's wellbeing it is important to seek help via your General Practitioner (GP) and/or existing health professional. Your GP can then support you in identifying the best treatment options to support your recovery from a potentially traumatic event (i.e. Psychological Therapies such as Cognitive Behavioural Therapy).

National Crisis Support lines:

Lifeline: **13 11 14 (24/7)**

Beyond Blue: **1300 22 46 36**

Relationships Australia, Queensland: **1300 364 277**

DV Connect: **Women's line** **1800 811 811**
Men's line **1800 600 636**

LGBTI peer support: **QLife 1800 184 527**

Queensland Government confidential phone service that provides health advice to Queenslanders: **1300 Health (13 43 25 84)**

Queensland Government confidential mental health telephone triage service that provides the first point of contact to public mental health services to Queenslanders: **1300 MH Call (1300 642 255)**

Psychosocial support for staff after a major incident

'Psychosocial' refers to the interaction of social, cultural, and environmental factors on people's psychological experiences and behaviours. Psychosocial support influence's individuals thinking and emotions and the surrounding social environment with the aim of promoting the wellbeing and functioning of individuals. Recent research shows that events encountered in emergency departments affect the psychosocial wellbeing of staff, and the cumulative effects for some individuals may be negative and long-lasting.

Mental health care refers to biopsychosocial interventions that are delivered to people to support them in their recovery from mental-ill health.

Staff who act as first responders and those who provide subsequent health care after a major incident may be at risk of being exposed to potentially traumatic experiences. In turn, which may be associated with a decline in a person's mental wellbeing and for a small minority of people the development of mental-ill health.

Most people involved in a major incident are likely to suffer short term negative effects on their mental wellbeing. In the majority of cases,, distress is transient and not associated with dysfunction or indicative of developing mental ill health. However, in a minority of cases distress is more prolonged and incapacitating and a small proportion of people may require access to specialist mental health care. In the aftermath of a critical incident, social and environmental factors amongst others may maintain a person's level of distress (e.g. separation from family, social isolation and loss of home and possessions).

Access to the right support and at the right time is important for mitigating the risk of a decline in mental wellbeing and/or development of mental ill health associated with a critical incident (i.e. exposure to potentially traumatic experiences). Immediately following a traumatic event, it is not advised that individual or group brief-single interventions that focus on the details and/or experiences of individuals involved in the event be conducted. Interventions such as this should NOT be routine practice and does not need to be organised. Instead, follow Phase 1 advice in the Table that is below.

Subject to the nature of events, the majority of staff who are affected by major incidents are psychologically resilient and will cope and recover, particularly with the help of effective social support.. Social support that is perceived by an individual as good quality (i.e. meets their needs) and available when required from relatives, friends, colleagues, and others can aid in alleviating people's distress. Hence, intervening early and providing access to social supports can promote a person's resilience to the negative impacts on mental wellbeing that may be associated with a major incident. Employers should support staff by ensuring that they have access to social support. Specifically, that they have access to Psychological First Aid and are offered an opportunity to elect to take part in support that they may perceive as effective (i.e. from peers, colleagues, and/or employee assistance services (EAS)).

Phase 1 Initial support

Collate information to define the incident, escalate as appropriate information that the incident has occurred and ensure everyone involved in the incident are safe

Arrange for immediate practical, and emotional support to be provided to affected persons (that protects privacy, is voluntary and provides emotional validation).

Identify an appropriate person to be providing PFA. Cultural considerations pertaining to the protocol where required (i.e. for Aboriginal and Torres Strait Island people).

Launched in reaction to the event

- Provision of Psychological first aid (PFA) that individuals can elect to take part in
- Have incident summary available with clear timelines and facts (that is devoid of analysis and interpretation) to be made available to key stakeholders as appropriate and as required
- When providing PFA, include the employer's leadership response to a major incident by communicating key messages of acknowledgement, self-care and support services, internal and external to the organisation. Do contain individuals' emotional reactions and distress and/or temptation to discuss the details of the event and their personal experience of it. Instead, where required validate concerns and suggest it best to discuss such at a later time and social environment of their choosing
- Convey various opportunities for help that individuals can choose to engage in (Peer support and/or Peer Support Program, Team Leaders/ Leadership Team, Employment Assistance Service etc.
- Encourage access to advice and support as necessary through existing universal services (General Practitioners (GP), community, and specialist services)

Advice available from:

