University Hospital Southampton NHS
NHS Foundation Trust

Adult Major Trauma Guidelines

University Hospital Southampton NHS Foundation Trust

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Amendment's log

Amendments	Page No.	Date
Update Wessex Trauma Network Automatic acceptance tool	24	Sept 2021

NOTE: These guidelines are regularly updated.
Check the intranet for the latest version.
DO NOT PRINT HARD COPIES

Please note these Major Trauma Guidelines are for UHS Adult Major Trauma Patients.

The *Wessex Children's Major Trauma Guidelines* may be found at

http://staffnet/TrustDocsMedia/DocsForAllStaff/Clinical/WessexChildrensMajorTraumaGuideline/WessexChildrensMajorTraumaGuidelines.pdf

NOTE:

If you are concerned about a patient under the age of 16 please contact SORT (02380 775502) who will give valuable clinical advice and assistance by phone to the Trauma Unit and coordinate any transfer required.

http://www.sort.nhs.uk/home.aspx

Please note current versions of individual University Hospital Southampton Major Trauma guidelines can be found by following the link below.

http://staffnet/TrustDocuments/Departmentanddivision-specificdocuments/Major-trauma-centre/Major-trauma-centre.aspx

Table of Contents (Hyperlinked)

Introduction

'These guidelines are the current policies and practice for the management of ***adult*** *major trauma patients at University Hospital Southampton. They have been designed to provide a day to day framework for the management of patients; including the roles and responsibilities of clinical teams and their members. The guidelines were produced to try and ensure timely, consistent, high-quality care for all patients whatever day or time of day they present, recognising that these are challenging and often stressful cases.*

There will be situations when it is appropriate to deviate from the guidelines or where the guidelines do not cover the specific circumstances. In these cases it is essential that care of the patient is the foremost consideration, that senior staff are directly involved and that documentation is clear. If in doubt, seek senior advice and document their involvement.

This second edition of the guidelines reflects the changes in practice in major trauma over the last 6 years together with changing national guidance and policy. My personal thanks to all members of the clinical and support teams who have contributed to the development of excellent practice at UHS and who have contributed to this revision. Thanks in particular to Dr Liz Shewry and Dr Simon Hughes, who begun these revisions and to Major Alan Weir who continued with this unenviable task.

In addition, this second edition would not be possible without such a comprehensive first edition. Thanks for the first edition go to Dr Andy Eynon, Dr Liz Shewry and Dr Simon Hughes, who authored the first edition of these guidelines in 2012. The first edition has guided Major Trauma Care across Wessex and further afield for nearly a decade.'

Dr. Mark Baxter
Director of Major Trauma, University Hospital Southampton,

1 Section 1: Preparation for Major Trauma Admissions

1.1 Pre-hospital Triage & Trauma Unit Bypass Tool

The pre-hospital triage & trauma unit bypass tool was developed by the Wessex Trauma Network (WTN) to identify patients who have or are at high risk of having sustained major trauma. Patients who are within a 60 minute travel time of UHS may be transferred direct to UHS as the Major Trauma Centre (MTC), bypassing hospitals closer to the scene of the accident. The rationale for this is that it is time to definitive treatment rather than time to arrival in hospital that makes the biggest difference in outcomes. UHS was chosen as the MTC as it has all major trauma services on site.

The pre-hospital team (Ambulance Service, BASICS, HIOWAA) will alert the ED that a patient with major trauma is en route. It is expected that a basic ATMIST (see p9) handover will be received with details of the mode and likely time of arrival of the patient.

Patients who are outside a 60 minute travel time or who are deemed to be at risk of imminent airway compromise or have catastrophic haemorrhage will go initially to their nearest trauma unit (TU) for resuscitation. Once resuscitated, if the TU feel that the patient's injuries are beyond their local facilities, the patient will be transferred on to either the MTC or another TU with specialist facilities (see Section 1.09 Secondary Trauma Transfers, p22).

Certain hospitals have been designated as local receiving hospitals (LRH) by the Wessex Trauma Network. Trauma patients will only go to these hospitals if there is an imminent cardiac arrest or immediate airway problem. Patients will be expected to have only these immediate life-threatening conditions controlled before onward transfer to a TU or MTC.

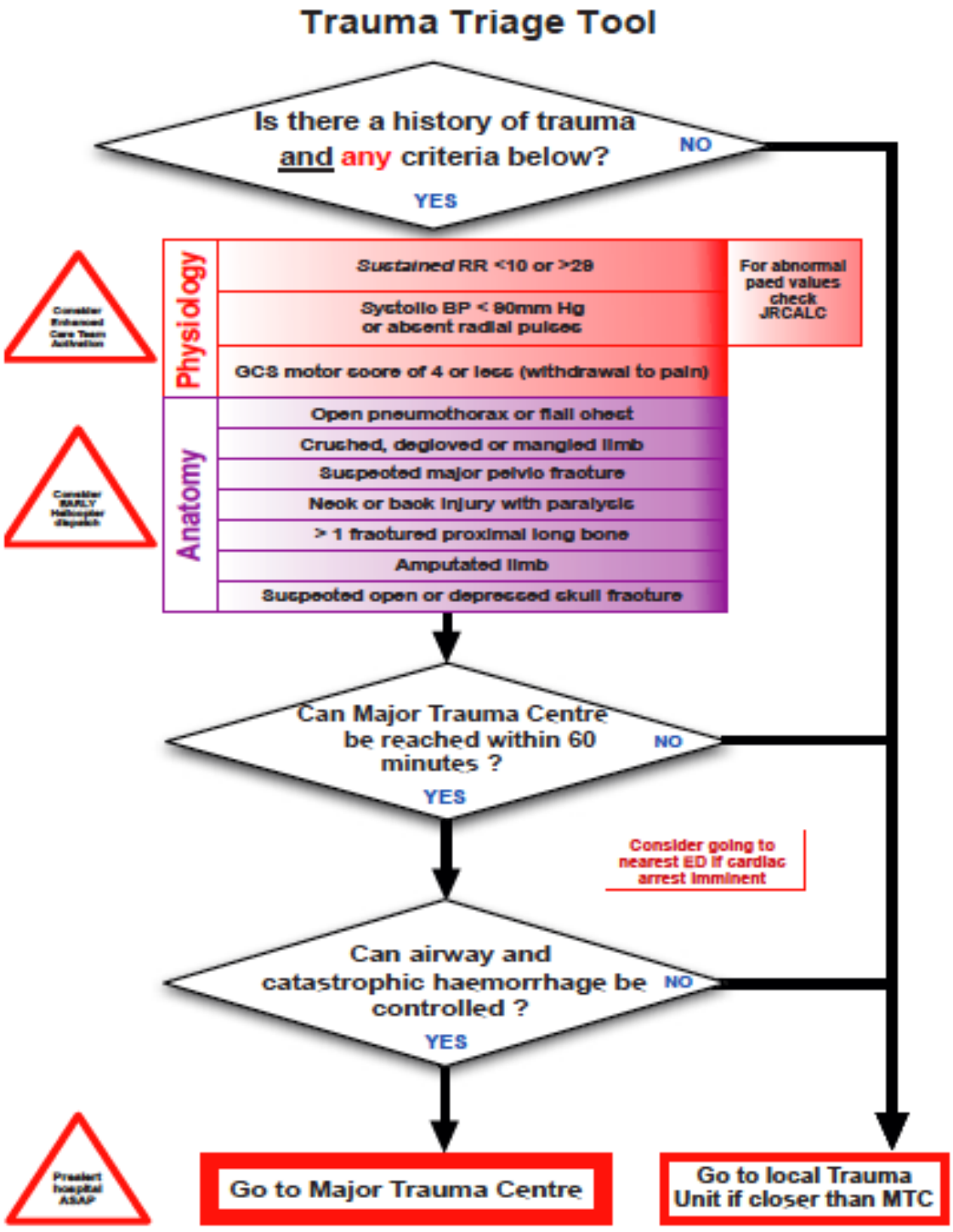


Figure 1. Trauma Triage Tool (2021)

1.2 ATMIST

Ambulance services, including the air ambulance service, are using the ATMIST handover tool. This gives basic information to enable preparations to be made to receive the patients. The sticker below is completed by the team leader and then it is stuck into the trauma booklet on arrival in ED resus.

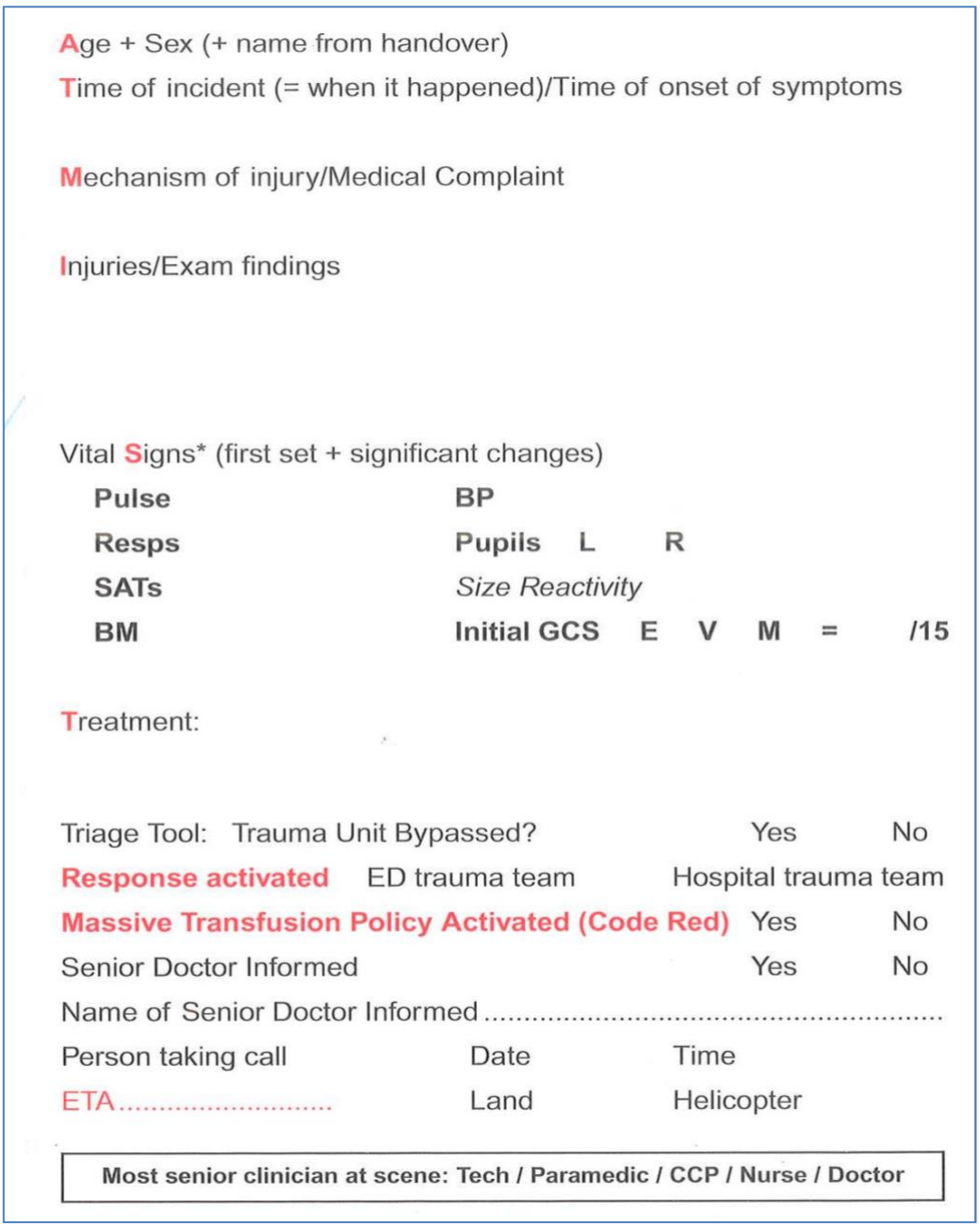


Figure 2. Pre-hospital alert ATMIST sheet

1.3 Adult Major Trauma Team Activation

A two-tier response to trauma has been developed at UHS. A full trauma team response (Level 1 trauma call) should be instigated by the ED Consultant where a patient triggers a pre-hospital major trauma call and there is concern by the ED team that a full trauma team response is required. For less severe trauma it may be appropriate to activate the ED trauma team alone (Level 2 trauma call), which can be escalated if more significant injury is found. Criteria for activating a Level 1 trauma call (Figure 3) are based on physiology, anatomical injury, and mechanism of injury, however, this is not an exhaustive list and full trauma team activation is at the discretion of the receiving clinicians.

To activate a Level 1 trauma call, contact Switchboard on 2222 and request "Adult Trauma Team, ED Resus"

Physiological	Respiratory rate <10 or >29 Or Pre hospital Sp02 o <92% - ***On Air***
	Systolic Blood Pressure <90mm Hg
	Pre hospital pulse rate <60 or >110
	GCS Motor Score of 4 or less Or Pre- hospital GCS of < 12
Anatomical	Penetrating injury to chest, abdomen, head, neck or groin
	Burns with ***a Hx of*** Trauma
	Flail chest, tension pneumothorax or haemothorax
	Crushed/degloved/mangled/amputated limb(s)
	> 1 fractured long bone
	Suspected major pelvic injury
Other Considerations	Trauma Triage Tool Activation (Trauma Unit Bypass)
	Pre-hospital intubation ***(Mandates Level 1 Call)***
	Senior Clinician Concern (including mechanism) Gunshot wounds, stabbing, impaling Falls >6 metres High impact RTC (Ejection, death of vehicle occupant, pedestrian struck by vehicle >30mph)
	For the ≥ 65 age group consider • Systolic BP of ≤ 110 mmgHg • Heart Rate of ≥ 100 bpm • Fall with GCS of ≤ 12 • Taking Anticoagulants • Co-morbidities; Liver disease, renal failure, heart failure, COPD

Figure 3. Criteria for Level 1 Trauma Response (December 2020)

1.4 Adult Major Trauma Team Composition

Level 2 Trauma Team

ED Consultant or ED ST4+
ED Doctor/ACP
ED Nurse in charge
ED Nurse x 2
HCA

Level 1 Trauma Team

Level 2 Trauma Team Members plus:

ED Consultant	
Trauma Orthopaedic Consultant	bleep 1780 (Daytime)
Major Trauma Anaesthetist	bleep 1783
Named Anaesthetist (Day)	bleep 1646
GICU SpR	bleep 2110
ODP / tech	bleep 1784
General Surgery SpR / Cons	bleep 9990
Orthopaedic Surgery SpR	bleep 2702
Site manager (if helipad arrival)	bleep 2238
Radiographer	bleep 1781
Major Trauma Clinical Coordinator (Daytime)	bleep 1963

There is agreement that the Neurosurgical SpR (bleep 2877) and Cardiothoracic SpR (bleep 9211) will not be part of unselected Level 1 calls. They may be contacted at the discretion of the Trauma Team if the pre-alert suggests their presence may be of benefit.

Other specialists (eg ENT and MaxFax) may be contacted in a similar fashion.

1.5 Responsibilities & Roles of Trauma Team Members

On receiving a major trauma alert, all members of the major trauma team should assemble in the ED Resus area to be briefed on the nature of the patient expected. This information should be written on a board or flipchart for the team to view throughout the trauma call. The Trauma Team Leader (TTL) will lead a team briefing and allocate roles in advance of the patient's arrival.

If a member of the team cannot attend within the given timeframe they should notify the ED immediately (x3807).

If a specialty SpR cannot attend, the duty specialty Consultant must be informed and attend.

CT

CT should be informed that a potential major trauma patient will be arriving so that the scanner can be cleared and be on stand-by to perform a trauma series CT. The default emergency CT is the C level scanner adjacent to the ED (x6108 / x4999).

Transfer equipment should be made ready in the expectation that the patient will be moving from resus to CT. Trauma mattresses are NOT to be used for Level 1 trauma cases. They should managed in the initial resuscitation phase on scoop, and transferred to CT/ Theatre / ITU on this scoop. If the patient remains in ED for a period of time following resuscitation then they may be transferred to a trauma mattress at this point.

There is an agreed protocol for requesting a trauma series CT +/- limb angiography. The request is made electronically and then a single telephone call is made to the CT Radiographer to inform them of the request. The CT Radiographer will then inform the duty Radiology SpR who will approve request and provide the Hot Report to the trauma team.

Major Haemorrhage (Code Red)

If the pre-hospital information suggests that the patient has severe, life-threatening haemorrhage a 'CODE RED' should be called. This facilitates prompt requests for blood products from Blood Bank and allows the major trauma team to make adequate preparations for management e.g. preparation of tourniquet, preparation of rapid infuser.

There is an allocated 'Code Red Nurse' for every shift. They should be identified when the trauma team assembles and if required prime the rapid infuser. A team of two is required for effective major haemorrhage management – a transfusion assist will be allocated to work with the 'Code Red Nurse' from the ED team.

Consider allocation of ‘T’ (Transfusion) number for patients who have Code Red declared prehospital. A number of patient note folders and ‘T’ numbers have been pre-assigned. Blood Bank must be informed if a ‘T’ number is used, and they can issue FFP using a ‘T’ number. If a ‘T’ number has already been allocated by HIOWAA then this must continue to be used on arrival at UHS.

Most of the Air Ambulances carry blood for prehospital use. If HIOWAA has given blood please inform blood bank before their arrival as the Air Ambulance will need restocking.

Helicopter Transfers

If the patient is being transferred by helicopter, switchboard will be informed and asked to alert the helipad team (Site Manager, Portering staff).

The Trauma Team is far more effective looking after major trauma patients in ED Resus rather than on the Helipad. Therefore, the priority is to transfer the patient from the Helipad to Resus before Hospital resuscitation commences.

NOTE: Aside from the helipad team, no members of UHS staff are to attend the helipad even if the patient is critical

Trauma Team Roles

Trauma Team Leader

- Controls and manages the trauma team resuscitation
- Makes decisions in conjunction with specialists
- Priorities investigations and treatments
- Is responsible for the handover and transfer
- Undertakes the trauma transfer checklist, prior to departure from ED

Before patient arrival

- Ensures trauma team activated (consider additional specialties andseniority)
- Liaises with **Scribe**
- Ensures team members are booked in with **Scribe**
- Introductions and roles assigned
- Activates Code Red (if required). Consider plain film (CXR/PXR) if toounstable for CT
- Ensures tranexamic acid is available
- Briefs team. Rehearse emergency plan
- Ensures Airway Assistant has started clock on patient arrival

NOTE: It is imperative that the Trauma Team Leader maintains control and insists on MINIMUM noise from the Trauma Team members

NOTE: The Team Leader will read aloud the Checklist for actions prior to leaving ED – the main indication for this is transfer to the CT Scanner.

Anaesthetist

- Ensures equipment and anaesthetic drugs (Blue/Red CD pack and yellow fridge Pack) are available on patients arrival
- Verbalises airway and anaesthetic plan to team leader and airway assistant
- Communicates airway patency and issues to team leader and scribe on arrival
- Communicates with team leader airway decision making following assessment. Ensure cervical spine immobilisation
- Assess pupil size and reactivity
- If indicated, RSI and ongoing sedation and ventilation
- Provide ongoing assessment of GCS. Reassures patient on arrival, takes AMPLE history:
  A- Allergies
  M- Medications
  P- Past medical history
  L- Last meal
  E- Everything else relevant
- Ensures neuro protective measures are undertaken for significant head injuries (30 degree trolley tilt, sedation, muscle relaxation, avoid tube ties and tight c-spinecollar, avoid hypercapnia)
- Arterial lines are rarely indicated. To avoid delay to CT this can usually be done after CT or in the operating theatre
- Ensures theatres are informed as appropriate (bleep 2894 or named consultanton 1646)
- Ensures CD book is signed

NOTE: Insertion of invasive lines should not delay transfer to CT or theatre

Airway Assistant

- Completes airway check list prior to patients arrival and that difficultairway trolley is accessible if required (ask if c-mac is required)
- Ensures Blue/ Red CD pack and yellow fridge pack are readily available with appropriate anaesthetic drugs drawn up in conjunctionwith Anaesthetist
- Confirm airway plan
- Start the clock on patient arrival
- May assist with removing patients clothing, have scissors to hand
- Assists anaesthetist in all airway interventions
- Ensure time of intubation is recorded by scribe
- Takes emergency airway equipment / drugs on any transfer(CT, Theatre, ICU)
- Assists in the preparation patient for transfer to CT/theatres ASAP
- Ensures CD book is signed

Primary Survey

- Undertakes primary survey <C> ABCDE. Clearly states findingsto Team leader and scribe
- Performs procedures depending on skill levels and training. Confirmsskill level with team leader prior to patient arrival
- If thoracostomies are present, re-finger to ensure patency.Is lung up or down? Delegate opposite side, if necessary
- FAST scan if accredited and does not delay CT
- Neurological exam needed before paralysing anaesthetic agent given
- Ensure patient is kept warm
- Ensures CT notified. Where indicated convey urgency of completingthe CT. Order any other radiology in discussion with the team leader,should this be appropriate

Circulation

- Ensures patient has two patent peripheral lines in situ (IV/IO
- Ensures bloods are taken:
  FBC
  U&E
  LFT
  Crossmatch
  Coagulation Screen
  Venous Gases
- Requests bloods and ensures these are sent to the lab
- Performs procedures depending on skill levels and training. Confirms skill level with team leader prior to patient arrival
- Administer drugs in conjunction with Drugs role
- Undertakes secondary survey
- Ensure patient is kept warm

Monitoring/Packaging

- Prepares for trauma call with warming devices
- Removes all patient clothes including underwear and stored securely
- Checks that all monitoring equipment is available
- Connects patient monitoring on arrival
- Ensures Bair Hugger / blankets are covering patient at all time
- Ensures temperature is taken
- Prepares patient for transfer to CT/theatres ASAP
- Checks transfer stack as per the checklist
- Helps with any procedures as identified e.g. catheter, chest drainand ART line

Drugs

- Manages any external major haemorrhage if present on arrival
- Assists Monitoring/Packaging with clothes removal
- Liaise with Airway specialist and airway assistant to support a promptanaesthetic if required
- Draws up drugs and administers them as prescribed
- Helps with getting IV/IO access in conjunction with Circulation
- Helps with any procedures as identified e.g. catheter, chest drainand ART line
- Assists Monitoring/Packaging to prepare for transfer

Scribe

- Ensures correct PPE and identification worn
- Use ED documentation
- Records names, grades and specialities of all clinical staff attending plus time of arrival
- Ensures clock is started when patient arrives
- Records primary survey findings
- Records all observations (including time of intubation).
- Records all findings and interventions
- Ensures wrist bands are applied including allergy
- Observe for abnormal observation and signs indicatingpotential reactions to blood products

Relative Liaison

- Identify any relatives on their arrival to the department and take tothe relatives room
- Ensure that relatives are kept up to date with information,where possible
- To assist medical team in the delivery of patient updates and to stay with the family for further questions
- If CPR is in progress discuss with team leader regarding witnessedresuscitation and if suitable offer to the relatives
- Where appropriate accompany the relatives/important others to the area where the patient is to be care for next (or make sure theyare escorted)
- If relatives/important others are not present whilst the patient is in theED resus room – ensure that a named individual is responsible for greeting them and passing on the necessary information

Code Red

Prior to Arrival

- Inform transfusion of code red being called and ask for MajorHaemorrhage Pack 1
- Ensure you are wearing the correct PPE and designated label
- Remove x2 units of Emergency blood and scan into BloodTrak

On Patient Arrival

- Ensure blood products have been prescribed on the transfusion chart
- Contact transfusion if major haemorrhage pack 2 is required andinform them of the requirements
- Ensure the transfusion are aware of the patients destination andwhere further blood products are required to be sent

Code Red Infuser

Prior to Arrival

- Ensure you are wearing the correct PPE and designated label
- If appropriate prime the Belmont ready to infuse
- Ensure Tranexamic acid 1g is available and consider second dose in massive haemorrhage

On Patient Arrival

- Administer blood products, under the direction of the team leaderas per the trust policy
- Inform team leader when boluses have been delivered
- Monitors compliance with 1:1 transfusion ratio (RBC:FFP)
- Ensure the scribe has documented the number of boluses administered

Code Red HCA

Prior to Arrival

- Ensure you are wearing the correct PPE and designated label

On Patient Arrival

- Takes crossmatch blood sample directly to the lab & waits for the Major haemorrhage pack 1 and bring back to ED resuscitation room
- Brings blood products to ED resuscitation room and scans unitson arrival

1.6 Hands-off Handover

Generally unless CPR is in progress, or there is airway compromise or concern over catastrophic haemorrhage, an ATMIST handover will be given by the ambulance staff whilst UHS staff stand-off the patient. The trauma team leader will first ask where the pre-hospital team are happy to give a 'hands off handover'. Ambulance staff assisted by UHS staff will transfer the patient from the stretcher to the trolley in resus. Patients should remain on the scoop-stretcher.

The ATMIST handover should be completed within 30 seconds and is designed to give **ALL** members of the trauma team the information necessary to proceed with the immediate care of the patient. Further information regarding the patient can be relayed to the Trauma team leader following the ATMIST handover.

1.7 Trauma Team Leader: Executive Role

The ED Consultant has authority from the Chief Executive and Medical Director to request any specialty Consultant to attend. All UHS Consultants have a statutory duty to be able to respond in an emergency within **30 minutes** of request.