- **Web-based information on coping with Stress following a major incident (e.g.** https://www.beyondblue.org.au/the-facts/trauma**)**
- **Employee Assistance Services** https://qheps.health.qld.gov.au/csd/employee-centre/workhealth-safety-wellbeing/employee-assistance-service-providers
- **National crisis support and help lines (Lifeline, Beyond Blue)**

Psychosocial support for staff after a major incident

Phase 2 Getting advice

Weeks 2 to 4

- Psychosocial support
- Aim to manage (stabilise, calm and contain) people's distress, but with an emphasis on maintaining social connectedness and people receiving support from their social networks and treating health professionals
- Promote self-agency, encouraging people to use their resources to effectively meet their needs (support people in eliciting practical suggestions that may prove helpful to them)
- Avoid telling people what you think they should be feeling, thinking or doing now or how they should have acted earlier. Rather, listen, validate emotion and hold different perspectives in a balanced way

Advice available from:

- **24/7 phone and online counselling services (e.g. Lifeline, Beyond Blue).**
- **EAS**
- **1300 Health**

Phase 3 Additional support/getting help

From 2 weeks onwards

Continuing psychosocial support

This may include encouraging people to access more intensive psychosocial support through:

- GP and any existing mental healthcare professionals that a person may have
- Services provided by the Primary Health Network
- Peer supports
- EAS

Advice available from:

- **General Practitioner (GP)**
- **EAS**
- **24/7 phone and online counselling services**

Phase 4 Specialist support/getting more help

When symptoms are still present between 4 and 12 weeks after an event

The following factors may increase a person's vulnerability to the development or exacerbation of mental-ill health associated with a major incident.

- Staff injured in the event or during the response
- Exposure to high-severity of trauma
- Close proximity to event
- Significant (pre- or post-event) personal trauma (including exposure to adverse life events in childhood) and previous history of a mental ill-health
- Family psychiatric history
- Perceived absence of social support network
- Substance misuse
- Traumatic bereavement

⚠ **If people are distressed or have symptoms of mental ill health after 4 weeks and any of these risk factors are present, encouraging and facilitating access to specialist mental health services may be advised**

Advice available from:

- **GP**
- **Existing treating mental health care professionals**
- **EAS**
- **13 Health**
- **1300 MH Call**
- **24/7 National Crisis Support Lines**
- **Consultant with the Human Resources Team if necessary**

Forensic awareness in a major incident

Critical patient treatment takes precedence over evidence collection. These guidelines have been created for clinicians required to disturb items of potential evidential value by treating a patient.

- Any recordings that can be made of any items of potential evidential significance will assist police in later investigations:
  - Forensic photograph and/or sketches (with scale if possible) and/or written notes/descriptions including locations where found and patient details from whom taken will particularly assist should the person not survive and disaster victim identification processes become important
  - Avoid contamination between patients (crime scenes), or by introducing material of your own (ie. DNA, fingerprints)

Major crime scenes are complex events, and admissions to hospital tend to occur at their outset before a clear investigative structure has been established. Any steps medical staff can undertake to preserve forensic evidence may greatly assist a later major investigation. For large protracted incidents a forensic or other police officer may be deployed to the hospital to assist with the collection/ preservation of evidence.

Dealing with multiple casualties from a single suspicious incident

If you are dealing with multiple casualties from the same suspicious incident, be aware of the risks of cross-contamination between them.

- If possible, request that other staff deal with one of the casualties
- If not, ensure you change all of your protective equipment between the two casualties and document the change

Injuries

- The recording of injuries before treatment can provide vital evidence. Police photographers are likely only to record the injury once it has been stitched, glued or dressed/bandaged
- Where possible take scaled photographs of an injury:
  - one wide 'locating shot' showing where the injury is
  - another detailed shot showing its extent is ideal
- Clinical sketches and clear written notes are also very valuable

Clothing and footwear

Trace evidence, DNA and blood pattern evidence on clothing, and damage to clothing, can assist in reconstructing the nature and sequence of an incident.

- When removing/cutting clothing avoid cutting through existing cuts and tears in the fabric
- Package each clothing item separately in paper bags, where practicable, clearly noting details of the patient whom it was removed. For wet clothing packaging in plastic bags may be required

Hazardous material

If you believe a patient may be contaminated with a potentially hazardous chemical, biological or radiological substance take steps to isolate the patient and contact Queensland Poisons Information Centre (QPIC): **13 11 26**

Weapons and shooting incidents

Edged weapons (knives etc.)