The Trauma Team Leader will:

- Determine and arrange the appropriate destination for the patient i.e. theatre, ICU, ward
- Ensure that medical staff of the appropriate seniority are involved in the care of the patient
- Ensure that only essential imaging is performed
- Ensure that necessary documentation has been completed
    a. Major trauma activation
    b. Trauma team attendance (including time of arrival and grade of doctor)
    c. The extent of examination performed in the ED and whether a further secondary examination is required
    d. The secondary survey must be signed off as complete at the earliest opportunity. The team leader is responsible for ensuring the survey is performed and documented. The default specialty to complete the secondary survey is the T&O Doctor
    e. Ensure spinal precautions are applied throughout where indicated
    f. Ensure that handover of a multi-trauma patient to a specialty service is formally documented. Until this has occurred, the patient will remain under the care of the Trauma Team Leader
    g. Handover between the Trauma Team Leader and the receiving team Doctor should always be done in person with a written handover of all admissions and any necessary actions

NOTE: The MTC Consultant or Trauma Team Leader must always attend the CT scanner and liaise with the Anaesthetist as to the patient's injuries and planned destination after CT.

In exceptional circumstances the TTL can delegate escorting the patient to CT to an appropriately senior Doctor from outside ED – e.g. the T&O Consultant. Their principal role is not to guide resuscitation (typically this will be performed by the anaesthetist) but to ensure prompt liaison with other teams (e.g. Neurosurgery) as required.

1.8 Site Manager

It is essential that patients can move as swiftly as possible from the ED to their place of definitive care. Patients may require immediate theatre / ICU bed / ward bed.

Patients requiring immediate theatre:

- Coordination of theatre will be done by the TTL with the Named Anaesthetic Consultant
- Patients with isolated head / spinal cord injury requiring immediate theatre should be managed in the appropriate specialist theatre
- The duty Anaesthetic Consultant will be responsible for coordinating the ongoing resuscitation

NOTE: F Level Theatres recovery can be used for patients requiring ongoing resuscitation after CT whilst theatre is being prepared.

Patient requiring ICU bed

In principle, patients with a primary neurological diagnosis (head or spinal cord injury) should be managed on Neuro ICU with the proviso that there are very limited resuscitation facilities available in the Wessex Neurological Centre. As such, patients with ongoing resuscitation needs or with significant cardiovascular injury are best managed initially on General ICU.

Patient requiring Ward bed

Patients with single system injury are best managed on wards with experience of managing that injury.

Patients with multi-system injury requiring a ward bed should by default go to the Major Trauma Ward (F1).

Patients with isolated thoracic injuries will be admitted to the thoracic ward under the care of Thoracic surgery.

NOTE: The Trauma & Orthopaedics Consultant is responsible for polytrauma patients where there is no clear single specialty.

1.9 Secondary Trauma Transfers

The secondary transfer tool has been developed by the Wessex Trauma Network to ensure that patients with certain categories of major injury, who are managed initially in a trauma unit or local receiving hospital, are rapidly transferred to the Major Trauma Centre without delay.

The categories of patient to which this applies are:

a. Injuries exceed Trauma Unit capabilities
b. Pre intubation GCS **Motor** Score 4 or Less AND evidence from CT of intracranial bleeding (any variant)
c. Life threatening haemorrhage not amenable to control at Trauma Unit
d. Successful resuscitative thoracotomy at Trauma Unit

These patients fulfill automatic acceptance criteria for transfer to the MTC. At the Trauma Unit the senior doctor will call the Ambulance Service and state that they have a "Time Critical Trauma Transfer". The Trauma Unit Team Leader will then inform the Major Trauma Centre via the red phone in the Emergency Department and state that there is a "Secondary Trauma Transfer". When prompted the Trauma Team Leader will give an extended ATMIST summary of patient.

- **NOTE: Do not negotiate terms of admission to UHS with the Trauma Unit. The transfer tool has been specifically written to ensure *automatic acceptance* by the MTC. The phone call from the Trauma Unit is purely to alert the MTC rather than to seek permission for the transfer.**

NOTE: Any paediatric secondary transfer referrals must go via SORT (02380 775502) who will not only coordinate the transfer but also give valuable clinical advice and assistance by phone to the Trauma Unit.

http://www.sort.nhs.uk/home.aspx

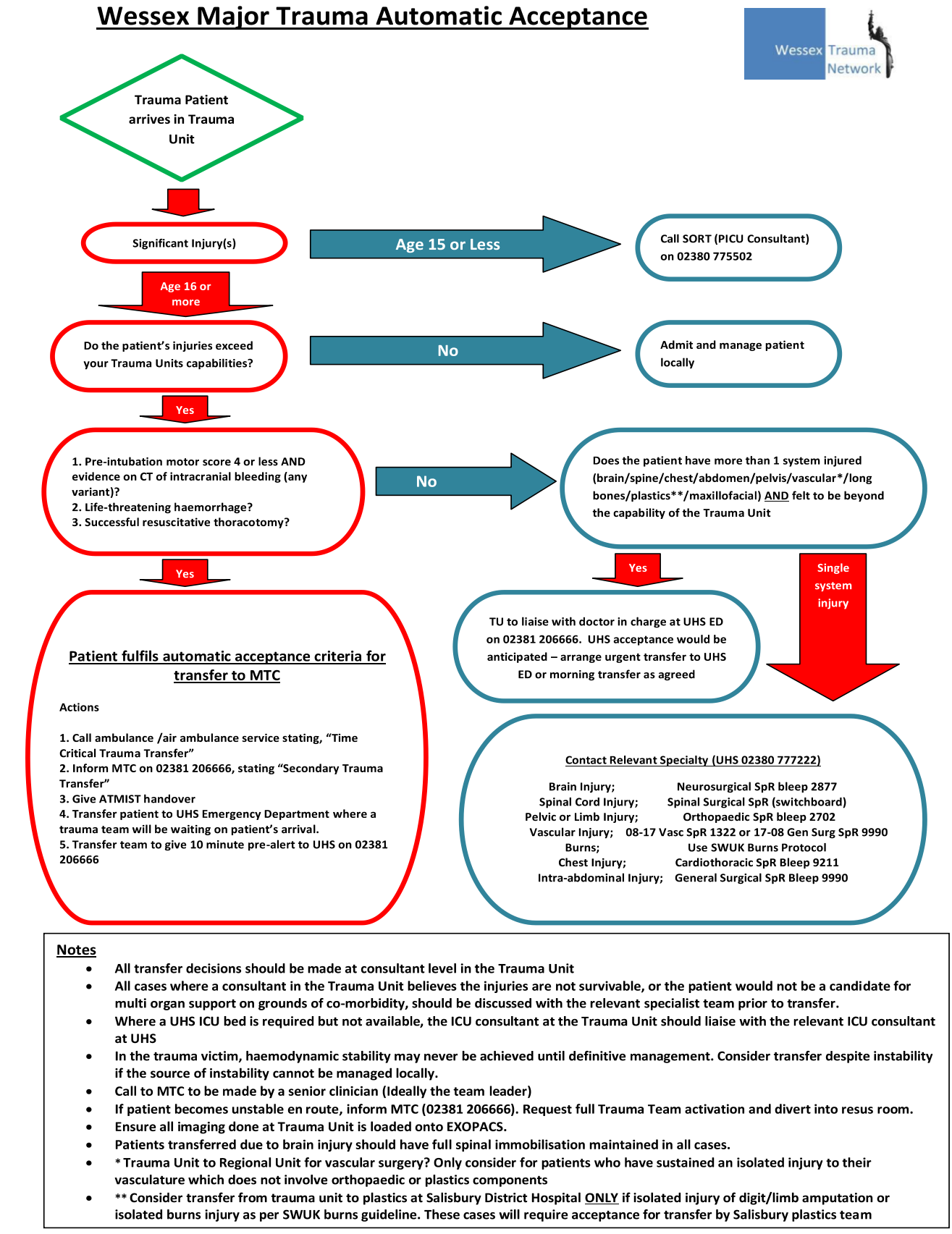


Figure 4. Major Trauma Automatic Acceptance Tool (2020)

After receiving a secondary trauma transfer pre-alert, the optimum response is to activate a full Level 1 Trauma Call when the patient arrives. It is expected that these patients will have a management plan in place before arrival at UHS and should move swiftly from ED to their destination.

Secondary Transfer due to *Pre-intubation Motor Score 4 or less*

- Contact Neurosurgery SpR and Site Manager
- Obtain plan from Neurosurgery – Critical Care bed or direct to Theatre
- Site manager to arrange Level 3 Bed - Preference NICU > GICU > CICU
- Site Manager to discuss with NICU Consultant regarding patient moves if NICU is full
- Site Manager to ensure relevant ICU resident medical team and Neurosurgical registrar aware of location of bed if going direct to ICU

Secondary Transfer due to *Life Threatening Haemorrhage*

- When Trauma Team arrive, brief that this is a secondary transfer, review imaging with relevant teams and plan for patient's arrival. This may include activating Theatre or Interventional Radiology teams
- Patient will go to ED Resus on arrival unless exact cause of haemorrhage known and time to prepare theatre/Interventional Radiology prior to arrival
- Any decision to Bypass ED Resus is only to be made by a Consultant Team Leader

Secondary Transfer due to *Successful Resuscitative Thoracotomy*

- Inform Cardiothoracic SpR (Bleep 9211) and Site Manager
- Cardiothoracic team should prepare to receive patient in Theatre. Cardiothoracic SpR to inform Consultant, activate theatres and Anaesthetist/ Perfusionist
- Site manager to arrange Level 3 Bed, preference Cardiac > General > Neuro
- The initial destination in UHS, ED Resus versus cardiac/thoracic theatres may need to be decided on a case by case basis by the TTL.

2 Section 2: Trauma Resuscitation (<C>ABCDE)

2.1 Catastrophic Haemorrhage

Recognition and management of catastrophic haemorrhage is the first priority in trauma resuscitation. Catastrophic haemorrhage is poorly defined and simply describes bleeding that is imminently life threatening. Major haemorrhage is variously defined as:

- Loss of more than one blood volume in 24 hours
- Loss of 50% total blood volume in less than 3 hours
- Bleeding in excess of 150ml/min

A clinical based approach to defining major haemorrhage is any bleeding which results in a systolic BP <90mm/Hg or a heart rate >110 bpm.

Pre-hospital management focuses primarily on the prevention of further blood loss and the active management of hypothermia and hypoperfusion to prevent Trauma Induced Coagulopathy (TIC).

- Tranexamic Acid (TXA) should be given within three hours of injury
- Minimal non-haematological fluids should be administered to maintain a central pulse
- Blood is available in the pre-hospital setting via HEMS and the Air Ambulances
- Tourniquets may be applied in the pre-hospital setting for the management of catastrophic limb haemorrhage

Non-torso Catastrophic Haemorrhage

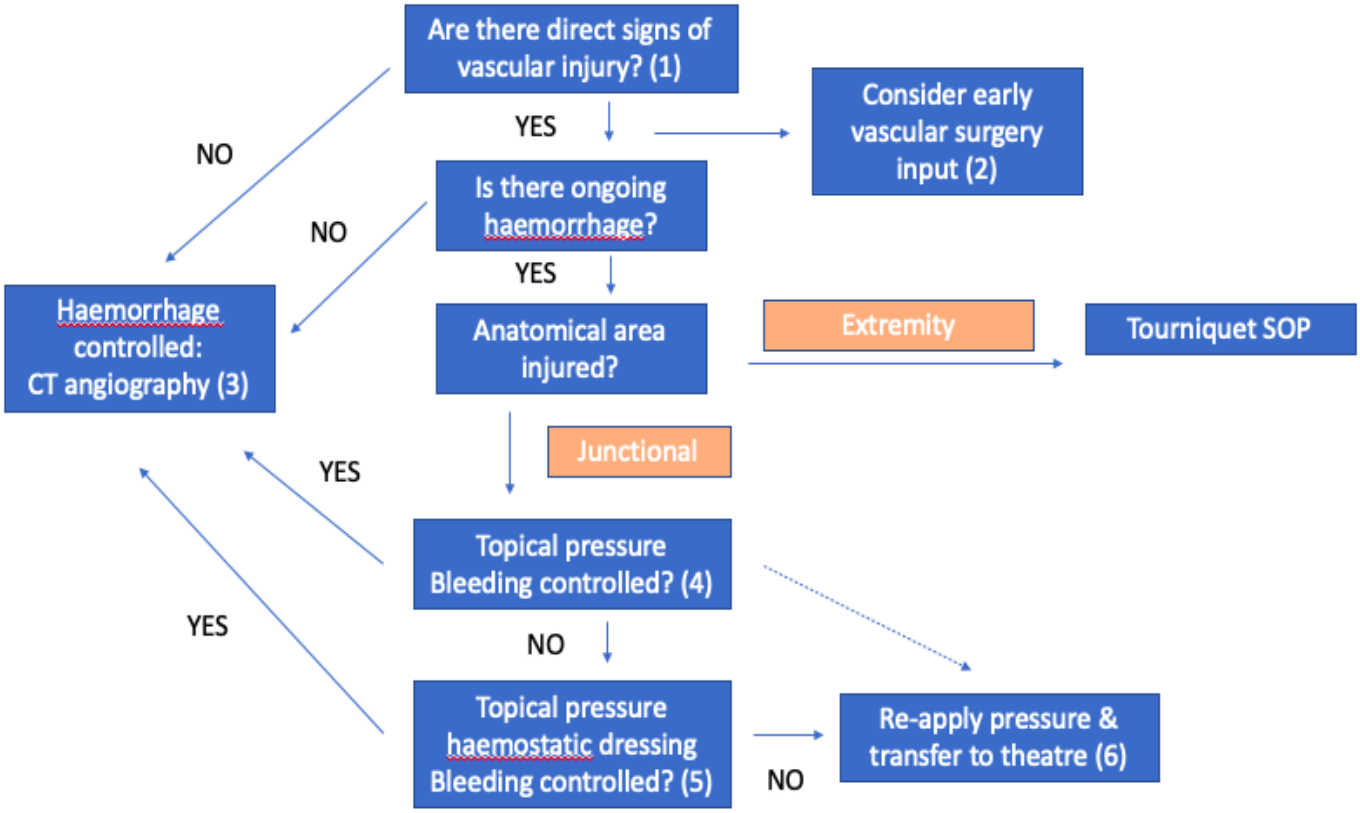


Figure 5. Management of Non-torso Catastrophic Haemorrhage

1. **Direct signs of vascular injury** – pulsatile haemorrhage, expanding haematoma, absence of pulse / ischaemic limb, bruit, palpable thrill,
   Indirect signs of vascular injury – observed pulsatile bleeding, decreased pulse, non-expanding haematoma, injury to adjacent nerve, anatomical location of injury near vessel
2. Vascular surgery input should be obtained prior to any imaging if there are direct signs of vascular injury. This can be via the registrar bleep (1322) between 0800 and 1900 and via switch for the on-call consultant after 1900.
3. CT angiography should be undertaken in all cases of suspected vascular injury unless
   a. There is active haemorrhage
   b. There is a tourniquet in situ
   c. Management of other injuries have taken precedence over a controlled vascular injury

   Discussion with vascular surgery should follow if there is injury to a named vessel which requires surgical management
   i. Isolated vascular injuries at or distant to the antecubital fossa (ACF) should be referred to Plastic Surgery at Salisbury District Hospital
   ii. Polytrauma patients with vascular injury at or distant to the ACF should be discussed with Plastic Surgery at UHS 8am – 6pm seven days a week; 6pm – 8am seven days a week these cases should be discussed with Plastic Surgery at Salisbury

4. Pressure should be applied for at least 10 minutes but ideally 20 directly over the wound using sterile gauze. If the bleeding clearly has no prospect of being controlled in the context of a junctional injury then proceed immediately to theatre
5. Celox™ gauze (Section 4.1)
6. Trauma team to transfer patient to theatre for ongoing resuscitation

Tourniquets

Tourniquets may be required to control life threatening limb haemorrhage. The Wessex Major Trauma Network has an agreed SOP for the use of tourniquets in the pre-hospital and hospital setting (Section 5.1).

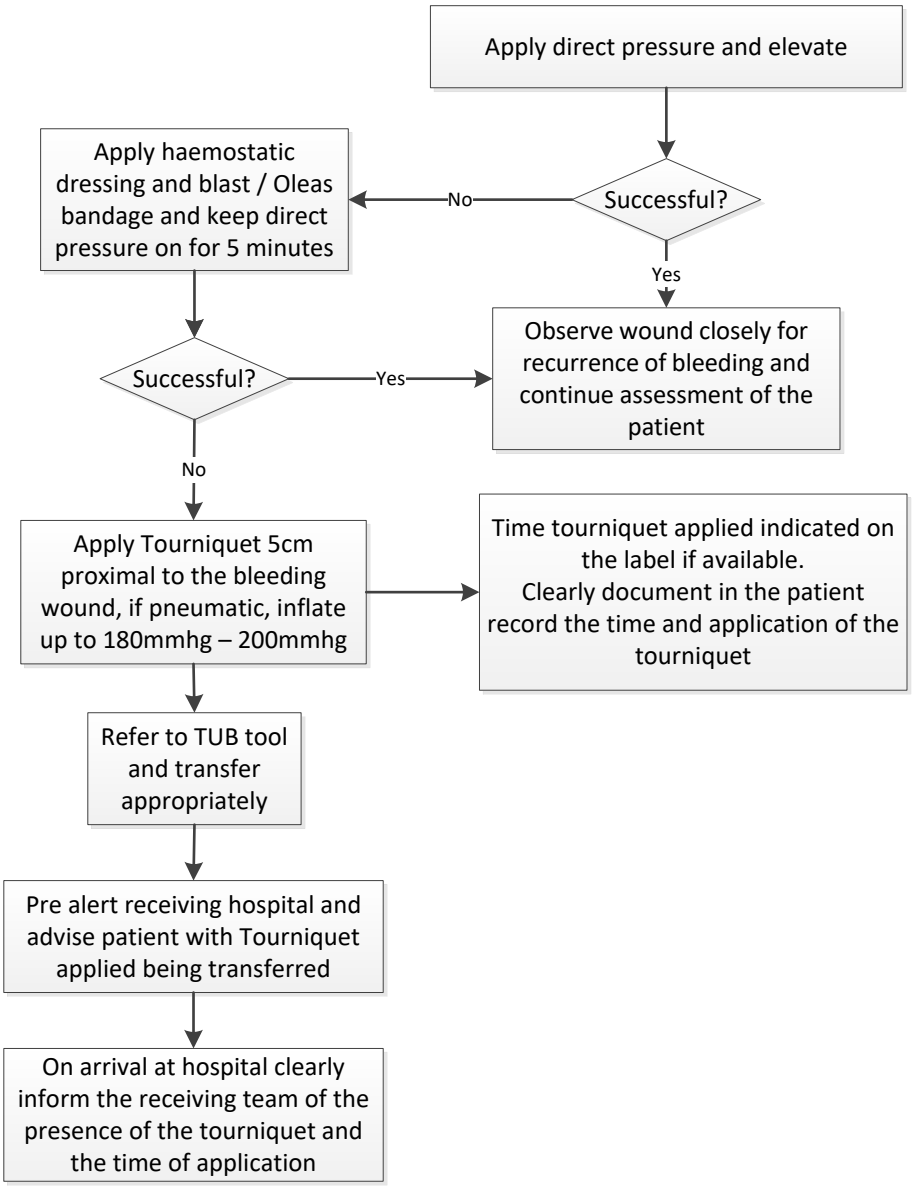


Figure 6. Pre-hospital Tourniquet Use

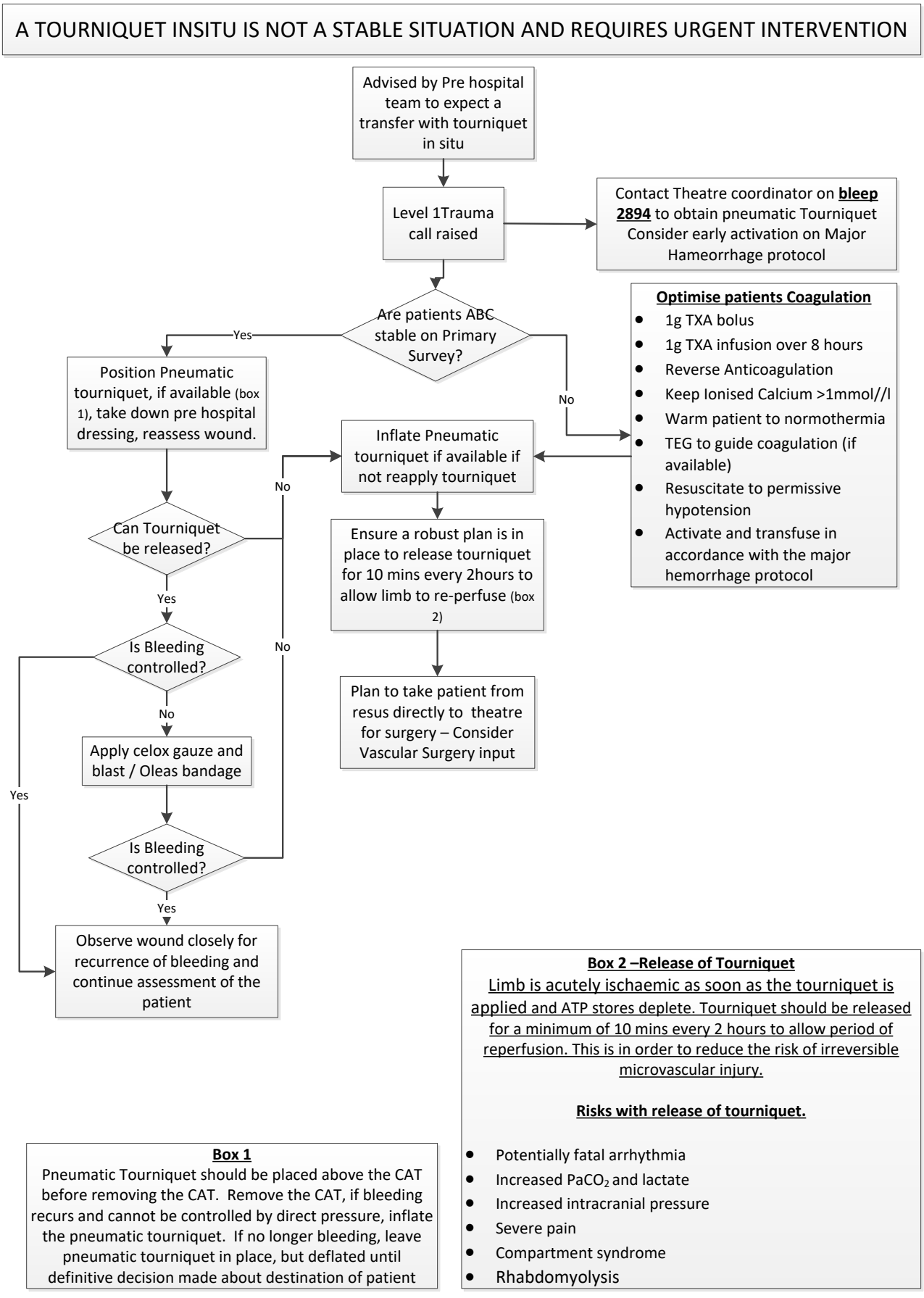


Figure 7. In-hospital Tourniquet Use

Cavity Catastrophic Haemorrhage

Evidence of cavity catastrophic haemorrhage (persistent hypotension and/or tachycardia presumed secondary to cavity blood loss) that cannot be stabilized in ED Resus requires urgent definitive control via Surgical or Interventional Radiology means. This requires a timely discussion between the TTL, Interventional Radiologist, and relevant Surgical Consultants. Further detail can be found in Section 2.4 Circulation.

Massive haemorrhage in the presence of haemodynamic instability should prompt consideration of calling in the oncall Consultant for the cavity of concern. This should be done as soon as possible, and may be considered based on the pre-hospital information received.

The decision to go straight to Theatre, either bypassing Resus on arrival or bypassing CT, carries great risk, particularly as the Theatre Suite is not located in close proximity to the ED. This decision must only be taken after consultation between the Team Leader and the relevant Surgical and Anaesthetic Teams.

CODE RED

Patients with life threatening haemorrhage require urgent replacement of lost circulating volume with blood products. Code Red refers to the activation of the UHS massive transfusion policy (Figure 8 & Section 4.2). Rapid transfusion of blood products is achieved via the Belmont Rapid Infuser (Section 3.2). This is an extremely powerful rapid transfuser which, left unchecked, can deliver huge volumes of blood/fluids within an extremely short period of time e.g. 750ml/minute. The default is to administer repeated boluses (e.g. 250 ml) with regular reassessment of the patient. The CODE RED nurse will be in charge of the Belmont and is also responsible for ensuring an accurate running total of the volume and type of fluids / blood products administered. They should regularly liaise with the Anaesthetist and Team Leader as to ongoing requirements. The benefits of the Belmont include the ability to transfuse when disconnected from a power source but the Belmont will not heat fluids whilst running on battery power and the rate will be reduced to 50ml/minute.