- **If an edged weapon is found on a patient, be mindful that it might contain evidence on both the handle and the blade ie. DNA and fingerprints.**
- Consider your safety; handle the weapon with gloved hands, and minimally and with care
- Handle sparingly with gloved hands
- Move the knife by handling uncommon points of contact, such as the edges of the hilt or the pommel (base)
- Place into a clean rigid tub, rather than a plastic bag

Firearms

- **If you recover what you believe to be a firearm, do not touch or handle it. Call the Queensland Police to inspect the weapon and make it safe**

Ammunition components (bullets, shot or wadding)

- **Any unspent round of ammunition found should be treated with care**
- A projectile removed from a suspected gunshot wound should be packages individually in a small plastic container lined with tissue paper to stop it moving around the container. Shotgun shot from one person can be collected into a single container

Forensic awareness in a major incident

*These guidelines have been created for clinicians forced to disturb items of potential evidential importance by treating a patient. They are not intended to act as a professional reference for forensic collection

Exhibits

An item taken from a patient may later become a police exhibit and used as evidence in a later court matter therefore the chain of custody of the items must be maintained.

- Where possible secure items until they can be handed over to police
- Keep a record of the date and time any person handles or has possession of the items and provide these details to police
- A statement of actions taken and or continuity may be required at a later date from the medical staff who took possession of, or later handled the items therefore the best possible records that can the made at the time will greatly assist later compilation of this statement

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Appendices

Contributors

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Continued overleaf...

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Glossary/list of terms

ABO	Refers to blood group types A,B and O
ABSCM	Anterior Border of the Sternocleido Mastoid muscle
ABx	Antibiotics
AIIMS	Australasian Inter-Service Incident Management System
AK47	Automatic Kalashnikov assault rifle
A-line	Arterial line
ALS	Advanced Life Support
AMPLE	Allergies, Medications, Past Medical History, Last eaten, Events leading up to injury
ANTS-NQ	Advanced Neonatal Transport Service North Queensland
ARDS	Adult Respiratory Distress Syndrome
ASIA	American Spinal Injury Association
ATD	Adult Therapeutic Dose
ATLS	Advanced Trauma Life Support
ATMIST	Age, Time, Mechanism of Injury, Injuries, Signs (vital signs), Treatments given
AVM	Arterio-Venous Malformation
AVPU	Alert, Voice, Pain, Unresponsive (levels of consciousness)
BBV	Blood Borne Virus
BM stix	Trade name for blood glucose test strip (Boehringer Mannheim, now called Roche)
BOAST4	British Orthopaedic Association Standards for Trauma Pathway 4, for patients with open lower limb injuries
BP	Blood Pressure
BTX-A	Botulinum Toxin Type A
°C	degrees centigrade
C1	Cervical Spine 1 (Atlas)
CABC approach	Catastrophic Haemorrhage, Airway, Breathing, Circulation (standard ATLS/ALS assessment routine)
CABCDE	Catastrophic Haemorrhage, Airway, Breathing, Circulation, Disability, Environment/Exposure
CBRN	Chemical, Biological, Radiation, Nuclear
C-Collar	Cervical spine immobilisation collar
CCS	Casualty Clearing Station
CH	Conductive Hearing loss
CHQRS	Children's Health Queensland Retrieval Service
CK	Creatine Kinase
CKN	Clinician Knowledge Network
clotting screen	e.g. INR, PT, APTT, Fibrinogen
CPAP	Continuous Positive Airway Pressure
CPE	Carbapenemase producing Enterobacteriaceae
CRRT	Continuous renal replacement therapy
CSF	Cerebrospinal Fluid
C-Spine	Cervical Spine
CT	Computed Tomography scan/imaging
CT Hot Report	first report issued by radiologist reviewing a trauma CT scan, usually within 15mins
CTwb	Computed Tomography whole body imaging
D50	Dextrose 50% in water
DAI	Diffuse Axonal Injury
DNA	Deoxyribonucleic Acid
Dr1, Dr2	Doctor 1, Doctor 2