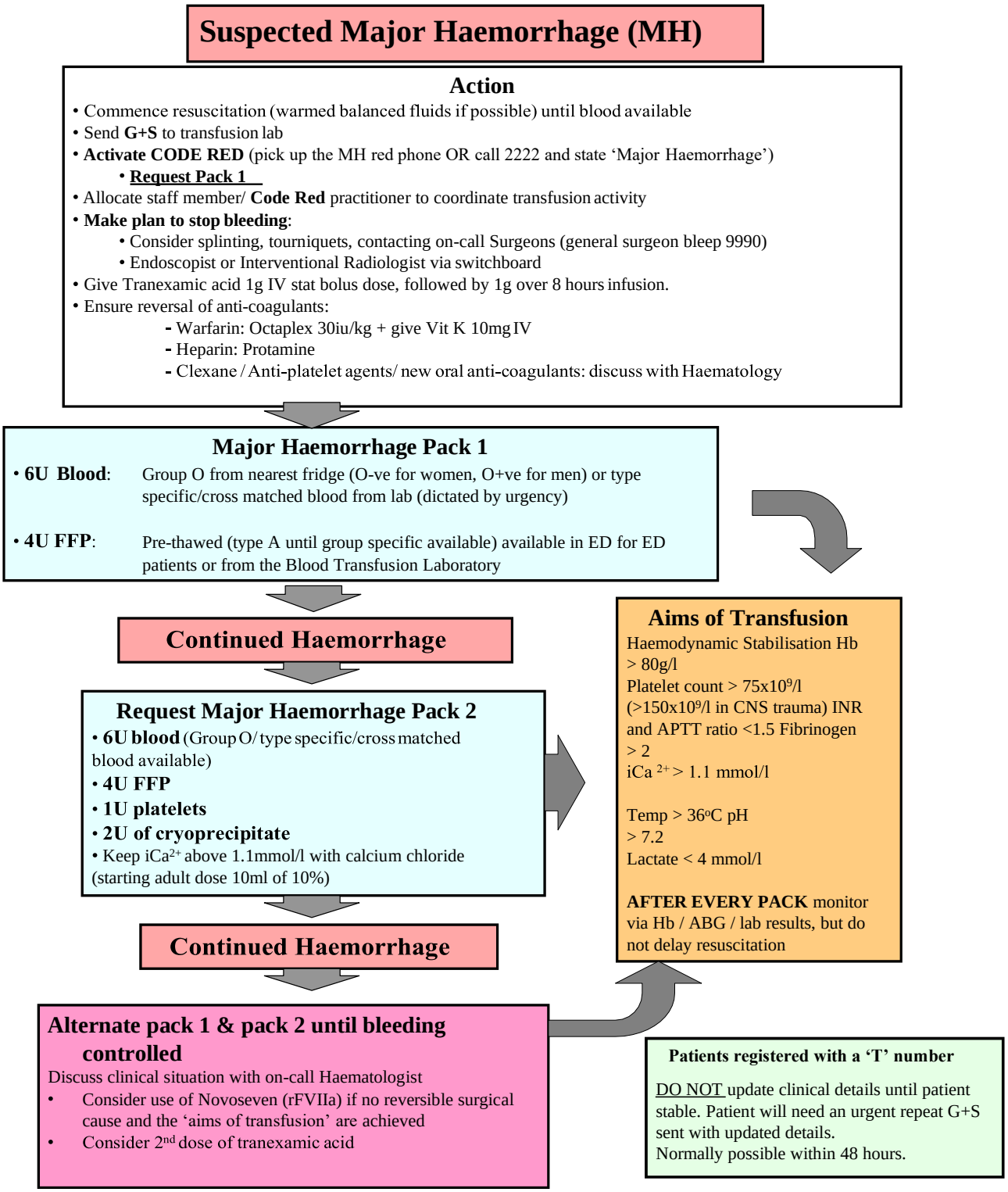


Figure 8. UHS Adult Major Haemorrhage Protocol

T Numbers

A number of patients admitted as an emergency to UHS will be in circumstances where their identity is not known or cannot be confirmed, and some of these patients inevitably require an immediate blood transfusion. In order to avoid any potential delays in transfusion the patient is allocation a temporary PAS registration ('T' or transfusion number). ***This T number should be left in place and not merged until the patient has no risk of requiring further transfusion (typically 48 hours).*** This is to avoid a situation where there is a mismatch between the patient number and that of their initial Crossmatch sample. A patient with incorrect details should also not have their details changed until they have no risk of requiring further transfusion. Before their details are changed, this must be discussed with a senior doctor in their care. A replacement Group & Save sample must be taken immediately and labelled with the new ID details. Patients who undergo organ donation may have their details changed before 48 hours to allow this to safely happen. Patients who receive pre-hospital blood from HIOWAA will also be allocated a T number in the pre-hospital environment, which should continue to be used in hospital.

Managing Haemorrhage in Patients Refusing Blood Transfusion

This is a difficult scenario, but an individual's wishes and rights must always be respected.

Key principles:

- Stop bleeding and promote haemostasis – control external haemorrhage (Celox™, tourniquet, pelvic binder, splint fractures), maintain normothermia, give anti-fibrinolytics (tranexamic acid – 1st dose within 3 hours of injury, repeat dose at 8 hours and consider continuing treatment). Interventional radiology and surgery as appropriate – senior involvement, prompt decisions, meticulous technique, cell salvage
- Conserve blood and reduce oxygen consumption – careful blood sampling, use paediatric bottles where possible, avoid shivering, pain control
- Promote haemopoiesis – discuss with haematologist – may require iron, B12, folate, EPO
- Consider transfusing products which may be acceptable to the patient - discuss with patient or use information from advance directives to see what clotting factors patient may be prepared to accept as there is considerable variation in beliefs. Specifically consider platelets, FFP, cryoprecipitate, prothrombin complex concentrates (Octaplex/ Beriplex), fibrinogen concentrate, recombinant factor VIIa

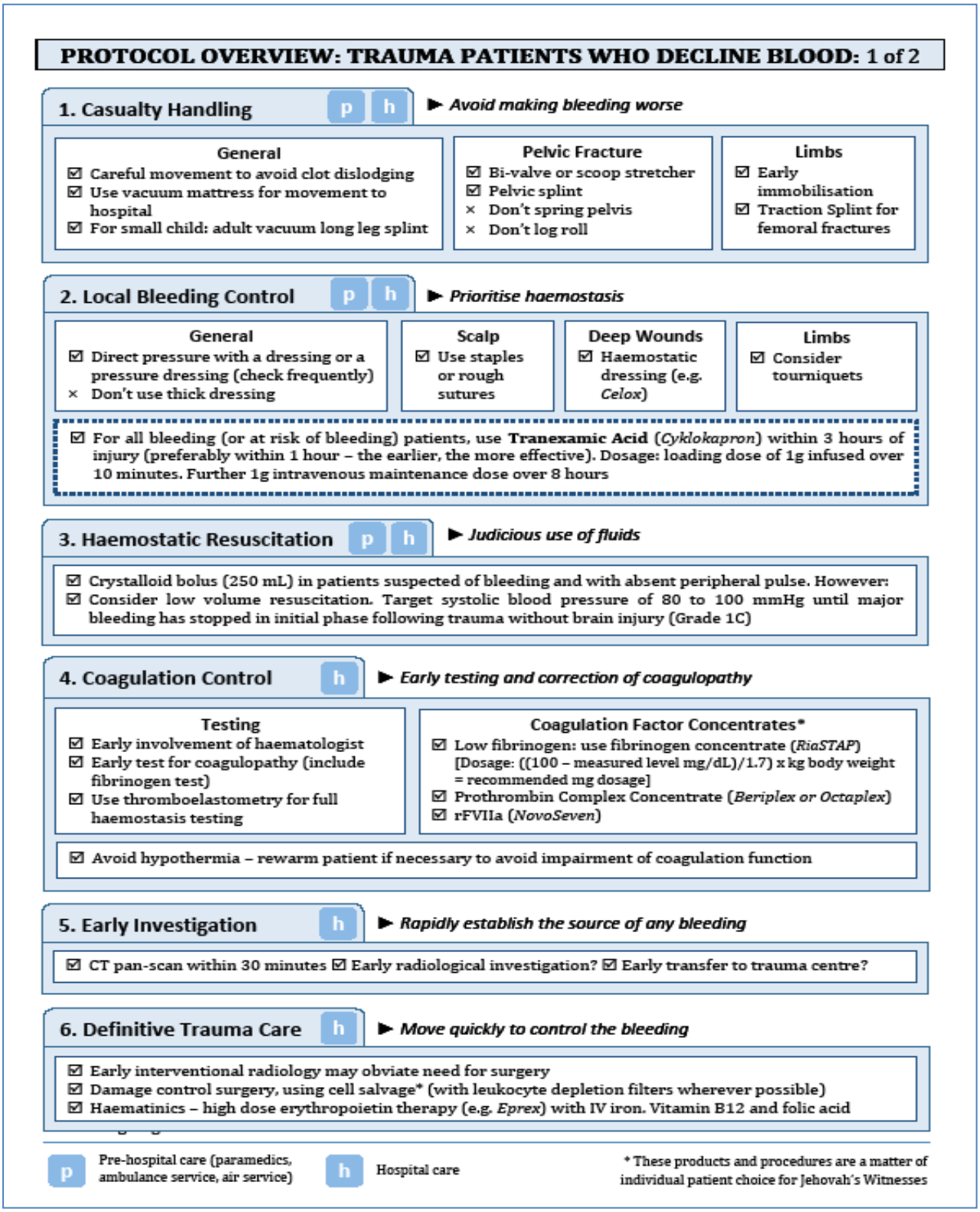


Figure 9. Trauma Patients Who Decline Blood

Traumatic Cardiac Arrest

Survival rates from traumatic cardiac arrest are extremely poor, especially where blunt trauma is concerned. Figure 10 details the algorithm for managing traumatic cardiac arrest.

NOTE: Patients most likely to survive are where the traumatic cardiac arrest is due to tension pneumothorax or from cardiac tamponade (e.g. resulting from cardiac stab wound).

Indications for Resuscitative Thoracotomy (Section 3.3):

- Penetrating trauma with loss of vital signs less than 15 minutes previously
- Blunt trauma with loss of vital signs in ED **and** evidence of a surgical target (ie pericardial collection) on bedside ultrasound.

Consideration should be given to debriefing the team and providing welfare support to members of the team participating in thoracotomy, particularly where unsuccessful, as the procedure can appear dramatic and some team members may be unprepared for such events.

The decision to perform resuscitative thoracotomy is the preserve of the Team and decision will be made, after consultation, by the Team Leader.

Resuscitative Laparotomy should not be performed in the ED. A FAST positive patient with output, should where possible, have a CT before theatre. The decision to take the patient to theatre in a low flow state for a laparotomy should be taken by the General Surgical Consultant on–call.

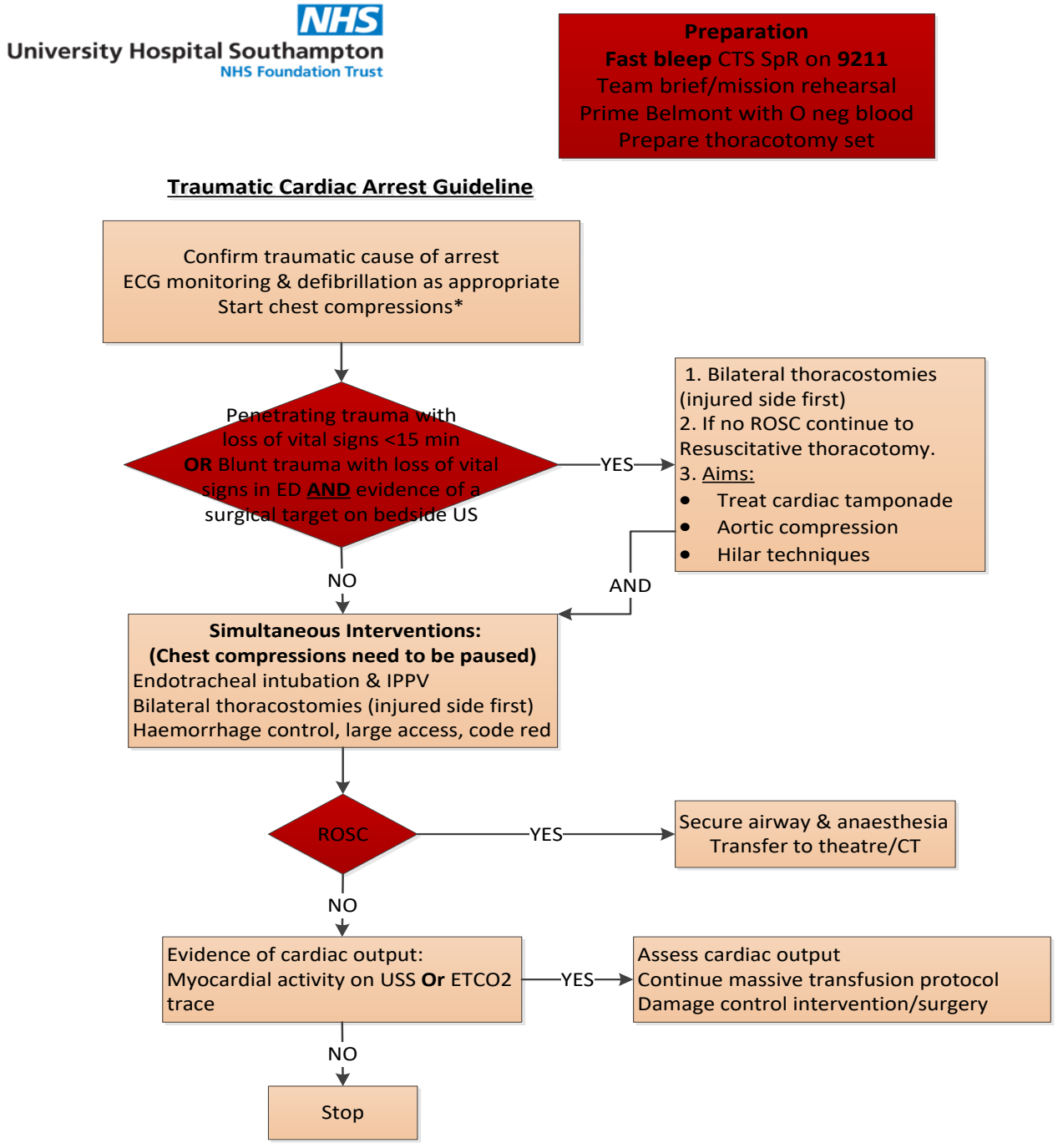


Figure 10. Traumatic Cardiac Arrest Algorithm (2021)

2.2 Airway

Emergency anaesthesia and advanced airway management are frequently required in the Emergency Department for major trauma patients. Securing the airway in these patients may be challenging. The Anaesthetist is working under a time pressure, in a remote and unfamiliar area with patients who typically have their cervical spines immobilised. The patient may be combative or haemodynamically unstable and have facial, laryngeal, or thoracic injuries. Following a protocol for RSI in these patients is likely to reduce the risk of complications, improve success and improve the trauma team performance. The pre-RSI challenge response checklist allows the preparation of equipment and drugs and communication within the team.

Generally there are two groups of major trauma patients who require drug assisted intubation:

1. Patients who require emergent and life-saving intubation.
2. Patients in whom intubation may be delayed for a short period to allow controlled and careful preparation for the procedure.

Reasons for intubation of the major trauma patient include:

i. *Actual or impending airway compromise*

ii. *Ventilatory failure*

iii. *Reduced GCS*

iv. *Humanitarian indications, e.g. severe burns, traumatic amputation*

v. *Combative or agitated patients, particularly after traumatic brain injury*

vi. *Anticipated clinical course requiring intubation (e.g. Trauma CT)*

The decision to anaesthetise patients should be made on the basis of a risk benefit assessment in every case. The Anaesthetist is the airway expert in the trauma team and is usually best placed to make the decision to intubate the patient; however it is important that decisions are channeled via the trauma team leader. For ‘Code Red’ patients the decision may be made to resuscitate first, or relocate the patient to a location the haemorrhage control can be achieved (e.g. Theatre 12) prior to anaesthetising.

Major Trauma Anaesthetist (bleep 1783)

This is a senior Anaesthetist, either a Consultant Anaesthetist or a senior Anaesthetic trainee (ST6-7) that is available to respond immediately to level one trauma calls. They will provide airway management and analgesia depending on the patient’s needs. They assist in the co-ordination of the level one trauma patient’s care from the trauma call in ED through to radiology and onwards to the destination of their care (ICU, Theatres, or Interventional Radiology). The TTL may request the Anaesthetist to attend Level 2 trauma calls if required for patient care.

Trauma Anaesthetic Practitioner- 'TAP' (bleep 1784)

This is an experienced anaesthetic practitioner e.g. ODP/ AN or an ICU technician that has been orientated to the ED department and is familiar with the principles of managing a major trauma patient. They are available to respond immediately.

Drugs for the Major Trauma RSI

The Anaesthetist should use the drugs that they are most familiar with, however particular caution with drug dose needs to be taken with the hypovolaemic patient. There are two different drug packs which the ED staff will provide to the Anaesthetist team; one for the controlled drugs and induction agents (red/ blue – kept in ED Resus Controlled Drugs cupboard) and the other (yellow – kept in Resus fridge) for muscle relaxants, vasoconstrictors, syringes etc.

Induction agents:

- A combination of fentanyl / ketamine / rocuronium should be used because of their relative haemodynamic stability, excellent analgesia and larger therapeutic window. Note however that young fit patients with significant polytrauma may present with compensated shock, which maybe unmasked on induction. In contrast those with GCS 15 may need a larger induction dose. In the cardiovascularly unstable patient consider using ketamine and rocuronium only.
- In trauma patients with an isolated head injury and thiopentone may be used as the induction agent instead of ketamine, if haemodynamic instability can be avoided.

Suggested Induction & Sedation Agent Dosing

A - RSI for shocked, hypovolaemic trauma patients

Fentanyl / Ketamine / Rocuronium "1:1:1 rule"
Fentanyl 1 mcg/kg (consider if haemodyanmics allow)
Ketamine 1 mg/kg
Rocuronium 1 mg/kg (or 1.2)

B - RSI for haemodynamically stable, alert trauma patients

Fentanyl / Ketamine / Rocuronium "3:2:1 rule"
Fentanyl 3 mcg/kg
Ketamine 2 mg/kg
Rocuronium 1 mg/kg

Ongoing Anaesthesia

Following intubation it is imperative to rapidly commence ongoing anaesthesia. Typically this is with a propofol infusion with additional boluses of fentanyl. Alternatively dual infusions of morphine and midazolam are possible. If there is cardiovascular instability consider intermittent small boluses of ketamine to maintain sedation.

Sedation

Ketamine with midazolam or fentanyl is used for procedural sedation and analgesia. Sedating non-starved trauma patients should be considered very carefully with regard to risk and polypharmacy may be particularly risky.

Combative Trauma Patient

Combative major trauma patients present a challenging scenario to the anaesthetist and the trauma team, especially if a head and/or spinal injury is suspected from the mechanism of injury. A sedative dose of IM or IV ketamine may be used to gain control, secure access and allow time for preparation and pre-oxygenation prior to the trauma RSI whilst ensuring airway patency, adequate ventilation and haemodynamic stability are maintained.

Trauma Airway Algorithm

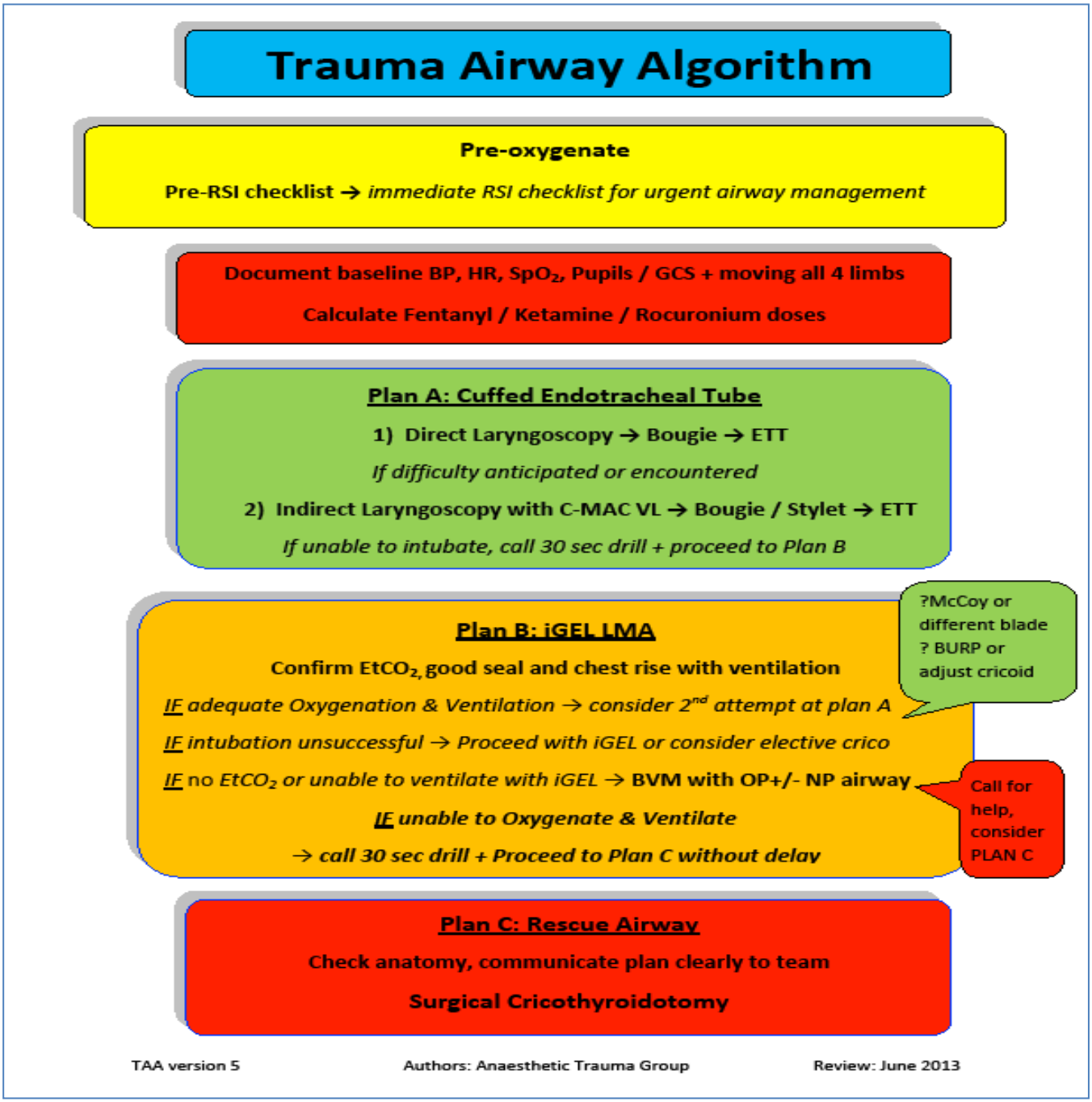


Figure 11. Trauma Airway Algorithm

Section 4 contains the following relevant supporting documents to the Trauma Airway Algorithm:

- Major Trauma Airway Algorithm (Section 3.4)
- Front of Neck Access Procedure (Section 3.5)
- Pre-RSI Checklist (Section 3.6)
- Immediate RSI Checklist (Section 3.7)
- Trauma Bay Checklist (Section 3.8)
- RSI Pack List (Section 3.9)

2.3 Breathing

Assessment

- Look – respiratory pattern, respiratory rate, evidence of bruising / deformity / wounds?
- Listen – air entry? Equal? Added sounds? Beware right bronchial intubation in ventilated patients which may mimic pneumothorax
- Feel – palpate both clavicles, sternum, and chest walls. Assess chest expansion.
- Monitoring & Adjuncts – SpO_2 with reference to FiO_2, $EtCO_2$ trace and partial pressure, imaging as required

NOTE: Treatment of suspected tension pneumothorax is an emergency and requires immediate decompression.

Tension Pneumothorax

Progressive accumulation of air in the pleural cavity, often due to a lung or bronchial tree laceration, resulting in an immediate threat to life due to raised intra-thoracic pressure and collapse of the circulatory system. Cardiac arrest may ensue rapidly.

Features:

- Chest pain, hyperinflated hemithorax, splayed ribs, respiratory distress, distended neck and upper arm veins
- Absent or reduced breath sounds, hyperresonance on percussion
- Reduced or absent chest wall movement on affected side, crepitus / surgical emphysema, trachea deviated away from affected side
- Low SpO_2, high ventilation pressures, hypotension, decreasing $EtCO_2$ indicating haemodynamic compromise

Treatment:

- Immediate decompression by thoracostomy this should be by finger thoracostomy, however, there may be a role for needle decompression as a temporising measure if there is a delay to obtaining the necessary equipment.
- Intercostal Drain insertion (ICD) is subsequently required.

Simple Pneumothorax

Collection of air in the pleural cavity without immediate threat to life.

Features:

- Clinical diagnosis may be difficult and only identified on imaging
- Increased respiratory rate
- Reduced breath sounds, hyperresonance on percussion
- Reduced SpO_2

Treatment:

- Dependent upon size and impact of pneumothorax – ranges from observation to ICD

Open Pneumothorax

Pneumothorax with communication to the external environment through a chest wall wound.

Features:

- Obvious chest wall wound, likely sucking in nature with features of pneumothorax

Treatment:

- Apply sterile occlusive dressing over wound and seal on **THREE** sides with tape to create a flutter valve – air can be expelled from chest cavity but not intrained on inspiration
- Proprietary chest seals exist
- ICD +/- Surgical intervention

Haemothorax

Collection of blood in the pleural space. Most are the result of rib fractures, lung parenchymal injury, and minor venous injuries, and are self-limiting. Arterial injury may result in major haemorrhage and require emergent surgical repair as part of resuscitation.

Features:

- Decreased chest expansion, dullness to percussion, and reduced breath sounds on the affected side
- Massive haemothorax involving the greater volume of a hemi-thorax may result in mediastinal / tracheal deviation
- Massive haemothorax result in haemodynamic compromise
- Most identified on imaging

Treatment:

- ICD,timing dependant on clinical picture
- Massive haemothorax will likely require concomitant resuscitation via the Major Haemorrhage Protocol (Sections 2.1 & 4.2) +/- surgical intervention

Rib Fractures & Flail Segment

Fractures of the lower ribs may be associated with diaphragmatic tears, liver and splenic lacerations. A significant force is required to fracture the first rib, thereby indicating a significant transfer of energy into the trauma patient. Flail segments may cause underlying lung parenchymal injury.