Glossary/list of terms

EA	Epidural Analgesia
$ECCO_2R$	Extra Corporeal Carbon Dioxide Removal
ECMO	Extra Corporeal Membrane Oxygenation
ECOSA	Emergency Coordination Scientific Advice system
ED	Emergency Department
EDH	Extra Dural Haemorrhage
EHN	Emergency Helicopter Network
ENT	Ear, Nose and Throat surgical specialty
EPRR	Emergency Preparedness, Resilience and Response
ESBL	Extended Spectrum Beta-Lactamase
ET	Endotracheal Tube
Ex-Fix	External Fixator
EZIO©	battery powered intra-osseous driver with needle
FAST	Focussed Assessment with Sonography in Trauma
FBC	Full Blood Count
FCP	Forward Command Post
FFP	Fresh Frozen Plasma
FiO_2	Fraction of Inspired Oxygen
FTL	Full Thickness Loss (in burns)
fVIIa	Factor VIIa
(Fwd)CCP	(Forward) Casualty Collection Point
GA	General Anaesthesia
GCS	Glasgow Coma Score
GP	General Practitioner
GSW	Gun Shot Wound
HALO	Hospital Ambulance Liaison Officer
HAZMAT	Hazardous Material, accidental incident involving hazardous material
HEOC	Health Emergency Operations Centre
HHS	Hospital Health Service
HIBI	Hypoxic-Ischaemic Brain Injury
HIV	Human Immunodeficiency Virus
HME	Heat and Moisture Exchanger
HR	Heart Rate
IAPT	Improving Access to Psychological Therapies
ICD	Intercostal Chest Drain
ICP	Intracranial Pressure
ICU	Intensive Care Unit
IED	Improvised Explosive Device
IM	Intramuscular Route
IMS	Incident Management System
in	inches
IO	Intra-Osseous
IOR	Initial Operational Response
IPC	Infection Prevention and Control
IPPV	Intermittent Positive Pressure Ventilation
ITSI	Intratympanic steroid injection IV Intra-Venous
IV	Intravenous route
IVC	Inferior Vena Cavae
LA	Local Anaesthetic
LCSC	Lower Segment Caesarean Section
LDMGs	Local Disaster Management groups
LEH	Local Emergency Hospital
LFTs	Liver Function Tests
L/hr	Litres per hour

Glossary/list of terms

mass casualty	typically events with casualties in the 100s, where the normal major incident response must be augmented with extraordinary measures
MCE	Mass Casualty Event
mcg	micrograms
MCI	mass casualty incident
MCS	Minimally Conscious State
MDT	Multi Disciplinary Team
mg	milligrams
MHP	Massive Haemorrhage Pack
MI	Major incident, Myocardial Infarction
MIND/Mind	mental health charity, Mind, delivers the blue light programme for all first responders
M-LLSACF	Medial to Lateral Lazy S across the Ante Cubital Fossa incision
mls/hr	millilitres per hour
mm	millimetres
mmHg	millimetres of mercury, e.g. unit of blood pressure measurement
MPTT-24	Modified Physiological Triage Tool-24
MRI	Magnetic Resonance Imaging
MRSA	Methicillin Resistant Staphylococcus Aureus
MSK	Musculoskeletal
mTBI	Moderate Traumatic Brain Injury
MTF	Medical Treatment Facility
MTFA	Marauding Terrorist, Firearms Attack
MTC	Major Trauma Centre
NA	Nerve Agent
NaCl	Sodium Chloride (normal saline)
NBM	Nil by mouth
NeoRESQ	Neonatal Retrieval Service
NGO	Non Government Organisation
NHS	National Health Service
NHSBT	NHS Blood Transfusion Service
NPIS	National Poisons Information Service
O_2	Oxygen
ObsRESQ	Obstetric Retrieval Service
OD	omni die, every day
ODP	Operating Department Practitioner
OGJ	Oesophageal Gastric Junction
OPD	Outpatient Department