Features:

- Respiratory distress, chest pain, crepitus, surgical emphysema, hypoxia, paradoxical chest wall movements

Treatment:

- Supportive management of underlying lung contusion aimed at preventing pneumonia
- Rib Fracture Pathway (Section 3.10)
- Ventilatory support may be required

Pulmonary Contusion

Caused by an injury to the lung parenchyma, leading to oedema and blood collecting in alveolar spaces resulting in poor gas exchange, increased pulmonary vascular resistance, and decreased lung compliance. There is also a significant inflammatory reaction to blood components in the lung, and 50-60% of patients with significant pulmonary contusions will develop bilateral Acute Respiratory Distress Syndrome (ARDS).

CT is very sensitive for identification of pulmonary contusion.

Management is supportive. The physiological impact of lung contusions develop over 24-48 hours, therefore, close monitoring and administration of supplemental oxygen is required.

Thoracostomy

- Two chest drain packs should made immediately available for the arrival of a patient with suspected chest trauma in ED
- Surgical thoracostomy is the preferred technique for decompression of the chest in hospital, needle thoracostomy is reserved for patients in extremis whilst preparing for RSI and/or surgical decompression
- All pre-hospital thoracostomies should be explored with a sterile gloved finger and the wound decontaminated as part of the primary survey
- Insertion of the ICD may follow the trauma CT in cases where the thoracostomies are patent and the patient's ventilatory status is satisfactory. If there are any ventilatory concerns in these patients, ICD insertion should be performed prior to CT
- Subsequent ICD insertion should proceed through the same incision as the pre-hospital thoracostomy, unless there is obvious soiling or concerns

- All patients with thoracostomies **MUST** either have the thoracostomy wound closed if no ICD is required, or the ICD inserted and correct positioning confirmed with imaging **PRIOR TO TRANSFER FROM ED**.

2.4 Circulation

Stop External Bleeding

Stepwise approach to external bleeding

- Apply Simple Dressing
- Apply Direct Pressure
- Haemostatic Dressing
- Tourniquet

Tranexamic Acid.

Align and splint long bone fractures.

Apply pelvic binder if pelvic fracture suspected. If binder already in situ, check it is correctly positioned. Ensure feet/ankles are bound together.

NEVER spring the pelvis.

IV Access

A minimum of two large bore IV cannula should be sited and the following bloods drawn:

i. FBC
ii. Clotting
iii. Biochemistry
iv. Group & Save / Crossmatch
v. Venous Blood Gas
vi. ßHCG for all females of reproductive age

Alternatives to IV cannulae include Intraosseous cannulae, MAC (Multi-lumen Access Catheters), and Trauma Lines (8.5F Swann Sheath introducer lines). Lines **must** only be inserted by those who are experienced in their use.

Treatment of Shock

Resuscitation to haemodynamic stability is the aim. If haemodynamic instability is due to blood loss then this should be managed by controlling haemorrhage and replacing circulating blood volume in accordance with the Major Haemorrhage Protocol (Sections 2.1 & 4.2).

Neurogenic Shock

Hypotension and/or bradycardia may occur in high spinal cord injuries caused by sympathetic disruption. Resuscitation and treatment of any hypovolaemia should occur first followed by spinal cord protection with the potential need for vasopressors. Always exclude hypovolaemic shock first, but other causes of shock must also be considered to avoid over transfusion in these patients.

Focussed Assessment with Sonography in Trauma (FAST)

CT is the imaging modality of choice for assessment of the trauma patient. However, FAST may play a useful role in cavity triage. FAST may be utilised, at the discretion of the TTL, to quickly assess for free fluid in the abdominal and thoracic cavities, and to assess for pericardial collection. In certain situations (eg the haemodynamically unstable patient not suitable for CT, cavity triage may help decide which anatomical cavity is opened first in Theatre). However, FAST **must not** delay any treatment of transfer.

Interventional Radiology

Interventional Radiology may be indicated in the following situations:

- Transient haemodynamic responder with abdominal solid organ injury
- Stable Great Vessel injury
- Unstable pelvic injury with haemorrhage and no further life-threatening injury (Figure 12)
- Penetrating proximal vessel injury

Upper Limb Vascular Injuries

Isolated vascular injuries at and distal to the ACF are to be referred to the Plastic Surgery service at Salisbury District Hospital.

Polytrauma patients that have a vascular injury at or distal to the ACF are to be discussed with the Plastic Surgery Consultant at UHS between 8am and 6pm seven days a week. Out with these times (6pm to 8am seven days a week) advice must be sought from the Plastic Surgery service at Salisbury District Hospital.

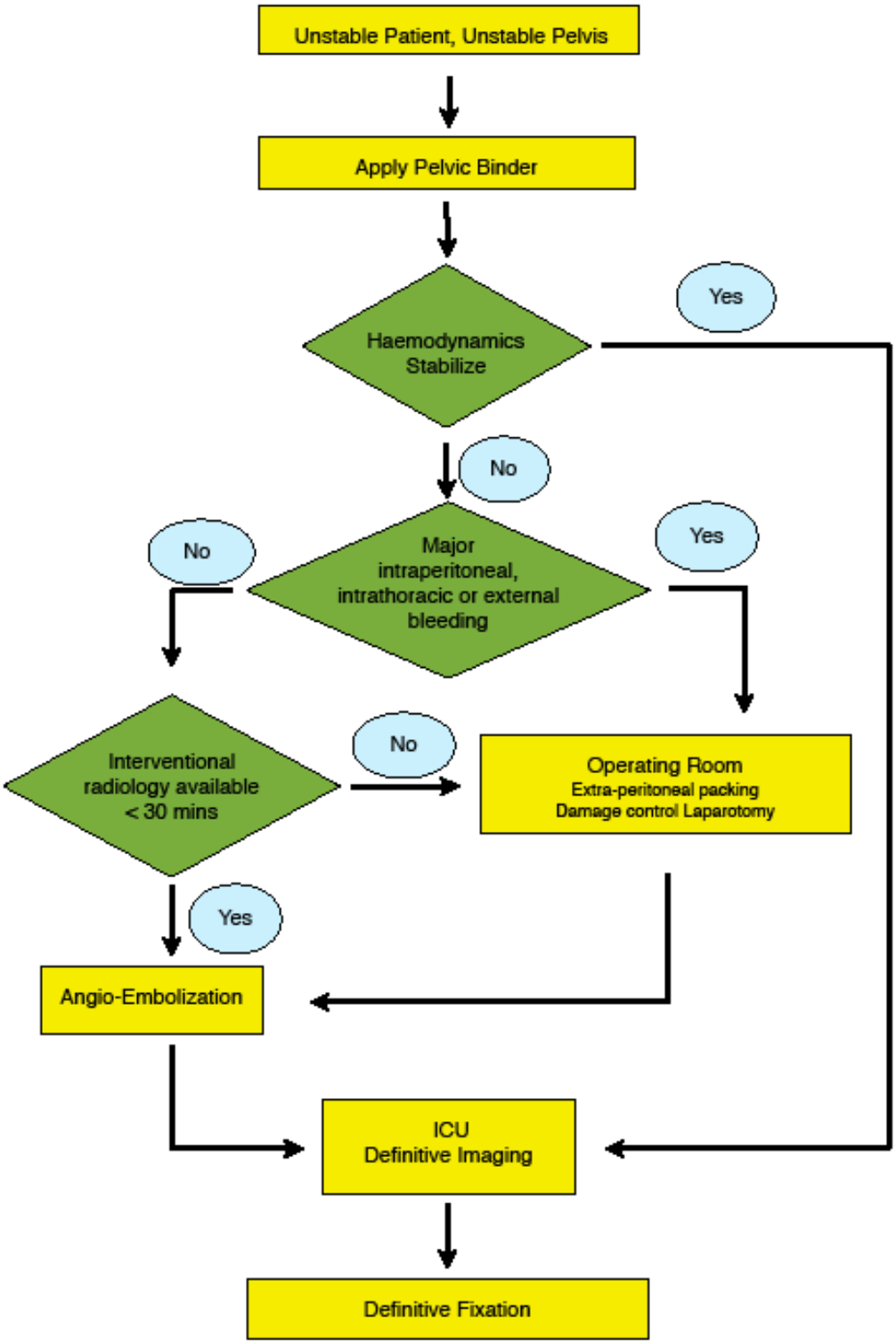


Figure 12. Haemodynamically Unstable Patient with an Unstable Pelvis Algorithm

Maxillofacial Haemorrhage

Exsanguinating haemorrhage from maxillofacial injury is an uncommon but potentially remediable problem. The Management of Catastrophic Maxillofacial Haemorrhage Algorithm (Figure 13) details the steps to be taken.

The patient must have their airway secured by RSI prior to formal attempts at haemorrhage control. Consider taking the patient to Theatre awake sitting forward where possible.

If required, a temporary control of haemorrhage may be achieved by pulling the midface forward manually. It should be noted that whilst the measures in the algorithm will achieve haemorrhage control in the majority of cases, in a few instances the manoeuvres may exacerbate bleeding. In this situation, the epistats and bite blocks may need to be removed.

In all instances of maxillofacial haemorrhage the Maxillofacial Surgery Consultant should be contacted immediately via Switchboard.

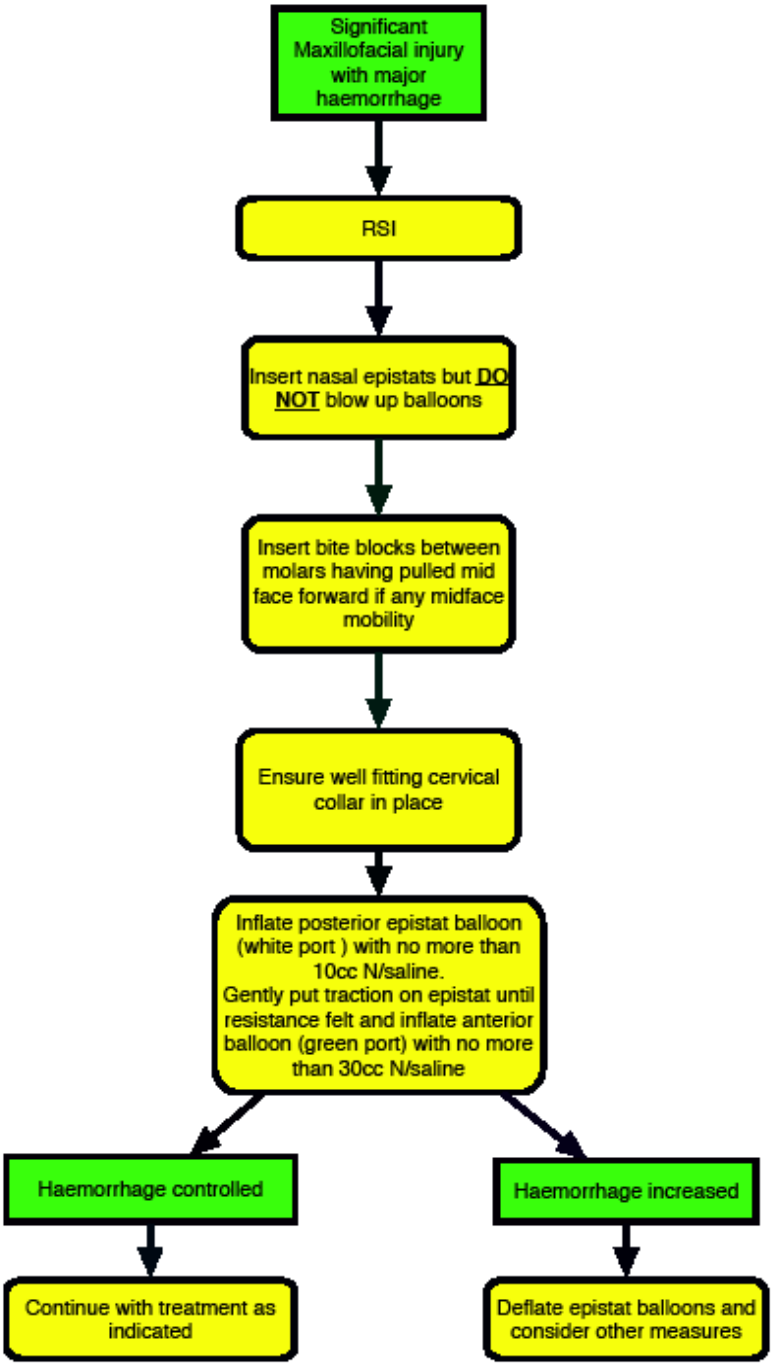


Figure 13. Catastrophic Maxillofacial Haemorrhage Algorithm

2.5 Disability

The priority for patients with potential brain or spinal cord injury is to prevent further harm. The severity and duration of secondary insults have a significant impact on outcome. It is essential that these are anticipated and prevented by all those involved in the care of the patient.

Assessment

Glasgow Coma Score (GCS)

The frequency required for reassessment of GCS depends on the risk of deterioration. Patients can go from being fully conscious to unconscious over a few minutes. Never assume that alterations in consciousness are due to alcohol or other drugs. Painful stimuli are best applied as a squeeze of the trapezius. Do not crush the nail beds or perform sternal rubs.

Eye opening response:	
Spontaneously	4
To speech	3
To pain	2
None	1
Eye closed due to swelling	C
Best motor response:	
Obeys commands	6
Localisation to painful stimuli	5
Normal flexion to painful stimuli	4
Spastic flexion to painful stimuli	3
Extension to painful stimuli	2
None	1
Best verbal response:	
Oriented	5
Confused	4
Inappropriate words	3
Incomprehensible sounds	2
None	1
Intubated	T

Figure 14. Glasgow Coma Score

Localising Signs

It is essential that both sides are compared and that the presence or absence of limb movements are noted and documented, particularly before patients are sedated and/or paralysed.

Pupillary Signs

A unilateral fixed and dilated pupil is most commonly due to raised intracranial pressure. Less commonly it may result from direct trauma. Bilaterally fixed and dilated pupils most commonly result from coning due to raised intracranial pressure. Rapid resuscitation with administration of a hypertonic solution such as mannitol or hypertonic saline may allow emergency imaging and Neurosurgical intervention.

NOTE: Check for coloured cosmetic contact lenses. These are difficult to see unless specifically looked for and can give rise to misinterpretation of both pupillary signs and reactivity.

Anal Tone

Absent anal tone implies loss of tone of the involuntary sphincter (smooth muscle) and a potential spinal cord injury. Anaesthetic agents reduce anal tone. Muscle relaxants abolish the tone of the voluntary sphincter (striated muscle). Where a spinal injury is suspected and time/clinical situation allows, perform a PR examination prior to induction of anaesthesia and intubation if possible.

Priapism

In male trauma patients, the presence of priapism implies a spinal cord injury. This is an important clinical sign that may disappear within minutes. Its presence should be noted and documented.

Minimise Secondary Brain Injury

All of the following can cause deterioration in patients with traumatic brain or spinal injury:

- Hypoxia — Aim PaO_2 >13kPa
- Hypo/Hypercarbia — Aim $PaCO_2$ 4.5-5kPa
- Hypotension — Aim MAP >90mmHg (CPP >60mmHg if ICP monitored)
- Hypo/Hyperthermia — Maintain normothermia
- Seizures — Loading with 1g IV Phenytoin should be considered

In addition, the patient's neck should be in a neutral position and the cervical collar checked to ensure venous outflow is not obstructed. **Loosen** cervical collar in intubated patients while keeping the head immobilised (e.g sand bags and tape).

NOTE: In the absence of hypotension the whole bed should be placed on a 30^0 head up tilt for patients with severe head injury. This simple manoeuvre can significantly help in reducing raised intracranial pressure.

Scoop stretchers are for extrication of patients and are used to facilitate transfers. They are uncomfortable and present a significant risk of pressure damage for all patients but particularly those with spinal cord injuries.

NOTE: It is the responsibility of the team leader to ensure that the scoop stretcher or spinal boards are removed as soon as possible.

Mannitol & Hypertonic Saline

The European Brain Injury Consortium and the Brain Trauma Foundation recommend the use of mannitol as the osmotic drug of choice in brain injured patients. Mannitol reduces intracranial pressure within a few minutes.

Patients with 1 or 2 fixed & dilated pupils, which is felt to be due to raised intracranial pressure, should receive an IV bolus of either

- 10% Mannitol 1g/kg (10ml/kg 10% Mannitol), or
- 2.7% saline 6ml/kg

Traumatic Brain Injury: Ventilated Patients

www.neuroicu.org.uk for up to date guidance.

Rapid assessment including pupils and monitoring parameters.

Airway	ET tube type & length at lips; $EtCO_2$ monitoring
Breathing	FiO_2; RR; Tidal Volume; Bilateral air entry & SpO_2 >97%
Circulation	HR; BP (MAP >90mmHg); Presence and positioning of arterial line
Disability	Pupils (remove contact lenses); Sedation; ?Muscle relaxation
Environment	Temperature; Glucose

Ensure adequate sedation and determine level of pre-existing neuromuscular blockade using a Nerve stimulator/ TOF device.

All patients should be assumed to have an unstable spinal injury unless the spinal algorithm (Figure 16) has been completed and Consultant Radiologist report confirms the absence of any acute spinal injury. Transfer patient onto Neuro ICU bed maintaining spinal alignment.

- Patient should be placed in a hard cervical collar
- Transfer of patient will require spinal turns or the use of a scoop stretcher
- 30^o head up tilt of whole bed

Follow Intracranial Injury Pre-transfer Checklist (Figure 15).

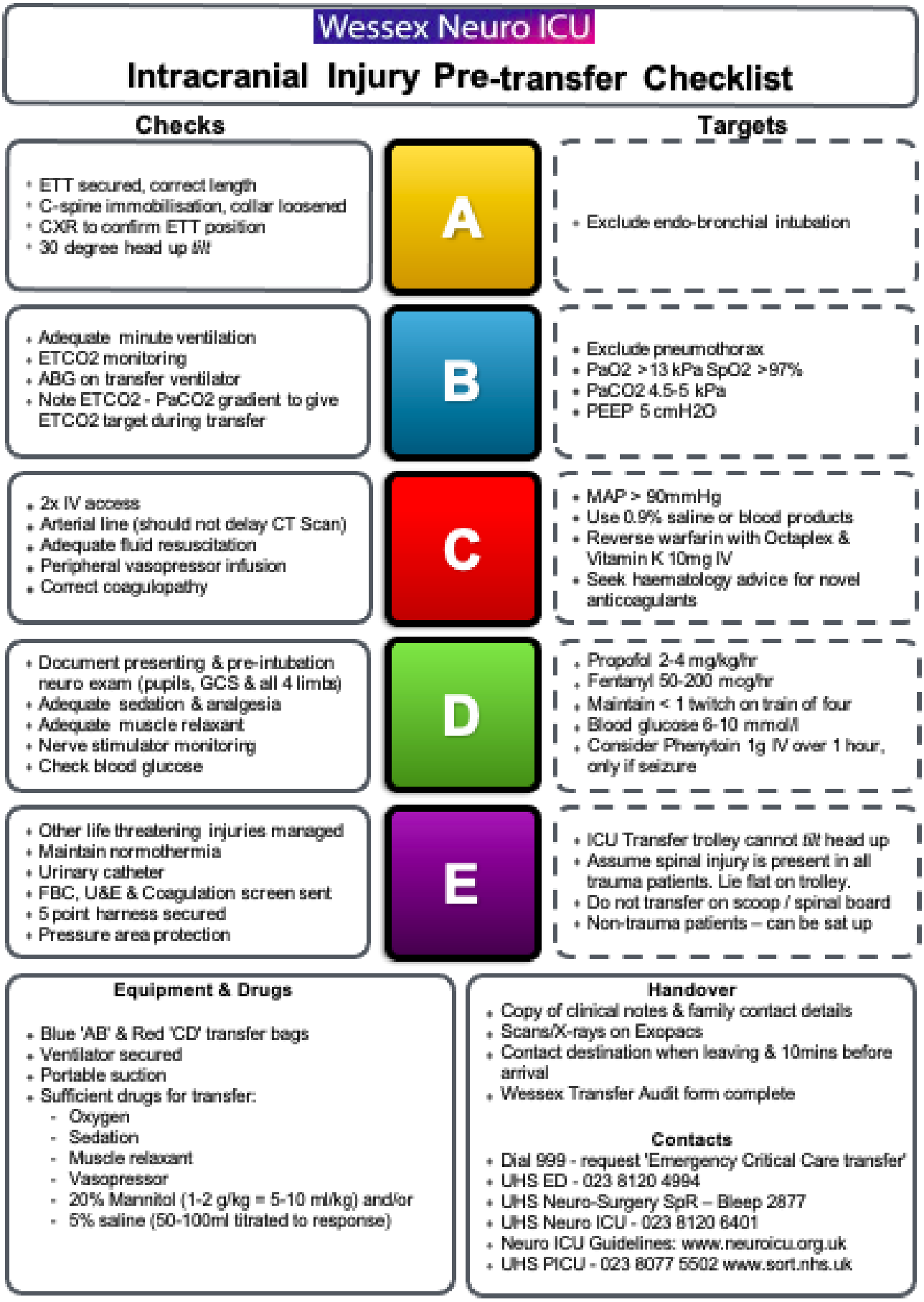


Figure 15. Intracranial Injury Pre-transfer Checklist

Traumatic Brain Injury: Self-ventilating Patients

www.neuroicu.org.uk for up to date guidance.

Rapid assessment including pupils and monitoring parameters.

Airway	Maintained and clear; No signs of upper airway obstruction
Breathing	Adequate rate and depth of respiration with SpO_2 >97%
Circulation	HR; BP
Disability	GCS; Pupils; Lateralising neurology, including dysphasia

All patients should be assumed to have an unstable spinal injury unless the spinal algorithm (Figure 16) has been completed and Consultant Radiologist report confirms the absence of any acute spinal injury.

- Patient should be placed in a hard cervical collar
- Transfer of patient will require spinal turns or the use of a scoop stretcher
- 30º head up tilt of whole bed
- Patient should not be triple-immobilised on a bed without a scoop – the rest of their body can move and result in spinal misalignment

Follow Intracranial Injury Pre-transfer Checklist (Figure 15).

NOTE: Any patient with a head injury who is sedated to a level that they cannot be clinically assessed should be discussed with the Neurosurgeons for consideration of ICP monitoring.

Phenytoin

Consider Phenytoin (1g IV loading dose) in all patients with traumatic brain injury, especially in the presence of:

- History of seizures
- Skull fracture
- Conservatively managed extradural haematoma
- Temporal lobe injury (eg contusion)

Other Considerations

- Tetanus if open wound (immunoglobulin +/- vaccination)
- Pneumovax if intracranial air
- Pabrinex 1 pair IV BD if patient alcohol dependent
- Ceftriaxone 4g single dose for open skull fracture
- Variable rate insulin infusion for glycaemic control

Management of Spinal Injury

Examination

Airway	Secure; C-spine immobilised
Breathing	Adequacy of ventilation
Circulation	Assume hypotension is secondary to blood loss **not** spinal shock
Disability	GCS; Pupils

Associated injuries including pressure areas.

Level of spinal injury

- Clinically
- Radiologically
- Complete / Incomplete / Absent

Investigations

Spinal imaging will be via trauma CT initially.

Arterial blood gases.

Non-ventilated patients will require regular measurement of vital capacity.

Management

Oxygen. Most patients with lesions below C4 are able to make sufficient respiratory effort to avoid respiratory support, but do need supplemental humidified oxygen.

Ventilation.

- Patients with injuries at C2 or C3 will require invasive ventilation
- Consider elective ventilation in high cervical injuries with RR >30/min, deteriorating ABGs, vital capacity <1200ml
- Tetraplegic patients find it easier to breathe when supine

Circulation. Spinal shock may produce hypotension and bradycardia, particularly from injuries above T6. Ensure BP is adequate to maintain normal mentation and urine output. Where there is concern regarding spinal cord perfusion a higher MAP of >80mmHg should be considered.

Immobilisation. Remove form scoop stretcher as soon as possible. Once immobilised, the decision to remove protection should only be made after appropriate investigations have been completed and reported. The decision to remove immobilisation must be clearly documented in the notes, signed and dated.

Steroids. There is ongoing debate regarding the efficacy of steroids in acute spinal injury. The consensus opinion from the Wessex Neurological Centre is that steroids **should not** be given.

Guidelines for initial spinal management of sedated and ventilated trauma patients

University Hospital Southampton NHS
NHS Foundation Trust

Full spinal precautions

Unknown mechanism of injury or fall greater than patient's own height or high energy impact or age >50

Hospital No:
DOB:
Surname:
First name:
ADDRESSOGRAPH LABEL

Trauma Patient Spinal Management

1

Yes ☐ → Full Trauma CT or CT Head & Cervical spine & thoracolumbar imaging

No ☐ → CT Head & Cervical spine → Bony injury of C-Spine → Thoraco-lumbar spinal imaging

Signed:
Print:
Date:
Time:

Consultant radiologist report

Report of spinal imaging to include:
?any inadequacy of imaging
?fracture ?alignment (dislocation)
?soft tissue swelling indicative of spinal injury

Cervical (C-spine) imaging report
Consultant name:

Thoracolumbar (T&L spine) imaging report
Consultant name:

2

Injury reported on imaging of spine

☐ No

Yes ☐

Signed:
Print:
Date:
Time:

A normal CT does not exclude ligamentous injury.

Consultant spinal Surgeon

Name:

Management plan / nursing care to ensure alignment maintained

Stable C-spine Stable T&L spine	Stable C-spine Unstable T&L spine	C-spine stable in hard collar Stable T&L spine	Unstable C-spine +/- Unstable T&L spine
A No hard collar Patient sat up Normal turns ☐	**B** No hard collar Bed tilted head up Full spinal turns ☐	**C** Hard collar Patient sat up Normal turns with head hold ☐	**D** Hard collar Bed tilted head up Full spinal turns ☐

3

ICU Consultant signature:
Print:
Date:
Time:

Mark identical box A-D over the page →

Sept 2012, Version 4.2

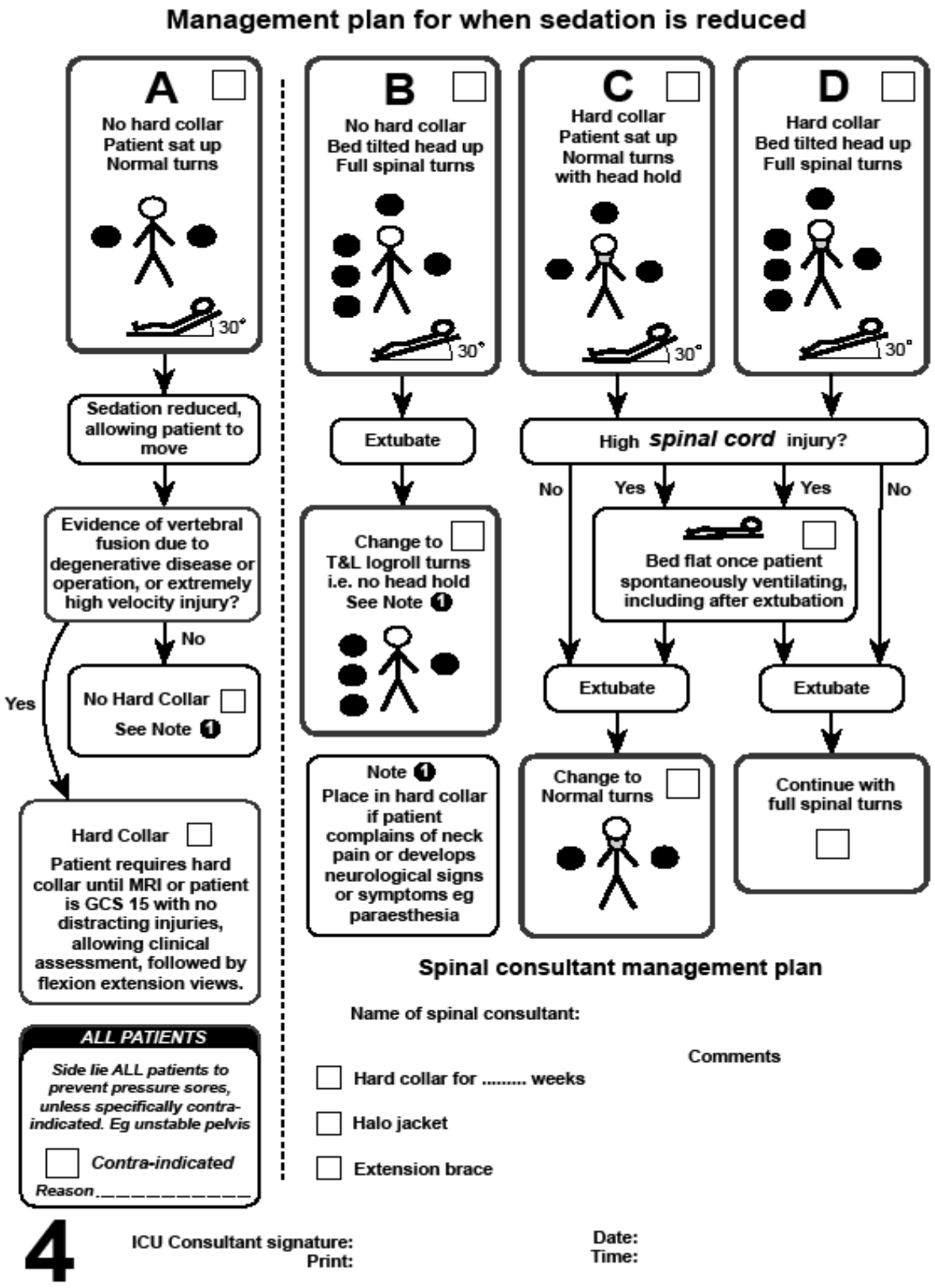


Figure 16. Initial Spinal Management of Sedated & Ventilated Trauma Patients

2.6 Exposure & Environment

Temperature

Temperature control is vitally important in major trauma patients. Patients lose heat from the moment of injury.

Patients arriving in the ED may already be hypothermic and there should be a definitive focus on preventing further heat loss and restoring body temperature.

Temperature should be measured on arrival and at regular intervals until normothermia is maintained. The environment itself may cause heat loss as the ambient temperature in Resus is often low.

Patients should be 'skin to scoop' but if this has not occurred all wet clothing should be removed on arrival. Efforts should be made to keep the patient covered at all times except during the initial assessment. Heat loss form the head can be considerable.

All fluids administered, blood or otherwise, should be warmed. This is achieved via the Belmont Rapid Infuser or Ranger.

Forced air warmers such as 'Bair Hugger' should be used to keep the patient warm. These may be transported to CT scan with the patient on the transfer trolley.

Immobilisation

All major patients should remain immobilised until their spine has been cleared by someone trained in this procedure. Those trauma patients within significant mechanism, signs or symptoms or spinal injury should in particular remain immobilised until their imaging and clinical assessment are complete.

These patients should continue to be log-rolled unless they are immobilised on a suitable transport board such as a scoop stretcher.

All major trauma patients should remain on the scoop stretcher during their initial management for ease of transfer and spinal protection. The scoop is extremely useful for transferring patients on/off the CT scanner table and/or straight to Theatre or ICU whilst maintaining spinal protection.

Further information on different scoops is at Section 3.11.

2.7 Trauma Imaging

The aim is for all level 1 trauma patients to be in the CT scanner within 30 minutes of arrival at hospital, clinical circumstances allowing. To facilitate this there is formal agreement with the Radiology Department that level 1 trauma patients do not require discussion with a Radiologist. The appropriate request is made on eQuest and then the emergency scanner is called (6108 / 4999) and the CT Radiographer informed that the request is on the system. The CT Radiographer will inform the Radiology SpR who will move to the scanner and provide a hot report (Section 3.12).

There is agreement that where there are limb injuries which may involve vascular structures then the relevant CT angiogram will be performed alongside the trauma CT. This decision should be made by the TTL and is requested alongside the trauma series CT. Likewise, where there exists maxillofacial injuries, a CT facial bones and mandible may be performed. This will reduce unnecessary repeat transfers for imaging and allow timely decision making by relevant specialist teams.

Transfer to CT

Reducing time to CT is vital. Nothing should be undertaken in the ED that delays transfer unless it will immediately affect the outcome for that patient.

Utilise transfer trolley and ensure that it is fully stocked.

Utilise Transfer Checklist.

2x IV access must be obtained to allow for IV contrast and ongoing treatment.

Be aware of pregnancy status in woman of childbearing age – the mother's health takes priority over the foetus.

As a minimum, the TTL, Anaesthetist, Surgeon, and Scribe are to attend the CT scanner.

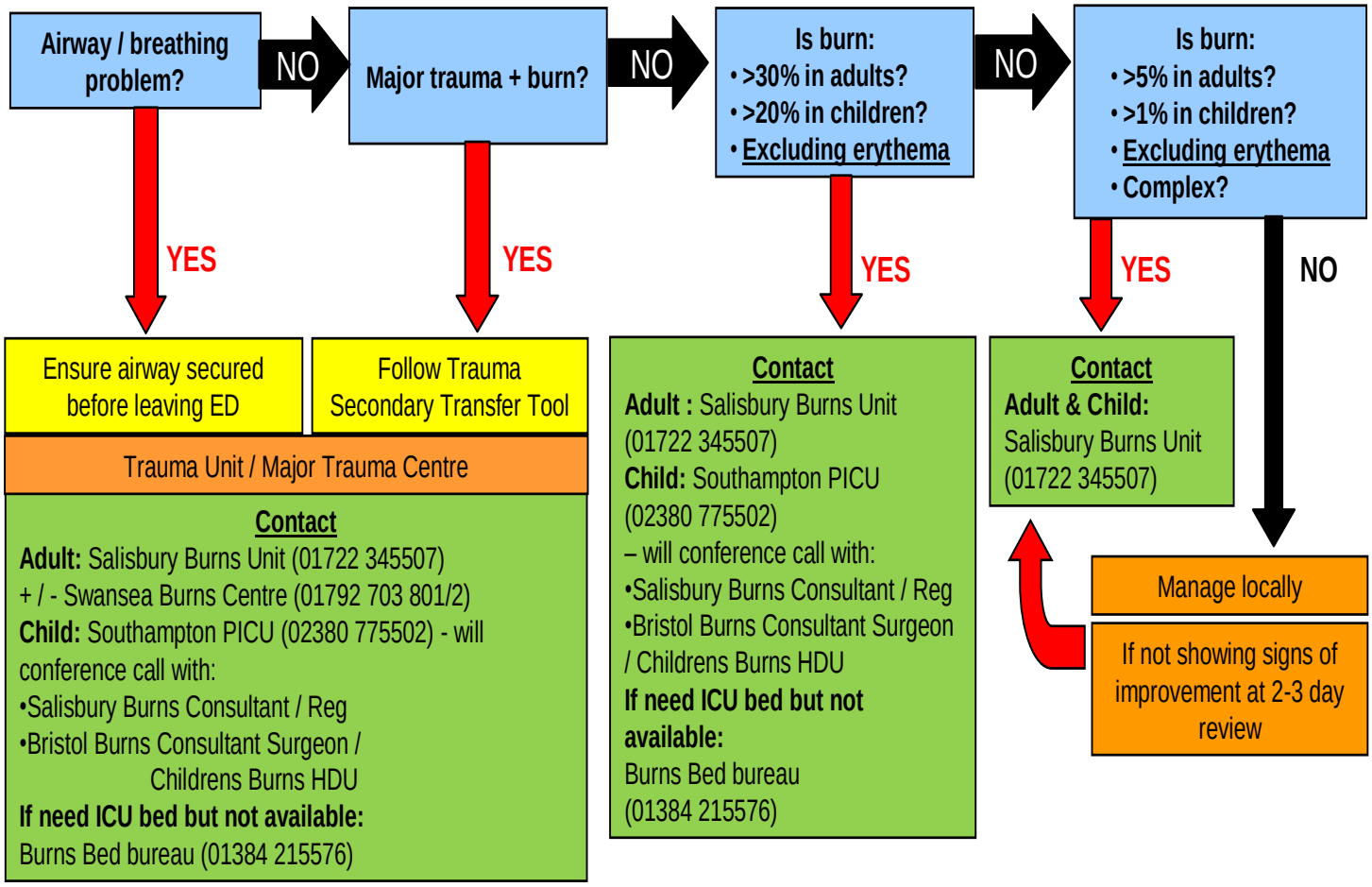
If intracranial injury is suspected contact the Neurosurgery SpR (bleep 2877) from the CT scanner so they can review images.

If an ICU bed is required call the relevant ICU from the CT scanner to allow them adequate time to prepare a bed.

Consider the destination following CT. this is most often back to Resus to allow completion of initial resuscitation, but on some occasions may be straight to the Operating Theatre, Interventional Radiology Suite, or ICU.

2.8 Burns Triage Tool

Burns Triage Tool : Trauma Centre & Trauma Units

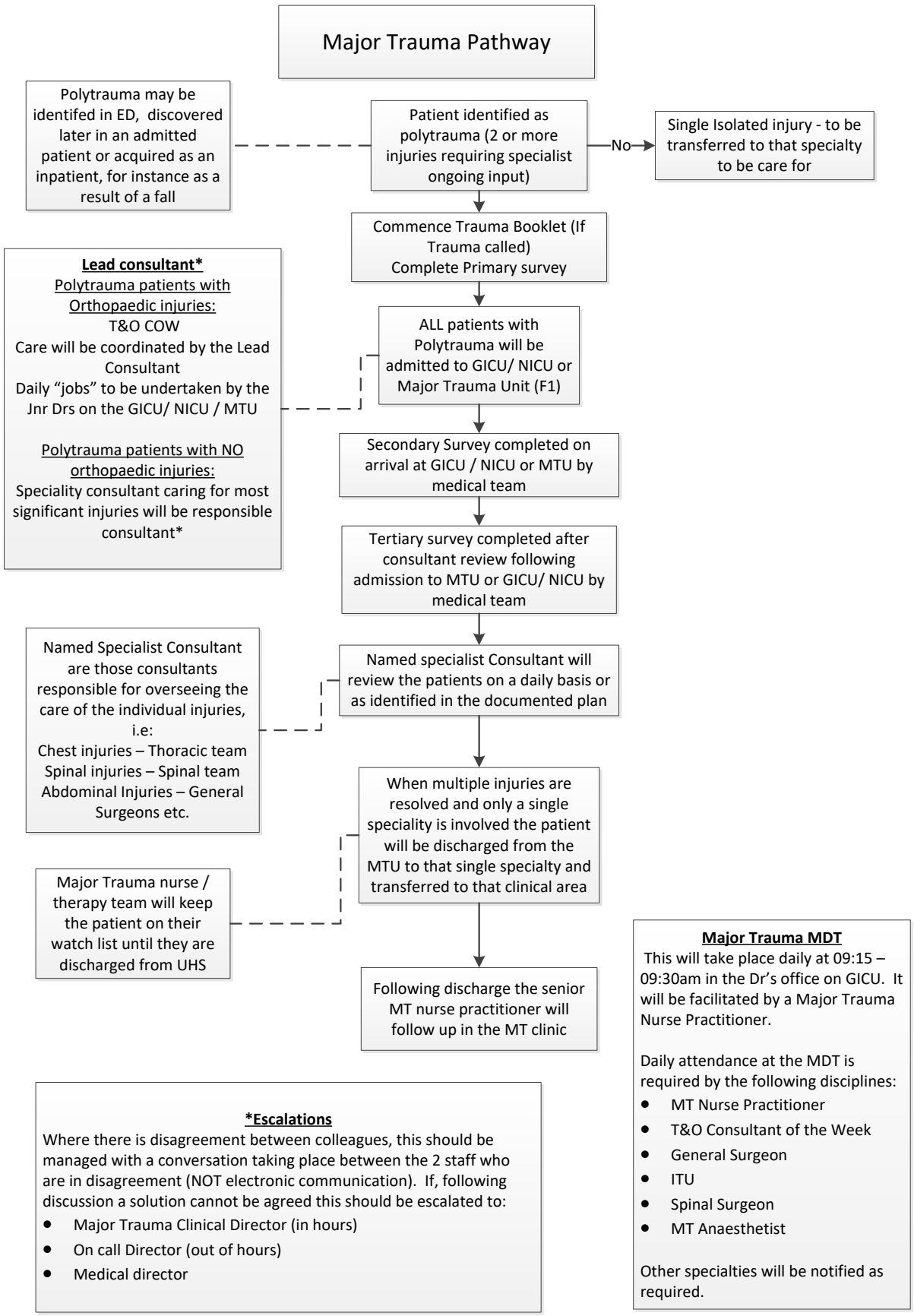


Complex Burn

- **Site:** Face, hands, perineum, feet, circumferential
- **Mechanism:** Chemical, Radiation, High pressure, Electrical
- **Toxic shock:** Delayed onset of High temp, rash, D&V, systemically unwell

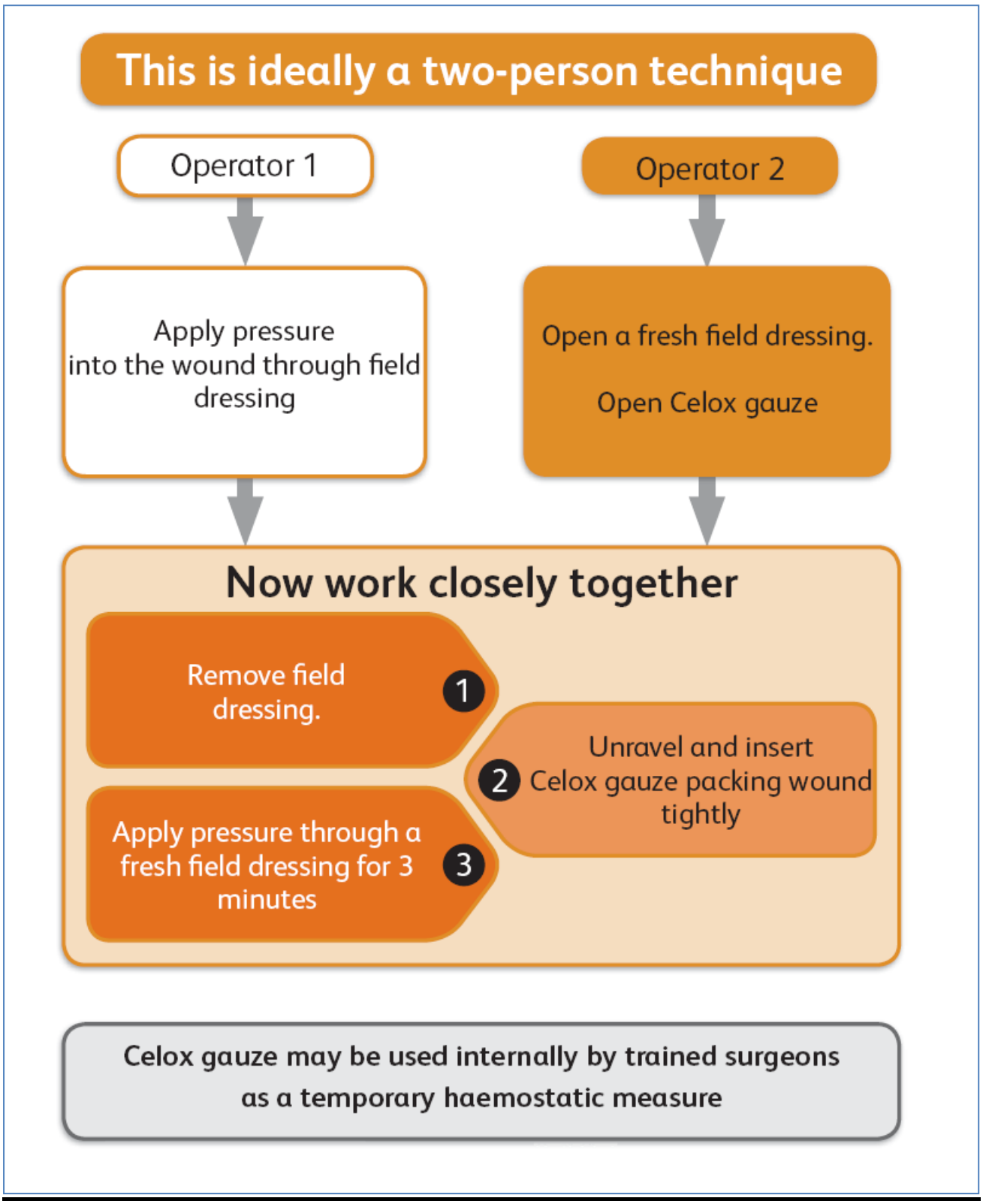
Depth: Full thickness any site
Age: <5 years, >60 years

2.9 Admission Destination



3 Trauma Resuscitation Supporting Documents

3.1 Application of CeloxTM Gauze



3.2 Belmont Rapid Infuser

The Belmont rapid infuser is utilised when large volumes of blood need to be given quickly. Training in the device must be undertaken before its use.

NOTE: That this is an extremely powerful rapid transfuser. Left unchecked it can deliver huge volumes of blood/fluids within an extremely short period of time.

The default is to administer repeated boluses (e.g. 300 ml) with regular reassessment of the patient. The CODE RED nurse will be in charge of the Belmont and is also responsible for ensuring an accurate running total of the volume and type of fluids / blood products administered. They should regularly liaise with the Anaesthetist and Team Leader as to ongoing requirements.

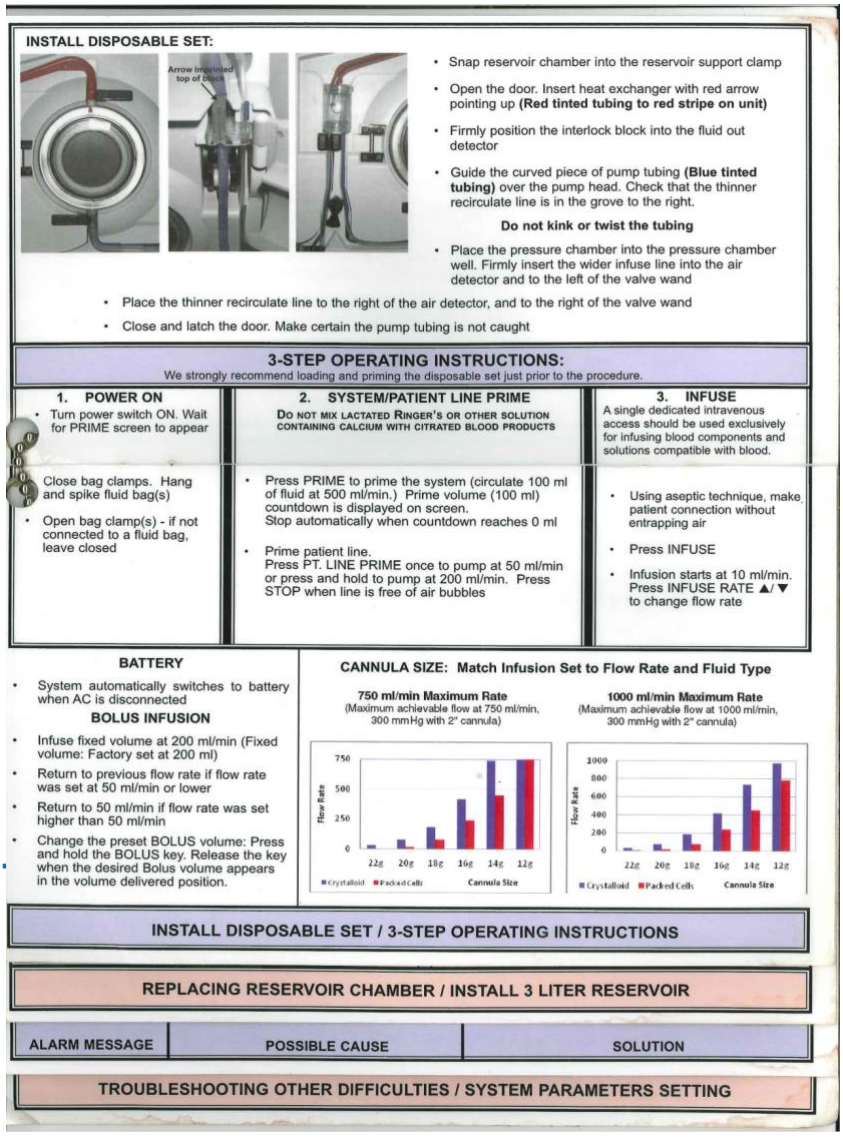


Figure 17. Belmont Rapid Infuser

The benefits of the Belmont include the ability to transfuse when disconnected from a power source.

The Belmont will not heat fluids whilst running on battery power and the rate will be reduced to 50ml/minute.

The x-ray lift if used to transport from ED to theatres may allow the Belmont to be plugged in briefly during transfer.

The Belmont should be plugged in when not transported to ensure the battery is charged when required.

3.3 Resuscitative Thoracotomy

- Request the ED thoracotomy set (A4 sized clear Tupperware box kept in ED Resus).

  Contents:

  1 pair of large shears
  2 pairs of trauma scissors
  1 suture set
  1 foley catheter
  3 3/0 vicryl sutures
  2 wound staples
  2 10 blade staples
  1 large artery forceps

- The procedure is carried out immediately within the emergency department, by the major trauma team. Call for the cardiothoracic registrar (fast bleep 9211) and consultant to attend. If the procedure is successful then the surgical team will be integral to continued care

- Intubation, ventilation, intravenous/intra-osseous access, should be performed by members of the trauma team and not delay the thoracotomy

- Time should not be wasted on full asepsis but a rapid application of skin preparation such as 2% chlorhexidine/70% alcohol preparation can be used

- Using a scalpel and blunt forceps make bilateral thoracostomies (breaching the intercostal muscles and parietal pleura) in the 5th intercostal space in the mid- axillary line

- The procedure is stopped at this point if tension pneumothorax is decompressed and cardiac output returns

- Connect the thoracostomies with a deep skin incision following the 5th intercostal space (figure 18). Ensure the incision extends posteriorly bilaterally to the posterior axillary line – this allows adequate access when opening the clamshell. A skin incision following the 5th intercostal space is made between the posterior axillary lines

Figure 18. Landmarks for Resuscitative Thoracotomy

- Insert two fingers into a thoracostomy to hold the lung out of the way while cutting through all layers of the intercostal muscles and pleura towards the sternum using heavy scissors following the skin incision previously made. Perform this on left and right sides leaving only a sternal bridge between the two anterolateral thoracostomies

- Cut through the sternum or xiphoid using the heavy scissors or Gigli saw

- Open the ‘‘clam shell’’ using one or two gloved assistants. If exposure is inadequate the incisions need to be extended posteriorly

Aims of Resuscitative thoracotomy

Treat cardiac tamponade

- The pericardium is opened longitudinally to avoid damage to the phrenic nerve, which runs along its lateral border. Make a small incision in the pericardium with scissors and then tear the pericardium longitudinally with your fingers - this will avoid lacerating the phrenic nerve. Evacuate any blood and clot from the pericardial cavity. Deliver the heart out of the pericardium
- Cardiac wounds should be controlled initially with direct finger pressure. Large wounds may be controlled temporarily by the insertion of a Foley catheter with inflation of the balloon. Take care also not to miss posterior cardiac wounds. Examination of the posterior surface of the heart requires displacing it anteriorly, which may obstruct venous inflow
- Wounds can be directly sutured using non-absorbable 3/0 sutures such as nylon or polypropene. Bypass is unnecessary, even in the beating heart. With wounds in the region of the coronary vessels, mattress sutures are used to avoid obstructing coronary flow. Atrial wounds are sutured using a continuous technique

Descending aorta compression

- The rationale for clamping the aorta is to redistribute blood flow to the coronary vessels, lungs and brain, to reduce exsanguination from injuries in the lower torso.
- Clamp time should ideally be 30 minutes or less.
- Cross-clamping of the descending thoracic aorta should possibly be reserved for patients with potential exsanguinating injuries to the distal torso.