Glossary/list of terms

P1	Priority 1, needing life-saving resuscitation or intervention
P1 Hold	Expectant, serious injuries with a poor chance of survival, or needing extensive treatment, casualties receive treatment compatible with resources
P2	Priority 2, needing early resuscitation and/or surgery, but some delay is acceptable
P2S	Pradidoxime (nerve agent antidote)
P3	Priority 3, requires treatment but a longer delay is acceptable
pAPRV	partial Anomalous Pulmonary Venous connection
PBLI	Primary Blast Lung Injury
PCA	Patient Controlled Analgesia
PEEP	Positive End Expiratory Pressure
PEP	Pre-Event Planning, Post-Exposure Prophylaxis
PFA	Psychological First Aid, Psychosocial First Aid
PHE	Public Health England
PO	per os, by mouth, orally
POC	Point Of Care
PPI	Proton Pump Inhibitor
PR	per rectum, rectal examination, rectal administration of medication
PRAFO	Pressure Relief Ankle-Foot Orthoses
PTA	Post Traumatic Amnesia
PTL	Partial Thickness Loss
PTSD	Post Traumatic Stress Disorder
PV	per vaginam, vaginal examination, describes vaginal blood loss through the vagina
QAS	Queensland Ambulance Service
QDS	quarter die sumendum, 4 times a day
QDMA	Queensland Disaster Management Arrangements
QFES	Queensland Fire and Emergency Service
QPIC	Queensland Poisons Information Centre
QPS	Queensland Police
R&R	Rest and relaxation
RA	Regional Analgesia
RACC	Regional Ambulance Coordination Centres
RBC	Red Blood Cell(s)
REBOA	Resuscitative Endovascular Balloon Occlusion of the Aorta
Resus	Resuscitation area in the emergency department
RFDS	Royal Flying Doctors Service
RhD	Rhesus D, a protein found on surface of RBCs
rising tide	a developing infectious disease epidemic, or capacity/staffing crisis or industrial action
ROTEM	Rotational Thromboelastometry
RSI	Rapid Sequence Induction
RSQ	Retrieval Services Queensland
RT	Rapid Transfuser
RT1/2	Rapid Tranfusionist 1 and 2
Rx	prescription, prescribes
Scribe	Team member who records results and actions during a trauma alert
SDCC	State Disaster Coordination Centre
SHECC	State Health Emergency Coordination Centre
shock pack	'pack' issued by blood bank in response to massive haemorrhage
SIEVE	Initial on scene triage of casualties by ambulance/pre-hospital services
SI(J)	Sacro-Iliac (Joint)
SNHL	sensorineural hearing loss
SOCC	State Operations Coordination Centre
SORT	Secondary triage of casualties
STEP 1-2-3 PLUS	safety triggers for emergency personnel in CBRN events
SVR	Systemic Vascular Resistance

Glossary/list of terms

TAP	Transverse Abdominis Plane
TBI	Total Brain Injury
TBSA	Total Body Surface Area (used in Burns)
TDS	ter die sumendus, three times per day
TEG	Thromboelastography
TIC	Trauma Induced Coagulopathy
TM	Tympanic Membrane
trauma bloods	FBCs/U&Es/G&S/Clotting (PT, APTT, fibrinogen), Ca2+, lactate, A/VBG, (plus ROTEM if available)
Trauma ID	patient identifier
TRiM	Trauma Risk Management
TRS	Terror Related Stab (injury)
TTL	Trauma Team Leader
TU	(major) Trauma Unit
TXA	Tranexamic Acid
U	Unit
U&Es	Urea and Electrolytes
UK DMS	United Kingdom Defence Medical Services
USS	Ultrasound Scan
VBG	Venous Blood Gas
VHA	Viscoelastic Haemostatic Assays
VS	Vegetative State
VTE	Venous Thrombo Embolic (disease)
VX	nerve agent
WHO	World Health Organisation
WBCT	Whole Body Computed Tomography
Yalurin	Yalurin Retrieval Service North Queensland (Children)

Glossary/list of terms

Hot debrief	immediately after the incident or period of duty
Cold/Structured/ Organisational debrief	within 2 weeks post incident
Multi-agency debrief	within 4 weeks of the close of the incident
Post incident reports	within 6 weeks of the close of the incident

P1	Priority 1, needing life-saving resuscitation or intervention
P1 Hold	Expectant, serious injuries with a poor chance of survival, or needing extensive treatment, casualties receive treatment compatible with resources
P2	Priority 2, needing early resuscitation and/or surgery, but some delay is acceptable
P3	Priority 3, requires treatment but a longer delay is acceptable
P4	Dead or for palliation. Use of this category can only be authorised by NHS England

Acronyms

M	Major incident?
E	Exact location
T	Type of incident
H	Hazards?
A	Access/arrival/egress, from the scene or from hospital
N	Number of casualties
E	Emergency services on scene

C	Catastrophic Haemorrhage, also ‹C›, CatHaem, big C
A	Airway
B	Breathing
C	Circulation
D	Disability
E	Exposure (of the patient), Environment, Everything Else

Activation response model

Level of activation	Definition
ALERT	A heightened level of vigilance and preparedness due to the possibility of an event in the area of responsibility. Some action may be required and the situation should be monitored by staff capable of assessing and preparing for the potential hazard
LEAN FORWARD	An operational state prior to 'STAND UP', characterised by a heightened level of situational awareness of a disaster event (either current or impending) and a state of operational readiness. Disaster coordination centres are on standby – prepared but not activated
STAND UP	The operational state following 'LEAN FORWARD' where resources are mobilised, personnel are activated and operational activities commenced. Disaster coordination centres are activated
STAND DOWN	Transition from responding to an event back to normal core business and/or recovery operations. The event no longer requires a coordinated operational response

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