Hilar techniques

- Massive haemorrhage from the lung or pulmonary hilum can be temporarily controlled with finger pressure at the pulmonary hilum. This may be augmented by placement of a Satinsky clamp across the hilum. An alternative is to tie off the pulmonary hilum using tracheal tube tie or tape from a laparotomy pack.

3.4 Major Trauma Airway Algorithm

Optimise the patient: Ensure trolley height appropriate, scoop at top of trolley, and establish 360 degree access to the patient. If required move the trolley slightly or instruct team members not directly involved in the RSI to momentarily step away from the patient. Do not attempt intubation or RSI without gaining situational awareness and team cooperation. The TAP should stand to the right of the patient as is standard in the anesthetic room. The TTL should call for silence from the rest of the team during RSI and handover leadership to the Anaesthetist, whilst maintaining overall situational awareness of the patient. The Anaesthetist is responsible for communicating their plan in advance and any difficulties to the TTL.

Access: preferably 2 reliable IV/ IO access

Rapid airway assessment: Do I need to call for help or a second pair of hands? Is this patient 'wakeable'? Would FONA be achievable? Consider marking cricothyroid membrane.

Optimise pre-oxygenation

Optimise physiology: e.g. blood, fluid, vasopressor

Confirm full monitoring is in place and functioning according to the AAGBI guidelines. Note baseline observations, including pupil diameters and light reflexes, GCS and presence of movement in all four limbs prior to RSI. End tidal CO_2 monitoring MUST be functioning and attached.

Preparation for the RSI: Everything should be aimed at optimising the first attempt at intubation. The TAP will provide the standard lay-out of equipment and ensure the difficult airway trolley is immediately available. Before commencing induction, the Anaesthetist and ODP should rapidly 'talk through' the procedure, and perform the pre-RSI challenge-response checklist whilst the patient is being pre-oxygenated.

Allocate roles: Roles should have been pre-allocated. Keep noise to a minimum.
Agree**-** *Who is giving drugs? Who do we call for help? Who is noting the time?*

- **Manual in-line cervical spine stabilization:** Allocate to a Team Member (most easily performed with this team member standing from the below the patients neck) and when this is in place remove the neck blocks and release the Cervical Spine collar for the intubation.
- If cricoid pressure is applied this must be performed by the TAP.
- **Tension pneumothorax**: Anticipate the rapid development of a tension pneumothorax after intubation in patients with chest injuries. A small simple pneumothorax may rapidly expand upon commencing positive pressure ventilation (PPV). Discuss this risk with the TTL in advance and ensure they instruct them a team member to prepare to perform immediate thoracostomies. Transthoracic ultrasound may be used to confirm the diagnosis.

Induction: Administer predetermined doses of induction agents. C-spine immobilization may worsen the laryngoscopy view therefore intubation should always be performed with the assistance of a bougie. Avoid cutting Endotracheal tubes. It may be helpful for the TAP to give time prompts to the Anaesthetist to assist with managing attempts at intubation, as well as verbalising the SpO2 reading. The Anaesthetist should stop laryngoscopy and re-oxygenate the patient if significant desaturation occurs.

Pre RSI sedation/ delayed sequence induction: In agitated patients it may be necessary to use small amounts of sedation to facilitate pre-oxygenation and compliance whilst preparing for the RSI. Use with extreme caution in hypovolaemic or hypoxic patients.

Failed Intubation

Failed first attempt at intubation

- Consider use of the McGrath or C-MAC video laryngoscope (often requires the use of a stylet to direct the endotracheal tube). Anaesthetists must ensure they have received appropriate training before using these.
- The iGEL LMA is the default device for re-oxygenation and ventilation following a failed intubation attempt. This device reduces gastric inflation and subsequent aspiration.
- Only once re-oxygenation has been achieved can a second attempt at intubation be performed. Always change something before proceeding to a second look

Failed second attempt at intubation

- If the second attempt at intubation is unsuccessful then attempt to maintain oxygenation and ventilation with the iGEL LMA. Decide if a third attempt is desirable.
- If anatomy / pathology of the neck suggest that a surgical airway will be difficult or the Anaesthetist decides that the risks of a surgical airway outweigh the possible benefits, then the iGEL LMA should be left in place.

Failed Intubation, failed oxygenation

- If oxygenation and ventilation via the iGEL LMA fails or bleeding in the airway / soiling of the airway prevents adequate airway protection by the LMA, Front of Neck Access (FONA) must be performed.

Front of Neck Access (Surgical Cricothyroidotomy)

The fourth national audit project (NAP4) data showed a needle cricothyroidotomy failure rate of approximately 60%, whereas a surgical technique for emergency cricothyroidotomy was almost universally successful. Common errors were a lack of ‘planning for failure’ and poor performance in ‘can’t intubate can’t ventilate’ (CICV) situations, despite clear guidelines from the Difficult Airway Society. Naturally this is a high stakes manoeuvre with significant risks both with action and inaction.

3.5 Front of Neck Access Procedure

Declare an emergency.

Call for help. Continue to give oxygen via upper airway. Extend neck.

- Where the structure can be identified a scalpel blade is inserted horizontally into the cricoid membrane using a “stab / rocking” technique. In those where structures can’t be identified a vertical incision is made through skin, followed by a horizontal incision through the membrane when identified.
- Turn blade 90 degrees, sharp edge caudally. Leaving the blade in position, a lubricated intubating bougie is inserted into the trachea.
- A 6.0 mm cuffed tracheal tube is then railroaded over the bougie with a rotating motion and the bevel of the ETT facing posteriorly to aid passage over the bougie.
- Once the ETT is inserted approximately 10 cm, the bougie is removed and the cuff inflated.
- Tube position is confirmed by capnography and auscultation. The tube is then secured in position with elastoplast and the proximal end taped to the jaw to aid stability.
- Conversion to a formal surgical airway is required once ENT or Maxillo-facial teams are available and at an appropriate point in the patients course.

In ED Resus the FONA equipment is present in the standard airway trolley (2nd drawer) and its use should be anticipated in the following circumstances:

- Facial or upper airway trauma
- Difficult anatomy
- Burns to face and neck precluding jaw movement
- Inhalational burns
-

Please contact Max-Fax or ENT early if airway difficulties are anticipated, but if the patient is in extremis do not wait for their arrival before proceeding.

3.6 Pre-RSI Checklist

UHS Anaesthetic Department – Trauma Group

Trauma pre-RSI challenge-response check list

Note: This checklist is for stable patients. Time should not be wasted on agonal patients who require precipitant RSI, where pre-oxygenation and performing the full checklist may not be possible – see reverse side for Immediate RSI Checklist

Indication for RSI - confirm RSI required and trauma team leader informed

Pre-oxygenation	
Oxygen mask on tight & reservoir bag moving with ventilation	Check
Tubing attached to Oxygen on high flow	Check
BVM / Waters circuit available and attached to O2	Check
Mask size checked and correct	Check
Sidestream EtCO2 attached to monitor and working	Check

Airway	
Tube size 'x'	size 'x' Check
Tube cuff tested, correct length & connector secure	Check
Syringe for cuff	Check
Alternate tube size 'x'	size 'x' Check
Bougie	Check
Tube tie	Check
Catheter mount	Check
HME Filter	Check
Sidestream EtCO2 connected to HME	Check

Laryngoscopes	
Mac 3/4 'x' & bulb working	Check
C-MAC D-blade & light/screen working	Check
Stylet preformed for D-blade	Check
OP + NP airways	Check
iGEL LMA size 'x'	size 'x' Check
Airtraq size 'x'	size 'x' Check
Difficult airway trolley available	Check

IVI / Drugs	
Cannula connected to fluid and runs easily	Check
Spare cannula in situ	Check
Induction: Fentanyl / Ketamine / Roc 3:2:1 – calculate doses	Check
Other drugs: Propofol infusion / Phenylephrine / Morphine / HTS	Check
Suction working and positioned	Check
In-line immobiliser briefed	Check
Cricoid pressure person briefed	Check
Baseline BP, HR, SpO_2 noted	Check
Pupils Sizes + all 4 limbs moving?	Check

V2 Sept 2012 Anaesthesia Trauma Group Review date:June 2013

Figure 19. Pre-RSI Checklist

3.7 Immediate RSI Checklist

UHS Anaesthetic Department – Trauma Group

IMMEDIATE RSI Checklist

NB – Only to be used for patients requiring immediate definitive airway, where pre-oxygenation is NOT feasible.

Indication - **confirm immediate RSI required and trauma team leader informed**

Oxygen + Ventilation		
BVM or Waters circuit attached to high flow Oxygen		Check
ETT size 'x'		Check
Bougie		Check
iGEL size 'x'		Check
Difficult airway trolley		Check
Suction		Check
IV in-situ and flushed		Check
Drugs	Fentanyl / Ketamine / Rocuronium	Check
	Dose: 3:2:1 or 1:1:1?	Check
$EtCO_2$		
Sidestream $EtCO_2$ connected + working or ***"Easicap"***		Check
BP, HR and SpO_2?		Check
Pupils – HTS required?		Check
Tension - Immediate thoracostomies required after RSI?		Check
In-line immobilisation		Check
Cricoid pressure		Check

V2 Sept 2012 Anaesthesia Trauma Group Review date:June 2013

Figure 20. Immediate RSI Checklist

3.8 Trauma Bay Checklist

Anaesthetic Adult Trauma Bay Checklist

Note: This checklist is to be completed prior to the arrival of the trauma patient and should be performed in a challenge-response manner by ED Nurses and ODP. All crosses should then be re-checked once equipment gathered.

"Back" shelf

Non-rebreathing Oxygen mask	√	X
BVM with appropriate sized mask available	√	X
Waters circuit available	√	X
Suction tubing + Adult Yankauer + tested	√	X
Monitoring: ECG cable, BP cuffs, SaO2 probe, $EtCO_2$ line (monitor)	√	X
Oxylog 3000 with ventilation tubing [adult (clear) / paed (blue)]	√	X

- **Anaesthetic Trolley top surface to be kept completely clear and clean at ALL times**

1st drawer- PLAN A

Face masks- size 4 and 5	√	X
ETT sizes 6,7,8	√	X
10 ml Syringe for cuff	√	X
Catheter mount + HME filter	√	X
Tube tie	√	X
Laryngoscope handles x 2 with batteries	√	X
Laryngoscope blades: Mac 3, Mac 4	√	X
Sachets of KY gel x 4	√	X
Gauze swabs	√	X
OP airways: green, orange, red	√	X
NP airways: sizes 6, 7	√	X
Roll of tape – inch pink x 1, transpore x 1	√	X
Scissors x1	√	X

2nd – drawer – PLAN B

Adult McGills forceps	√	X
Stylet	√	X
$EtCO_2$ sidestream sampling sets x 2 (Propaq nasal, COETT)	√	X
Easicap	√	X
iGEL LMA: sizes 3, 4, 5	√	X
Surgical Crico kit: 6.0 ETT, Scalpel 22, small curved artery forceps	√	X

3rd drawer - CIRCULATION

Sterile gloves; size 6,7,8		√	X
Paed CVC insertion pack x 1		√	X
Chloraprep sticks x 2		√	X
Art lines:	Radial arterial pack x 1	√	X
	Jelco 20 G x 4	√	X
	Leadercath 20 G short x 1, 20 G long x 2	√	X
CVC:	Quad lumen CVP line x 1	√	X
	“Trauma line” (Swann-introducer set) x 1	√	X
	Jelco 14 G x 2, 16 G x 2	√	X
	Abbocath 14G long x 2	√	X
Silk 2.0 suture with straight needle x 2		√	X
3-way tap with short extension x 2		√	X

4th drawer – EXTRA KIT

Pressure monitoring set (single) x 1	√	X
500 ml Pressure bag x 1	√	X
0.9% sodium chloride 500ml bag x 1	√	X
Temperature probe x 1	√	X
Stethoscope x 1	√	X
Spare suction tubing x 1 and Yankauers x 2	√	X

Side of trolley

Bougies: sizes 15 x 2	√	X

Soft Suction catheters: Orange x 3, green x3	√	X

Drip stand / IV infusion

500 ml warmed Saline with giving set run through	√	X
500 ml pressure bag	√	X
Belmont transfusion set available	√	X
Belmont plugged in	√	X
Syringe driver pump with cable	√	X

Drugs packs: yellow + CD present, checked and sealed? Y / N

Difficult airway trolley present? Y / N

Paediatric airway trolley present? Y / N

3.9 RSI Pack List

Emergency Department RSI Anaesthetic Drug Pack Contents

Anaesthetic Drug Pack 1	Item	Item size	Quantity
	Drug dose aide memoire	A4	1
	Suxamethonium	**50mg/ml, 2ml vial**	**2**
	Rocuronium	**10mg/ml, 5ml vial**	**4**
	Phenylepherine	**10mg/ml, 1ml vial**	**1**
	Ephedrine	**3mg/ml, 10ml syringe**	**1**
	Adrenaline mini-jet	**100mcg/ml, 10ml syringe**	**1**
	Lorazepam	**4mg/ml, 1ml vial**	**1**
	Ondansetron	**4mg**	**1**
	Water for injection	10ml vial	2
	0.9% saline pre-drawn flush	10ml	4
	0.9% saline	10ml vial	1
	0.9% saline	**100ml bag**	**1**
	2.7% saline	**500ml bag**	**1**
	1ml syringe		2
	2ml syringe		2
	5ml syringe		2
	10ml syringe		4
	20ml syringe		2
	Fentanyl sticker		2
	Morphine sticker		2

	Ketamine sticker		2
	Propofol sticker		2
	Thiopentone sticker		2
	Suxamethonium sticker		2
	Rocuronium sticker		2
	Midazolam sticker		2
	Phenylepherine sticker		2
	Plain stickers	large	5
	Spike with non-return valve and bionector		1
	Alcohol wipes	large	5
	Needles	18G (green)	5
	50ml syringe		3
	200cm extension set		3
	3 way tap		3

Anaesthetic Drug Pack 2	**Ketamine**	**10mg/ml, 20ml vial**	**1**
	Thiopentone	**500mg, powder**	**1**
	Propofol (1%)	**50ml vial**	**1**
	Morphine	**10mg/ml, 1ml vial**	**1**
	Midazolam	**1mg/ml, 5ml vial**	**1**
	Fentanyl	**50mcg/ml, 10ml vial**	**1**

3.10 Rib Fracture Pathway

Rib Fracture Pathway

Analgesia	
Standard	❑ **Paracetamol 1g Oral / 750mg IV QDS** ❑ **Ibuprofen 400mg TDS** (avoid in elderly/contraindications) & **Omeprazole 20mg OD** ❑ **Dihydrocodeine 30mg QDS** *OR* **Morphine Sulfate MR 10-20 mg BD** depending on severity ❑ **Oral Morphine Solution (10mg/5ml) 10-20mg 2 hrly PRN** Reduce to 5-10 mg OR consider Oxycodone in elderly or if renal impairment eg egfr <60 Opioids to be regularly reviewed and titrated/tapered as appropriate
Consider	❑ **Lidocaine plasters 5% 1-3 plasters, 12 hrly** *If* > 3 rib fractures Not in addition to regional anaesthesia, maximum 2 weeks, in-patient prescription only ❑ **Gabapentin 300mg BD** *If* features of neuropathic pain present Reduce to 100mg BD in elderly, in-patient prescription only ❑ **Movicol BD & Senna ON** *If* bowels not opened within 2 days ❑ **Opioid PCA** may be required if pain moderate to severe

Battle's Risk Prediction Score[1]		
Risk Factor:		**Score:**
Age	1 point for every 10 years of age (eg 67 yrs = 6)	
Rib Fractures	3 points for each *individual* rib # (eg 3 # = 9)	
Chronic Lung disease	5 points	
Pre-Injury Anticoagulants	4 points	
Oxygen Saturations (on air)	2 points for every 5% reduction (90-94% =2, 85-89% = 4 , 80-84% = 6)	
	TOTAL:	

Final Risk Score	0-10	11-15	16-20	21-25	26-30	31+
Probability of Complications*	13%	29%	52%	70%	80%	88%

1. **Battle CE, et al.** Predicting outcomes after blunt chest wall trauma: development and external validation of a new prognostic model. *Critical Care 2014; 18 : R98.* ** eg pneumonia, prolonged LOS >7 days, ICU admission, In-hospital mortality*

Physiotherapy
Refer all patients with ≥3 rib fractures for physiotherapy review, to be seen within 24 hrs of admission.
□ *Date:* *Time:*
In Patient Pain Service
For patients with ≥ 3 rib fractures, or advice regarding patients with inadequately controlled pain despite pathway, or complex patients (eg long term opioid users), contact the pain team, bleep 2974 or via EQUEST
□ *Date:* *Time:*
Intensive Care
If Battle's score ≥ 26 or other clinical concerns discuss with ICU (bleep 2110)
□ *Date:* *Time:*
Thoracic Surgery
Contact RibFixation@uhs.nhs.uk for consideration of Surgical Fixation if... ➢ *Flail chest* ➢ *Chest wall deformity* ➢ *≥ 3 displaced rib fractures* ➢ *NIV/Ventilator dependant*
□ *Date:* *Time:*
Regional Anaesthesia
If ≥3 rib # and ANY risk factor below, discuss with anaesthetist, bleep 1783 (or 1646) for consideration of regional anaesthetic block/ catheter *RISK FACTORS...* ➢ *Flail chest* ➢ *Haemo/pneumothorax* ➢ *Lung contusion on CT* ➢ *≥65 years* ➢ *Pre-existing cardio-respiratory disease* ➢ *Smoker* ➢ *Low SP02 or requiring supplemental Oxygen* ➢ *OR significant pain despite appropriate analgesia*
□ *Date:* *Time:*

Regional Anaesthesia Documentation

❑ Serratus Anterior (sub or supra) / Erector Spinae / Paravertebral / Thoracic Epidural/ other: ❑ Consent form completed ❑ Stop Before You Block ❑ AAGBI monitoring ❑ Patient position: Sitting or R/L Lateral ❑ Gloves/gown/mask/hat ❑ Full aseptic technique	❑ 1% lidocaine to skin ❑ R/L/ Bilateral ❑ USS guided ❑ In plane technique ❑ Needle/catheter used: ❑ Depth of catheter at skin: ❑ Bolus given- Local: Vol: ❑ Ongoing LA regimen:

Performed by: Location: Date: Time:

If Regional Catheter sited:

❑ Anaesthetist to complete Rib Fracture Regional Anaesthesia database on EDMS
❑ Refer ward patients to Inpatient Pain Service: Bleep 2974 or via EQUEST
❑ For problems out of hours, contact Anaesthetist (Bleep 1783)
❑ Poly-trauma to be managed on either Critical Care or Major Trauma Unit (F1), isolated rib fractures on E4
❑ Remove catheter at 7 days, ensuring regular analgesia prescribed
❑ If removal considered prior to 7 days: stop infusion & ensure analgesic regimen established before removing

Rib Fracture Assessment

Assess Pain 4 hourly, or 2 hourly if: Pain Moderate – Severe, PCA or LA infusion

Date & Time	Pain •No Pain •Mild •Moderate •Severe	Able to ***deep breathe***?	Able to ***cough***?	If pain score Moderate/Severe or ***No*** to any question- document action taken:

Rib Fracture Assessment

Assess Pain 4 hourly, or 2 hourly if: Pain Moderate – Severe, PCA or LA infusion

Date & Time	**Pain** •No Pain •Mild •Moderate •Severe	**Able to *deep breathe*?**	**Able to *cough*?**	**If pain score Moderate/Severe or *No* to any question- document action taken:**

3.11 Scoop Stretchers

All major trauma patients should remain on the scoop stretcher during their immediate phase for ease of transport and spinal protection. The standard scoop utilised by South Central Ambulance Service is the yellow Ferno scoop. On occasion, the Trauma Team may be faced with different scoops, some of which are detailed below with instructions on how to transfer onto the Ferno scoop.

Ferno Scoop

Figure 21 Ferno Scoop

NOTE: The yellow Ferno scoop is CT compatible.

Occasionally other makes of Scoops are utilised by other ambulance services. These scoops are not CT compatible and the patient needs transferring onto the yellow Ferno scoop.

Insertion

- The head is positioned at the wide end of the scoop
- There are two halves to the stretcher and each side is inserted carefully then clipped together at each end
- The patient only required minimal log-rolling of approximately 10 degrees to insert the each side

Removal

- The patient is braced
- The scoop is unclipped at the top and bottom
- Each side of the scoop then can then be removed in turn
- The patient should only require bracing during removal of the scoop, rather than a full logroll

Aluminium Scoop Stretcher

- Place Ferno scoop with pelvic binder on at the appropriate level (if the patient does not have one) below the aluminium scoop
- This would require a straight lift of a few inches of the patient on the aluminium scoop
- Then when the aluminium scoop is on the Ferno scoop unclip the aluminium scoop and, with the patient braced on the opposite side, slide out one side and then with reverse bracing the other side
- This approach negates the need for a log roll but does require vertical lifting and support for the patient.

Figure 22. Aluminium Scoop Stretcher

Green Solid Scoop Board

- With a log roll team, a 10 - 20 degree modified log roll is performed and place one side of the Ferno scoop under the patient but on top of the green board
- Repeat the other side, clip together
- Vertical lift of patient on Ferno scoop and remove green board

Figure 23. Green Solid Scoop Board

3.12 Major Trauma CT Hot Report

CT Multi trauma Primary Assessment: UHS

Patient Name:

Date of Scan:

Reporting Radiologist:

Formal detailed report will follow on Results Server.

AIRWAY			
ET placement	*N/A*	*Satisfactory*	*Unsatisfactory*
Airway obstruction	*Yes* *site*		*No*

BREATHING			
Pneumothorax	*Yes-details*		*No*
Contusion	*Yes-details*		*No*
Laceration	*Yes-details*		*No*
Chest drain placement	*N/A*	*Satisfactory*	*Unsatisfactory*

CIRCULATION (BLEEDING)		
Thoracic	*Yes*	*No*
Abdominal	*Yes*	*No*
Pelvic	*Yes*	*No*
Soft tissue	*Yes*	*No*

DISABILITY		
Intracranial bleed/oedema	*Yes*	*No*
Major spinal injury	*Yes*	*No*
Major abdominal or pelvic injury	*Yes*	*No*

Clinician Contact	***Name***	***Phone/bleep***
ED		
Orthopaedic		
General Surgery		
Vascular Surgery		
Anaesthetic		
Neurosurgery		

4 Standard Operating Procedures

4.1 UHS Management of Extremity Bleeding & Tourniquet SOP

Management of extremity bleeding and the use of Tourniquets SOP	Version: 1
Date Issued:	XX November 2020
Review Date:	November 2023
Document Type:	Standard Operating Procedure (SOP)

Contents		Page

Document Status
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Executive Summary

This procedure defines the principles of the Wessex Major Trauma Network towards management of extremity bleeding and the use of Tourniquets..

1. Scope and Purpose

This SOP applies to all pre-hospital providers and hospitals within the Wessex Major Trauma Network.

It is to support the safe management of extremity bleeding and advise on the use of and management of tourniquets when used to stem bleeding.

2. Definitions

2.1. CAT (Combat Application Tourniquet)

A basic tourniquet that uses a windlass system to completely occlude arterial and venous blood flow of an extremity in the event of a traumatic wound with significant haemorrhage.

2.2. Major Trauma Centre (MTC):

Manages all types of trauma but specifically have the lead for managing major trauma patients, providing consultant-level care and access to tertiary and specialised level services. Within the Trauma Network the MTC:
• Is optimised for the definitive care of injured patients. In particular it has an active, effective trauma programme. It also provides a managed transition to rehabilitation and the community.

2.3. Pneumatic Tourniquet

Uses compressed gas to inflate a bladder or cuff to occlude or restrict blood flow. A regulating device on the tourniquet machine can control the amount of cuff pressure exerted on the limb. The pressure, determined by the clinician, is delivered by an electrically driven pump or by a central compressed air supply.

2.4. Pre hospital Services

The WTN works with 3 ambulance trusts and multiple Air Ambulance organisations, in particular;
South Central Ambulance Service (SCAS)
South West Ambulance Service (SWASfT)
South East Coast Ambulance Service (SECAMB)
Hampshire and Isle of Wight Air Ambulance (HIOWAA)
Dorset and Somerset Air Ambulance (DSAA)

2.5. Standard Operating Procedure (SOP):

A SOP is a set of instructions to be followed in carrying out a given operation, or in a given situation, which lend themselves to a definite or standardized procedure without loss of effectiveness.

2.6. Trauma Unit (TU)

A Trauma Unit is to accept and manage, at any time, arrival of patients from the following two groups:

- Those considered having injuries not requiring expertise of MTC
- Those critically injured for whom direct transfer to MTC could adversely affect outcome (with subsequent plans to transfer).

2.7. Wessex Trauma Network (WTN)

Wessex Trauma Network is an Operational Delivery Network (ODN) encompassing

- UHS as Major Trauma Centre,
- North Hampshire Hospital; Dorset county hospital, Dorchester; Queen Alexandra Hospital, Portsmouth; St Mary's Hospital, Isle of Wight; Salisbury District Hospital, Poole General Hospital as Trauma Units and
- Royal Hampshire County Hospital, Winchester and Royal Bournemouth Hospital as local emergency hospitals.
- Local ambulance and air ambulance Trusts

3. Principles

3.1. Tourniquets are indicated for life threatening extremity haemorrhage not controlled by haemostatic dressing, for example celox, and direct pressure. Examples may include traumatic amputation, partial amputation and the mangled extremity.

3.2. Once applied the limb is threatened. The patient should be immediately discussed with the MTC and consideration given to immediate transfer to the MTC.

3.3. When a tourniquet is applied a record of the time should be clearly documented; on the Tourniquet itself if there is a space and / or in the patient record.

3.4. All staff should be made aware if a Tourniquet is applied and the time was it was applied.

3.5. Pre hospital teams MUST verbally handover to the hospital receiving team

3.6. Apply at least 5cm proximal to the wound but as distally as possible. A tourniquet **does not** have to be over a single long bone.

3.7. Where possible, and after appropriate training a pneumatic cuff should be used as opposed to a CAT.

3.8. On arrival in ED the need for a CAT must be re-evaluated, and if still required replaced with a pneumatic tourniquet as this reduces tissue damage (See figure 4.2)

3.9. De-escalation from the use of a tourniquet early will save life and limb

3.10. Optimise the patients clotting

3.11. Bleeding that required CAT in pre hospital setting may not require a tourniquet within the hospital setting (see Page 5 of this SOP)

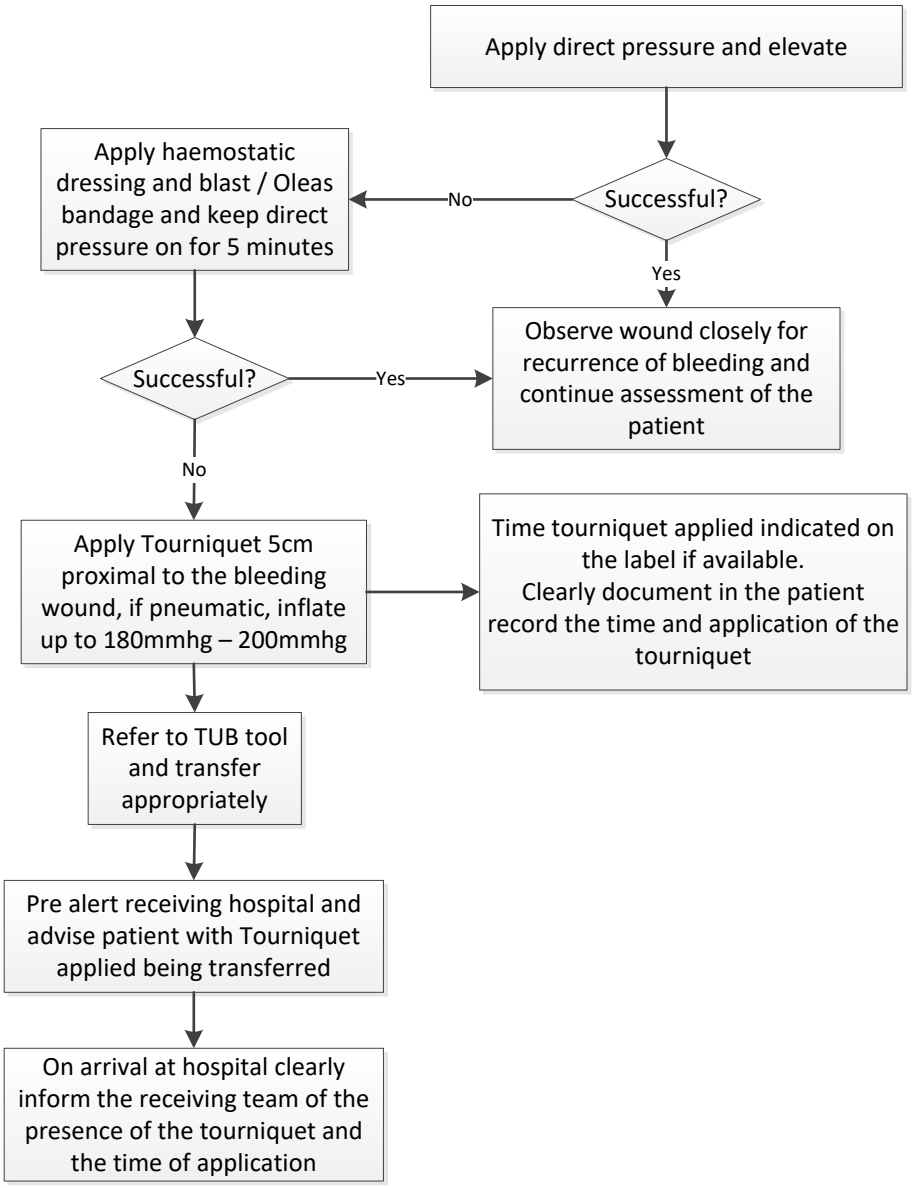
3.12. Traumatic amputation is not an absolute indication for tourniquet

3.13. Once a tourniquet is placed surgical haemorrhage control and reperfusion should be achieved within two hours to avoid limb loss. Use of a Tourniquet to stem catastrophic bleeding requires vascular opinion. In the event of a tourniquet being in situ for over 2 hours, the tourniquet should be released in order to provide a period of tissue reperfusion for 10 minutes.

3.14. A patient should not move laterally (i.e. TU to TU) their care should be escalated if required (i.e. TU to MTC)

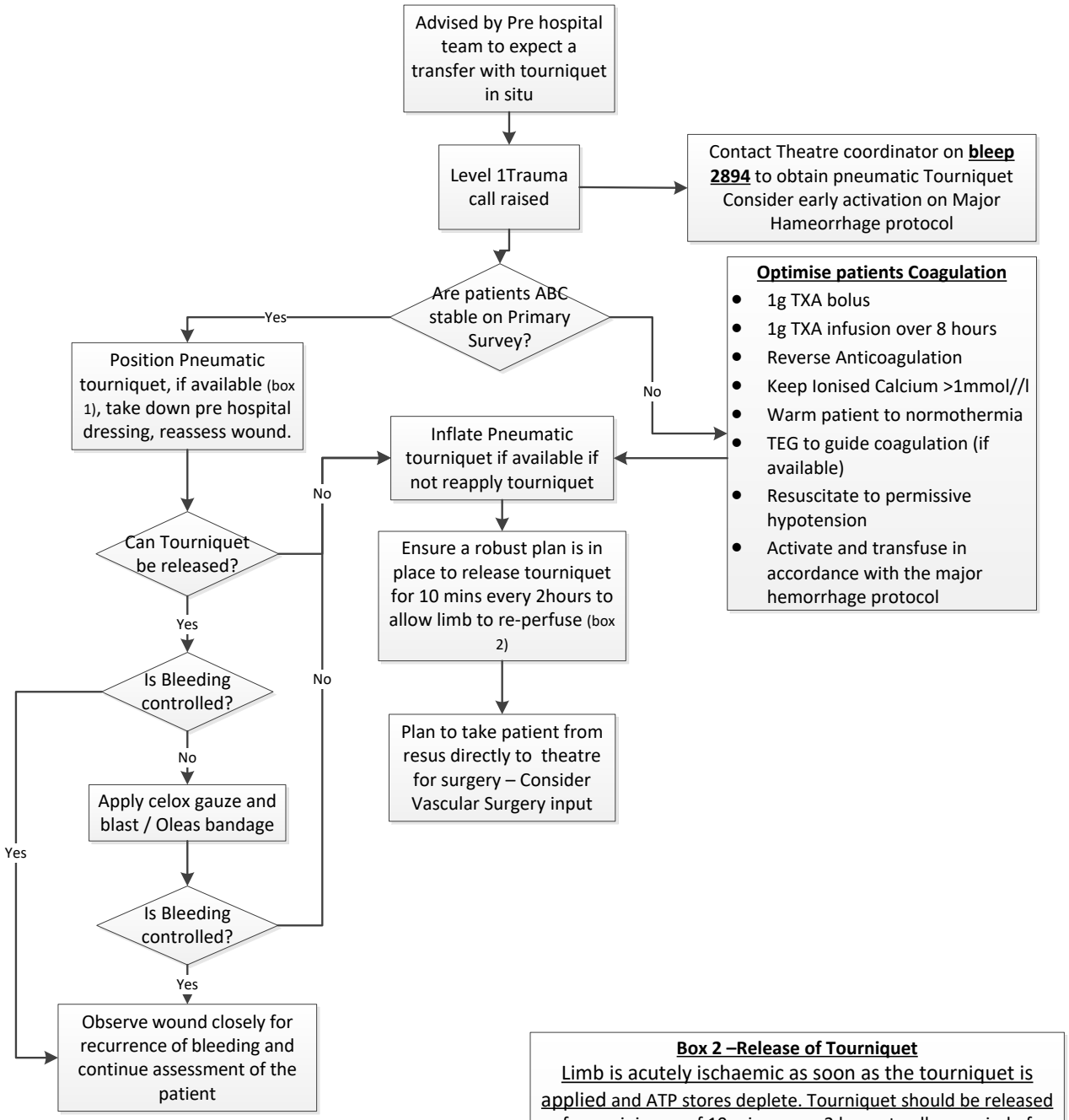
4. Procedure to be followed

4.1. Application of Tourniquet outside of the hospital environment



4.2. Management and de-escalation of a patient with a tourniquet in Situ

A TOURNIQUET INSITU IS NOT A STABLE SITUATION AND REQUIRES URGENT INTERVENTION



Box 1

Pneumatic Tourniquet should be placed above the CAT before removing the CAT. Remove the CAT, if bleeding recurs and cannot be controlled by direct pressure, inflate the pneumatic tourniquet. If no longer bleeding, leave pneumatic tourniquet in place, but deflated until definitive decision made about destination of patient

Box 2 –Release of Tourniquet

Limb is acutely ischaemic as soon as the tourniquet is applied and ATP stores deplete. Tourniquet should be released for a minimum of 10 mins every 2 hours to allow period of reperfusion. This is in order to reduce the risk of irreversible microvascular injury.

Risks with release of tourniquet.

- Potentially fatal arrhythmia
- Increased $PaCO_2$ and lactate
- Increased intracranial pressure
- Severe pain
- Compartment syndrome
- Rhabdomyolysis

5. Supporting Trust Documents

5.1. UHS Management of Catastrophic Haemorrhage protocol

6. Roles and Responsibilities

- **<u>Pre-hospital Providers</u>**

  Assess patient for the need of a tourniquet

  If available, time applied is to be indicated onto the label on the Tourniquet (picture below).

  Clear document within the patient record, indicating Tourniquet applied and time applied.

  Verbal handover to clearly indicate Tourniquet applied and time.

  Communicate to hospital that patient is expected with a tourniquet in situ

- **<u>Trauma Units</u>**

  Assess patient and wound

  Aim to de-escalate tourniquet for pressure dressing with celox where possible

  Apply pneumatic tourniquet as soon as possible if removal is not possible

  Optimise patient coagulation

  Invoke the WTN secondary transfer / automatic acceptance criteria if case is beyond the capabilities of the TU.

  A patient should not move laterally (i.e. TU to TU) their care should be escalated if required (i.e. TU to MTC)

- **<u>Major Trauma Centre</u>**

  Assess patient and wound

  Aim to de-escalate tourniquet for pressure dressing with Haemostatic dressing /celox where possible

  Apply pneumatic tourniquet as soon as possible if removal is not possible

  Optimise patients coagulation

  Provide definitive treatment

- **<u>WTN Management team</u>**

  Develop, review, implement and monitor the procedure across the WTN

- **MTC management team**
  Inform, implement and monitor this procedure within the MTC (UHS) and audit times lines

- **TU Trauma Leads**
  Inform, implement this policy within their local TU

7. Communication plan

For communication across the Wessex Trauma Network to all pre hospital and hospital providers. Within all Emergency departments of the WTN hospitals via the WTN trauma leads

8. Process for Monitoring Compliance/Effectiveness

The purpose of monitoring is to provide assurance that the agreed approach is being followed – this ensures we get things right for patients, use resources well and protect our reputation. Our monitoring will therefore be proportionate, achievable and deal with specifics that can be assessed or measured.

Key aspects of the procedural document that will be monitored:

What aspects of compliance with the document will be monitored	What will be reviewed to evidence this	How and how often will this be done	Detail sample size (if applicable)	Who will co-ordinate and report findings (1)	Which group or report will receive findings
Appropriate use of tourniquets and timely removal	No. of WTN incident involving Tourniquets No. of TU / MTC incidents raised citing tourniquet usage	When incidents are raised	N/A	MTC / WTN manager and WTN Clinical governance lead	WTN Clinical governance MTC Clinical governance ED clinical governance

(1) State post not person.

Where monitoring identifies deficiencies actions plans will be developed to address them.

9. Arrangements for Review of the Policy

This SOP will be reviewed 3 years after ratification or earlier if required.

10. Contributors

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Owen Hammett – on behalf of South West Ambulance Service
Mr Lee Winterbottom – on behalf of North West Ambulance Service
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Extremity Bleeding and Tourniquet SOP	**Version: 1**

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Approval Committee:	ED, Critical Care, MTC and Division D governance Groups
Date of Approval:	
Ratification Committee:	QGSG
Date of Ratification:	
Signature of ratifying Committee Group/Chair:	
Lead Name and Job Title of originator/author or responsible committee/individual:	Emma Bowyer – MTC manager Mark Baxter – MTC Clinical Director Emily Cooper – Major Trauma Nurse Practitioner
Policy Monitoring (Section 6) Completion and Presentation to Approval Committee:	
Target audience:	UHS ED and Trauma accepting Specialities, UHS Major Trauma Nurse practitioners, Trauma Leads, Pre hospital providers
Key words:	Bleeding / Tourniquet
Main areas affected:	ED, T&O, all Trauma specialties, Critical care areas, CV&T, Neuro, Spinal surgery
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Type of document:	SOP
Does this document replace or revise an existing document	No
Should this document be made available on the public website?	No
Is this document to be published in any other format?	No

4.2 UHS Major Haemorrhage Protocol

Adult Major Haemorrhage Protocol		Version: 3
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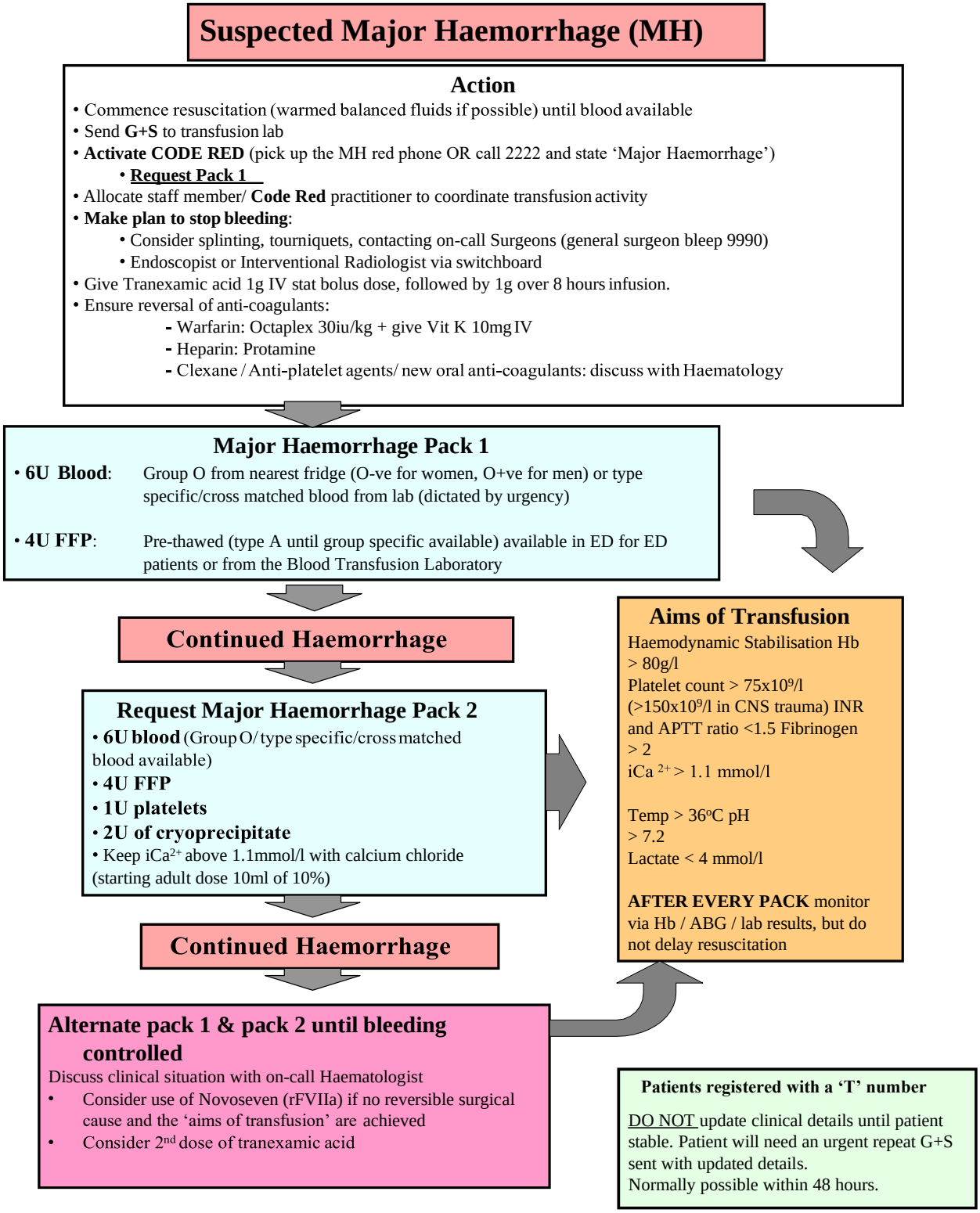
Executive Summary

The Major Haemorrhage Protocol is intended to assist and guide all staff members involved at any stage of the transfusion process with patients that have major haemorrhage. This includes the use of a simple flowchart to guide the clinician to replace blood components and products to minimise the risk of developing an acute coagulopathy.



ADULT MAJOR HAEMORRHAGE PROTOCOL: CODE RED

Scope and Purpose

This policy applies Trust wide across Southampton University Hospitals NHS Trust, and applies to all staff who are involved in some stage of the Transfusion Process using the major haemorrhage protocol.

This policy **does not** cover:

- In-utero or paediatric transfusions.
- Procedure for Registration of Emergency Patients (unknown/unidentified) requiring a blood transfusion

Please see separate Policies on Staffnet for the management of these procedures.

The objective of the policy is to give staff clear guidance on the correct procedures for:

- Major Haemorrhage protocol.
- Appropriate use of blood components and products as per national guidelines and evidence based practice.
- Monitoring of a patient receiving a blood transfusion.

Definitions

Code red – activation of the major haemorrhage protocol

Pack 1 – Major haemorrhage pack 1 containing 6 units of red blood cells and 4 units of FFP

Pack 2 - Major haemorrhage pack 2 containing 6 units of red blood cells, 4 units of FFP, 1 adult pool of platelets and 2 units of cryoprecipitate

ADULT MAJOR HAEMORRHAGE PROTOCOL

Introduction

Major trauma complicated by massive haemorrhage is associated with a high mortality. This clinical scenario is typically complicated by a rapidly developing acute coagulopathy of trauma as a consequence of consumption of clotting factors plus platelets, hyperfibrinolysis, activation of protein C and up-regulation of thrombomodulin pathways. Hypothermia with core temperatures of $< 35^{o}C$ exacerbates the coagulopathy by virtue of decreasing the function of clotting factors and platelets. Inadequate transfusion is associated with poor outcomes but empirical over transfusion can lead to increased morbidity and mortality from increased donor exposure, sepsis and multi-organ failure.

Current UK guidelines rely heavily on the results of blood tests to dictate the use of blood components but this can lead to a delay in correcting the coagulopathy (1). There is increasing evidence to suggest the early use of plasma and platelet transfusions improves the clinical outcome (2). Experience from the military and other major trauma

centres of the use of a more proactive approach using transfusion protocols including red cell : plasma ratios of 1 to 1.5 : 1 improve outcome by avoiding the development of a coagulopathy (3,4). Aggressive treatment of the lethal triad of hypothermia, acidosis and coagulopathy is required to manage this acute coagulopathy of trauma.

The CRASH 2 study confirmed the better outcomes and lower mortality including that related to bleeding for patients with major trauma receiving intravenous Tranexamic Acid within 3 hours of injury. There was no increase in the incidence of vascular occlusive events in those patients treated with Tranexamic acid (5, 6).

A recent European guideline on the management of bleeding and coagulopathy following major trauma suggested that institutions develop evidence based protocols to manage traumatically injured patients and emphasised urgent bleeding control procedures or investigations to look for the source of bleeding. It recommends the use of point of care testing to characterise the coagulopathy and guide haemostatic therapy, including viscoelastic methods (7).

A senior clinician should activate the protocol when there is suspected major haemorrhage related to major trauma, gastrointestinal or surgical bleeding. There needs to be a designated team leader and information coordinator within the Emergency Department, operating theatre or ward with responsibility for liaising with the Transfusion Laboratory regarding the condition of the patient and the blood components that are required.

Definition of massive blood loss

There are various definitions but these include blood loss of > 1.5 mls/kg body weight for at least 20 minutes or the replacement of 50% of a patient's blood volume in < 4 hours. Another reasonable definition would be continued hypotension with systolic readings of < 90 mmHg despite transfusing at least 4 units of red cells within 60 minutes and with no alternative cause such as a tension pneumothorax, pericardial tamponade, cardiogenic shock, neurogenic shock, myocardial infarction, septicaemic shock, major cerebral trauma or a massive pulmonary embolus.

Aims

- Fluid resuscitation should continue until blood components and blood products are available and a systolic blood pressure of $\geq$ 90mmHg in non-penetrating trauma should be targeted, provided adequate cerebral and coronary perfusion are maintained.
- Make a plan to stop the bleeding:
  - **Control external haemorrhage**; Catastrophic haemorrhage tourniquets, splinting, rapid wound closure, direct pressure, haemostatic gauze, elevation
  - **Search for internal haemorrhage**; chest, abdomen, pelvis (apply pelvic binder) and long bones (apply splints / skin traction)

- On-call acute (general) Surgeon (bleep 9990), Orthopaedic Surgeon, Endoscopist or Interventional Radiologist via switchboard, alert emergency operating theatre (ext 4073 or co-ordinator on bleep 2894)
  - Large bore vascular access;
  - Consider use of intra-osseous (IO) access if peripheral IV access is poor
    - Caution with femoral / lower limb access if suspected pelvic or abdominal injuriesUse large bore central access (i.e. 'Trauma line' 8.5 Fr swann sheath introducers, which are kept in ED resus): the subclavian vein is ideal
  - Give tranexamic acid 1g (or 15mg/kg for paediatric patients) and follow with an infusion of 1g over eight hours, or with each blood volume replaced.
  - Hb $\geq$ 80 g/l
  - Platelet count $\geq$ 75 (or $\geq$ 150 x 10^9/l if bleeding involves the central nervous system)
  - INR and APTT ratio $\leq$ 1.5 times the normal control values
  - Fibrinogen $\geq$ 2 g/l
  - Regular monitoring of blood counts and clotting screens to assess the response to treatment and consider the use of point of care testing e.g. TEG, ROTEM.
  - Regular monitoring of K^+ and ionised Ca^{2+} (iCa^{2+}) levels, lactate and blood pH.
    - Keep iCa^{2+} > 1.1 mmol/l. Keep K^+ between 3.5 and 5 mmol/l, which may require an infusion of insulin + dextrose particularly if old red blood cells are given.
  - Maintain arterial blood pH $\geq$ 7.2 and lactate < 4 mmol/l.
  - Aim for a core temperature of > 36ºC. Blood warmers or rapid infusion devices should be used when red blood cells are transfused. Use warm blankets, under mattress warmers and Bair huggers when able.

Activation of the protocol and major haemorrhage packs

The major haemorrhage protocol needs to be **activated with a CODE RED alert call directly to the Transfusion Laboratory.** The Blood Transfusion Laboratory can be contacted on a priority line by picking up one of the emergency red phones or by dialling 2222 and stating major haemorrhage or major obstetric haemorrhage.

Allocate a staff member/ **Code Red** practitioner to coordinate transfusion activity. There needs to be a **designated coordinator** who can liaise directly with the Blood Transfusion Laboratory and the Consultant Haematologist to determine the blood component therapy that is required and ensure timely transfusions with appropriate monitoring. Blood samples should be sent urgently for a FBC, coagulation screen, blood group and cross match, baseline biochemistry a minimum.

Major Haemorrhage Pack 1 needs to be requested at this stage comprising:-

Note: In some clinical situations it may be appropriate to go straight to pack 2.

- **6 units of Red Blood Cells** (Group O unless there is a confirmed blood group in which case the Blood Transfusion Lab will issue the patient's own blood group)

Group O blood will consist of O negative for women or O positive for men.
Note that post-menopausal women (if unknown, assume if over age 55) can be administered O Positive RBC, particularly in times of shortage.

- **4 units of Fresh Frozen Plasma (FFP) (**Pre defrosted group A FFP is kept in the Emergency Dept.

blood fridge and the Blood Transfusion Laboratory issue fridge.

If the patient has a confirmed blood group and does not need immediate resuscitation, the Blood Transfusion Laboratory can dispatch FFP of the patient's own blood group (40 minutes thaw time required).

Every effort should be made to ensure that a blood sample is collected for blood grouping and cross-matching before emergency group O (EMO) blood is transfused to the patient.

Units of emergency group O blood are kept in the following satellite blood fridges:

	For female patients of childbearing age and paediatric patients	**For male patients over the age of 18 years.**
Location	**Number of EMO (-) units (red bag)**	**Number of EMO (+) units (blue bag)**
Emergency dept.	6 EMO-	12 EMO+
D Level	4 EMO- + 2 paed units*	4 EMO+
E level theatres	2 EMO-	2 EMO+
F level theatres	2 EMO-	2 EMO+
G level theatre	2 EMO-	2 EMO+
Neuro fridge	2 EMO-	2 EMO+
Princess Anne Hospital	4 EMO- (CMV-) + 2 paed units*	-
HEMS (pre hospital service)	2 EMO- (CMV -)	

***Paed units are only to be used for patients under the age of one year old**

BloodTrack Tx **MUST** be used to link and trace these units to the patient just before commencing administration.

Hyperfibrinolysis is a common complication with major haemorrhage hence we recommend the administration of 1 g of Tranexamic Acid intravenously and then followed by an infusion of 1g over 8 hours until bleeding resolves.

The results of the FBC and clotting screen will help to direct ongoing transfusion therapy in those patients not needing immediate resuscitation but if bleeding is rapid and persists we suggest that the ***Major haemorrhage Pack 2 is requested at this stage comprising:-***

- 6 units of group-specific or cross matched red cells (group O if blood group unknown)
- 4 units of group-specific FFP (group A if blood group unknown)
- 1 adult pool of group-specific platelets (group A if blood group unknown*)
- 2 units of group-specific cryoprecipitate (group A if blood group unknown)

*Group A, high-titre (HT) negative platelets are kept at SGH and this will be appropriate for all blood groups. 1 unit will normally raise the platelet count by 20 to 40 $x10^9$/l.

On-going bleeding

With ongoing bleeding the blood transfusion laboratory can issue ***further Major Haemorrhage Packs and will alternate between pack 1 and 2,*** especially if the haemoglobin, platelet count and coagulation screen results are suboptimal.

Use of activated factor VIIa

If bleeding persists despite the above treatment with no remediable surgical cause with a platelet count of $\geq$ 75 x 10^9/l and fibrinogen of $\geq$ 2 g/l one should consider using recombinant activated factor VII concentrate (Novoseven). The initial dose is 90 mcg / kg and novoseven is available in 1, 2 and 5 mg vial size doses. It is best to round up to the nearest whole vial dose. It is important that the patients temperature (> 36^{o}C), pH (> 7.2) and ionised calcium levels have also been optimised for effective use of novoseven. If there is no response after 1 to 2 hours a second dose of Novoseven at the higher dose of 120 mcg / kg can be tried assuming that the platelet count and fibrinogen are still optimal. If there is no response after two doses of Novoseven then additional doses are very unlikely to prove successful.

Ensure full reversal of anti-coagulants:

- Warfarin: Octaplex 30 iu/kg + 10 mg of IV Vitamin K
- Heparin: Protamine, see BNF for dosing guide
- Clexane / Anti-platelet / new oral anti-coagulant agents: discuss with on-call Haematologist

Prothrombin Complex Concentrates such as Beriplex or Octoplex are used if the patient is bleeding **and is** also receiving warfarin or another coumarin anticoagulant with a prolonged INR or has a rare deficiency of Factor II or X.

Contact haematologist for advice if major bleeding persists or for approval of Novoseven

Monitoring

Regular monitoring of blood test results will be required. FBCs and clotting screens should be performed every 2 hours initially or after each pack of blood components are given (after the transfusion of every 6 units red cells and 4 units FFP). Near patient testing is extremely useful (haemoglobin measures (Haemocue), and blood gas monitoring (Hb, lactate, base deficit, K^+ and Ca^{2+}), closely monitor the calcium levels and treat accordingly. The starting adult dose is 10ml of 10% calcium chloride. Hypocalcaemia is common and related to the large citrate load from receiving large volumes of blood products.

There is a role for using thromboelastography (TEG and ROTEM available) to help identify the cause and direct the optimal treatment of a coagulopathy.

These are the laboratory aims of transfusion:

- Hb $\geq$ 80g/l
- Platelet count $\geq$ 75x10^9/l

- INR and APTT ratio $\leq$1.5
- Fibrinogen $\geq$ 2 g/l

- K^+ between 3.5-5 mmol/l
- iCa^{2+} > 1.1 mmol/l
- Temp > 36ºC
- pH > 7.2
- Lactate < 4 mmol/l

In central nervous system trauma you may need to aim for higher values; platelets
> 150x 10^9/l.

Stabilisation phase

Once the major haemorrhage has resolved it is important to inform blood bank of the **STAND DOWN as soon as possible so that no further blood components are released**. The 'Code Red' coordinator should liaise with blood bank.

The coordinator also is responsible for informing the blood bank staff if the patient is transferred to the operating theatre, a ward or an intensive care unit.

For unknown patients registered with a dummy name and a T number:

These are patients that have been issued a 'T number' before or on arrival in hospital. They may:

- have received a pre-hospital blood product infusion (this policy includes those whose demographics are known).
- or they may present directly to the Emergency department with unknown demographics (name, DOB).

DO NOT update their clinical details until the bleeding risk has stopped and NONE of the following apply or will apply within the next four hours:

- The patient is currently in the Operating Theatre
- The patient is due to have an operation or procedure (e.g. Gastroscopy)
- The patient has active ongoing bleeding
- The patient may need a blood transfusion.

When it is safe to update details, the patient will need an urgent repeat G+S sample sent to the laboratory with their updated clinical details before any further blood components or blood products will be released.

The Blood Transfusion Laboratory MUST be contacted when this has been done so that they can remove blood components issued under the T number and re-issue them

with the updated details (if further blood support needed). As soon as components have been issued, a new patient's ID band should be put on the patient.

It is expected in most cases that this update will take place within 48 hours of the original admission. Details should not be updated when the patient is still in the Emergency Department.

Please see Related Trust Policies below for the 'Registration and Identification of Unknown or Unidentified Patients' policy.

Roles and Responsibilities

The Chief Executive has overall responsibility and is accountable for ensuring that the Trust complies with Blood Quality and Safety Regulations, 2005 and the conservative approach to the use of blood components as set out by the National Blood Transfusion Committee

The Director of Nursing, working with the UHSFT Hospital Transfusion Committee (HTC), is responsible for ensuring that healthcare professionals are informed and follow the Trust Blood Transfusion policy for patient safety.

The Medical Director, working with the UHSFT Hospital Transfusion Committee, is responsible for ensuring that all medical personnel adhere to the Trust Blood Transfusion policy and that there is a designated medical representative from each Division who will attend the Hospital Transfusion Committee as per HTC terms of reference

Divisional Clinical Directors are responsible for designating a medical representative to attend the HTC and for ensuring that all medical staff comply with the UHS Blood Transfusion Policy. There is also a responsibility to implement recommended actions arising from investigations of incidents and audits conducted to monitor compliance with this policy.

Matrons are responsible for working with Ward Managers to make it possible for all staff who administer blood transfusions and take blood samples to be trained and updated to the standards set out in the Trust's Training Needs Analysis. There is also a responsibility to implement recommended actions arising from investigations of incidents and audits conducted to monitor compliance with this policy.

Divisional Governance Managers are responsible for ensuring that staff in their Division comply with the Blood Safety and Quality Regulations, 2005, by ensuring that non-compliance letters are responded to.

Care Group Managers are responsible for ensuring that policies on patient identification are in place, implemented and monitored throughout the blood

transfusion process from prescription, sampling, laboratory testing and issue of blood to collection and administration of blood transfusion.

Matrons and Care Group Managers are jointly responsible for ensuring:

- that staff who are involved in the blood transfusion process are competent through training to follow procedures which ensure that the correct blood is given at the right time.
- that written information is made available to patients about blood transfusion and potential alternatives.
- that staff have their training on BloodTrack Courier and BloodTrack Tx
- that the patient is positively identified through verbal interrogation and by looking at the patient identity wristband prior to taking a blood sample for cross-match or administering a blood component transfusion using BloodTrack Tx (PDA)
- that incidents are reported through the Trust Adverse Incident Reporting procedure

The Hospital Transfusion Committee has delegated responsibility, on behalf of the Clinical Effectiveness Outcomes Steering Group, to oversee, develop and implement the Trusts policies and procedures related to blood transfusion. It is also responsible for identifying and managing risks associated with transfusion. It reports regularly to the CEOSG and submits a formal annual report describing the committees' goals, achievements and challenges.

The Hospital Transfusion Team assists in the implementation of the Hospital Transfusion Committee's objectives of promoting safe and appropriate transfusion practise, and providing training to all staff involved in the process of blood transfusion.

All staff

- All staff involved in transfusion are responsible for maintaining and updating their knowledge, competency and practice
- Medical staff are responsible for prescribing of blood components and/or blood products appropriate to the needs of the patient.

Medical staff are responsible for:

- Requesting blood using appropriate forms (follow local guidelines)
- Providing full information on transfusion request forms as defined by Trust procedures
- Explaining the risks and benefits of blood transfusion to patients or relatives

Nursing staff are responsible for:

- Requesting collection of blood including arranging urgent transportation if required.
- Carrying out pre-transfusion checks to ensure the right blood is transfused (these can be performed by Operating Department Practitioners)
- Administer blood components and products
- Monitoring of the patient during transfusion
- Involvement of medical staff in any management of the patient if reactions occur
- Reporting of transfusion reactions or other incidents to the Blood Transfusion laboratory.
- Documentation of indications for transfusion, number of units administered and observations recorded in patients medical notes

Phlebotomists and others taking blood samples are responsible for:

- Checking the identity of a patient before taking any blood samples
- Checking information written on the request form is complete
- Using safe techniques for obtaining blood
- Correct labelling of blood sample tubes in accordance with Trust procedures
- Reporting incidents.

Clinical Healthcare Assistants

- Do the patient's vital signs and document them
- Inform the nurse looking after the patient if there are any changes in these vital signs
- Collect blood from the Blood Bank
- Receive blood components and products on the ward

The Blood Transfusion laboratory is responsible for:-

- Compatibility testing and issuing of blood products
- Managing blood stocks and liaison with the National Blood and Transplant (NHSBT)
- Investigating adverse events and reporting them to Clinical Risk, the Serious Hazards of Transfusion scheme and the Medicines and Healthcare products Regulatory Authority.
- Monitoring blood requests and usage

Related Trust Policies

Adult Blood Transfusion Policy - http://staffnet/TrustDocsMedia/DocsForAllStaff/Clinical/AdultBloodTransfusionPolicya ndProcedures/AdultBloodTransfusionPolicy.pdf

Children's Major Haemorrhage Guideline – http://staffnet/TrustDocsMedia/DocsForAllStaff/Clinical/ChildrensMajorHaemorrhage Guideline/ChildrensMajorHaemorrhageGuideline.pdf

Postpartum Haemorrhage Guidelines - http://staffnet/TrustDocsMedia/DeptDivSpecific/DivC/WomenNewborn/Maternity/Mate rnityClinicalGuidelines/PostPartumHaemorrhageGuidelines/Postpartumhaemorrhage guideline.pdf

Registration and Identification of Unknown or Unidentified Patients – http://staffnet/TrustDocsMedia/DocsForAllStaff/Clinical/Registration-and- identification-of-unknown-patient/Registration-and-identification-of-unknown- patients.pdf

Communication Plan

The Policy will be implemented via uploading to Staffnet and via Care Groups ensuring that relevant staff are made aware of the revised Policy through their local governance mechanisms.

The Adult Major Haemorrhage flowchart will be displayed in the key clinical areas where major haemorrhage is managed and attached to the rapid infusion devices,
i.e. the level one and Belmont fluid infusors.

Process for Monitoring Compliance/Effectiveness

The purpose of monitoring is to provide assurance that the agreed approach is being followed – this ensures we get things right for patients, use resources well and protect our reputation. Our monitoring will therefore be proportionate, achievable and deal with specifics that can be assessed or measured.

Key aspects of the procedural document that will be monitored:

What aspects of compliance with the document will be monitored	What will be reviewed to evidence this	How and how often will this be done	Detail sample size (if applicable)	Who will co-ordinate and report findings (1)	Which group or report will receive findings
Activation of protocol	Reason for activation	6 monthly	Approx 40 per half year	Blood transfusion lead	HTC
Wastage of blood products and components	Blood transfusion records	6 monthly	As above	Blood transfusion lead	HTC

(1) State post not person.

Where monitoring identifies deficiencies actions plans will be developed to address them.

Arrangements for Review of the Policy

This policy will be reviewed and updated every three years or when further evidence of consensus suggests revision is required.

References

1. British Committee for Standards in Haematology Guidelines on the Management of Massive Transfusion. *British Journal of Haematology* 2015, 170:788-803

2. Malone DL et al. Massive Transfusion Practices around the Globe and a Suggestion for a Common Massive Transfusion Protocol. *Trauma* 2006, 60: 591-596

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4. Borgman MA et al. The ratio of blood products transfused affects mortality in patients receiving massive transfusions at a combat support hospital. *Journal Trauma* 2007, 63, 805 – 813.

5. Effects of tranexamic acid on death, vascular occlusive events and blood transfusion in trauma patients with significant haemorrhage (CRASH2):a randomised, placebo-controlled trial. *The Lancet* 2010; 376:23-32

6. The importance of early treatment with tranexamic acid in bleeding trauma patients: an exploratory analysis of the CRASH2 randomised controlled trial. Lancet 2011; 377:1096-1101

7. Spahn DR et al. Management of bleeding and coagulopathy following major trauma: an updated European guideline. Critical Care 2013; 17:R76

Appendices

1) Print friendly version of flowchart
2) Equality impact assessment

ADULT MAJOR HAEMORRHAGE PROTOCOL: CODE RED

Suspected Major Haemorrhage (MH)

Action

- Commence resuscitation (warmed balanced fluids if possible) until blood available
- Send **G+S** to transfusion lab
- **Activate CODE RED** (pick up the MH red phone OR call 2222 and state 'Major Haemorrhage')
  - **Request Pack 1**
- Allocate staff member/ **Code Red** practitioner to coordinate transfusion activity
- **Make plan to stop bleeding**:
  - Consider splinting, tourniquets, contacting on-call Surgeons (general surgeon bleep 9990)
  - Endoscopist or Interventional Radiologist via switchboard
- Give Tranexamic acid 1g IV stat bolus dose, followed by 1g over 8 hours infusion.
- Ensure reversal of anti-coagulants:
  - Warfarin: Octaplex 30iu/kg + give Vit K 10mg IV
  - Heparin: Protamine
  - Clexane / Anti-platelet agents/ new oral anti-coagulants: discuss with Haematology

Major Haemorrhage Pack 1

- **6U Blood**: Group O from nearest fridge (O-ve for women, O+ve for men) or type specific/cross matched blood from lab (dictated by urgency)
- **4U FFP**: Pre-thawed (type A until group specific available) available in ED for ED patients or from the Blood Transfusion Laboratory

Aims of Transfusion

Haemodynamic Stabilisation Hb > 80g/l
Platelet count > $75x10^9$/l (>$150x10^9$/l in CNS trauma) INR and APTT ratio <1.5 Fibrinogen > 2
iCa^{2+} > 1.1 mmol/l

Temp > 36°C pH > 7.2
Lactate < 4 mmol/l

AFTER EVERY PACK monitor via Hb / ABG / lab results, but do not delay resuscitation

Continued Haemorrhage

Request Major Haemorrhage Pack 2

- **6U blood** (Group O/ type specific/cross matched blood available)
- **4U FFP**
- **1U platelets**
- **2U of cryoprecipitate**
- Keep iCa^{2+} above 1.1mmol/l with calcium chloride (starting adult dose 10ml of 10%)

Continued Haemorrhage

Alternate pack 1 & pack 2 until bleeding controlled

Discuss clinical situation with on-call Haematologist

- Consider use of Novoseven (rFVIIa) if no reversible surgical cause and the 'aims of transfusion' are achieved
- Consider 2nd dose of tranexamic acid

Patients registered with a 'T' number

DO NOT update clinical details until patient stable. Patient will need an urgent repeat G+S sent with updated details.
Normally possible within 48 hours.

Document Monitoring Information	
Approval Committee:	Hospital Transfusion Committee
Date of Approval:	2nd March 2020
Ratification Committee:	Policy Ratification Group (PRG)
Date of Ratification:	Insert Date
Signature of ratifying Committee Group/Chair:	Insert Signature or name (Chair of PRG if Level 1 document)
Lead Name and Job Title of originator/author or responsible committee/individual:	Hospital Transfusion Committee
Policy Monitoring (Section 7) Completion and Presentation to Approval Committee:	Every 6 months (see section 7 for further details)
Target audience:	All trust staff involved in the transfusion process
Key words:	Major haemorrhage, massive transfusion, code red, exsanguinations, catastrophic haemorrhage, bleeding
Main areas affected:	Trust wide for Level 1 documents
Summary of most recent changes if applicable:	Added reference to use of 2222 to access MH Line. Added advice regarding use of TXA infusions. Added use of Emergency O Positive RBC. Updated T number process in light of revised policy. Other changes to reflect current practice.
Consultation:	Members of the HTC
Equality Impact Assessment completion date:	August 2016
Number of pages:	14
Type of document:	Policy
Does this document replace or revise an existing document	Replaces Adult Major Haemorrhage Policy (Version 2)
Should this document be made available on the public website?	Yes – under the major trauma website
Is this document to be published in any other format?	No

The Trust strives to ensure equality of opportunity for all, both as a major employer and as a provider of health care. This document has therefore been equality impact assessed to ensure fairness and consistency for all those covered by it, regardless of their individual differences, and the results are available on request.

4.3 UHS Guideline for the Management of Chest Injuries and Chest Decompression in Adult Major Trauma

Version:	**Version 1 May 2014**
Approval Committee:	**MTC Governance/ Division D Governance/ PRAM for QGSG**
Date of Approval:	16/07/14
Ratification Committee (Level 1 documents):	**Level 1**
Date of Ratification (Level 1 documents):	16/07/14
Signature of ratifying Committee Group/Chair (Level 1 documents):	**JP - PRAM**
Lead Job Title of originator/author:	**Consultant Anaesthetist, Trauma lead anaesthetist, Dr Carin Dear**
Name of responsible committee/individual:	**MTCGG / MTWG**
Date issued:	July 2014
Review date:	July 2015
Target audience:	**All staff involved in the management of major trauma patients in ED, trauma teams**
Key words:	**chest decompression, pneumothorax, haemothorax, tension pneumothorax, flail chest, intercostal drain, needle decompression, thoracostomy, major trauma, rib fractures**
Main areas affected:	**Emergency department & theatre sites**
Summary of most recent changes:	**New document**
Consultation:	**Emergency Physicians, Trauma Anaesthetists, Thoracic Surgeons, General Surgeons, Intensive Care Physicians**
Equality Impact Assessments completed and policy promotes equity	Completed
Number of pages:	**12**
Type of document:	**Level 1**
Is this document to be published in any other format?	**Hospital intranet, Major Trauma guidelines and hardcopy available in Anaesthetic and Emergency depts..**

The Trust strives to ensure equality of opportunity for all, both as a major employer and as a provider of health care. This guideline for the management of chest injuries and chest

decompression in adult major trauma has therefore been equality impact assessed to ensure fairness and consistency for all those covered by it, regardless of their individual differences, and the results are available on request.

Contents

Executive Summary

This guideline primarily addresses the management of blunt thoracic trauma with resultant ventilatory compromise. [The management of penetrating chest trauma and chest decompression for traumatic cardiac arrest is addressed in a separate guideline.]

Hypoxia and hypoventilation are the primary killers of acute trauma patients. Assessment of ventilation is therefore given high priority in the primary survey. It may be obvious that there is a ventilatory problem during assessment of the airway. Similarly, the identification or actual severity of certain conditions may only be determined subsequently, following completion of the primary survey and with knowledge of the circulatory status, or the use of monitoring and/or diagnostics adjuncts.
Patients with blunt chest trauma often have other injuries that may contribute to periods of instability at their presentation in the Emergency Department and during the first phase of their in-hospital management. Blunt chest trauma often co-exists with head injuries, and as such there is an increased urgency both in the treatment of both obstructive and hypovolaemic shock or the impediment to cerebral venous return as may be caused by a pneumothorax, whilst rapid diagnostic imaging is required to aid early definitive treatment. In addition this is often a stressful, time pressured environment. Simple auscultation of the chest is fraught with difficulty in this setting and the correct diagnosis and timely treatment of pneumo-, haemo- and/or tension pneumothoraces can be challenging.

In view of these problems this guideline aims to improve patient safety and the timeliness of lifesaving interventions by providing consistency in the process and procedure for the management of chest injuries and chest decompression in major trauma patients.
Drainage of the pleural space by means of a chest tube is the commonest intervention in thoracic trauma, and provides definitive treatment in the majority of cases. While a relatively simple procedure, it carries a significant complication rate, reported as between 2% and 10%. While many of these complications are relatively minor, some require operative intervention and deaths still occur.

1.1 Introduction

Major Trauma patients are frequently admitted with blunt chest injuries for which a needle decompression or a thoracostomy (intubated and ventilated patients only) had been performed in the pre-hospital field, for a suspected pneumothorax. Blunt chest trauma may also cause the insidious formation of a simple pneumothorax, which can then rapidly result in a tension pneumothorax upon the introduction of positive pressure ventilation following a trauma RSI. The trauma RSI may have been indicated for ventilatory failure as a result of diagnosed chest injuries, but may also have been performed for an unrelated indication such as a decreased level of consciousness in the head injured patient. Whether the diagnoses of a pneumothorax, haemothorax or tension pneumothorax is clear and expected on the bases of the clinical examination and mechanism of injury, or whether the presentation is more insidious and only apparent upon institution of further interventions, monitoring and/or diagnostics, the timely management of these life threatening conditions are paramount to good trauma care.

Following a guideline for the assessment and management of patients with blunt chest trauma is likely to reduce the risk of complications, improve rapid diagnosis and treatment and improve the trauma team performance and avoid unnecessary delays in obtaining diagnostic imaging, which will in turn improve outcomes. [1]

1.2 Scope

This guideline is for the management of adults with chest injuries and chest decompression in major trauma.

This guideline is for all Emergency Department (ED)staff, all members of the trauma team, including Anaesthetic, Surgical and Intensive Care staff involved in the management of major trauma patients;

Anaesthetic Registrars and Consultants (Bleep 1783 and 1646 carriers)

Operating Department Practitioners / Intensive Care Unit (ICU) Technicians (Bleep 1784 carriers)

ED staff and Trauma team leaders

General Surgeons

Thoracic Surgeons

Intensive Care Physicians

1.3 Purpose

To improve consistency of the management of chest decompression in major trauma patients to increase procedural safety, lower risk and stress to the patient and staff, thereby improving the standards of care and helping to achieve Major Trauma Centre (MTC) quality targets.

- Define indications for chest decompression in the Emergency Department (ED).
- Describe the management of the awake, self ventilating patient requiring chest decompression
- Describe the management of the anaesthetised, ventilated patient with/without pre-hospital needle decompression or thoracostomies
- Describe specific circumstances in which prior needle decompression of the chest may be managed expectantly,
- Describe the suggested sequence of urgent vs delayed insertion of intercostal chest drains (ICD) and diagnostic imaging
- Refer to the Guideline for the use of Antibiotic Prophylaxis in Major Trauma for the prevention of infection following surgical decompression of the chest

1.4 Definitions

Simple pneumothorax: Pneumothorax is the collection of air in the pleural space. Air may come from an injury to the lung tissue, a bronchial tear, or a chest wall injury allowing air to be sucked in from the outside.

Haemothorax: Haemothorax is a collection of blood in the pleural space and may be caused by blunt or penetrating trauma. Most haemothoraces are the result of rib fractures, lung parenchymal and minor venous injuries, and as such are self-limiting. Less commonly there is an arterial injury, which is more likely to require surgical repair.

Tension Pneumothorax: Tension pneumothorax is the progressive build-up of air within the pleural space, usually due to a lung laceration which allows air to escape into the pleural space but not to return. Positive pressure ventilation may exacerbate this 'one-way-valve' effect. Progressive build-up of pressure in the pleural space pushes the mediastinum to the opposite hemithorax, and obstructs venous return to the heart. This leads to circulatory instability and may result in traumatic cardiac arrest.

ICD: intercostal chest drain

RSI: rapid sequence intubation

CXR: chest radiograph – usually AP in the supine, recumbent and immobilised trauma patient

FAST: focused assessment by sonography in trauma

ED: Emergency Department

2 Related Trust Policies

Wessex Major Trauma Network Guidelines
Guideline for the management of traumatic cardiac arrest and emergency thoracotomy
Guideline for the management of rib fractures and analgesia with Lidocaine patches
Guideline for the use of Antibiotic Prophylaxis in Major Trauma

3 Roles and Responsibilities

The Anaesthetic Major Trauma Group and the Anaesthetic Major Trauma Fellow will be responsible for the dissemination of information and education relating to the management of chest decompression in major trauma patient's for Anaesthetists, Intensivists, ODP's, Intensive Care Technicians and theatre staff.
Trust lead for Trauma Education and Clinical Education Lead for Major Trauma will be responsible for the dissemination of information and education relating to the management of chest decompression in major trauma patient's for all ED staff, and will support training in other specialties where required. The individual surgical specialty leads for major trauma will be responsible for dissemination of the guideline and the training within their own specialty.

Trauma Anaesthetist (bleep 1783)

This is a senior Anaesthetist, either a Consultant or an experienced trainee that is available to respond to level one trauma calls. They will provide airway management and analgesia depending on the patient's needs. They assist in the co-ordination of the patient's care from the trauma call in ED through to radiology and onwards to the destination of their care (Intensive Care unit, operating theatres or interventional radiology). The ED team leader can request the Anaesthetist to attend level two trauma calls if required, i.e. to provide analgesia / sedation for the insertion of an ICD.

Trauma Operating Department Practitioner (ODP - bleep 1784)

This is an experienced ODP or ICU technician that has been orientated to the ED department and is familiar with the principles of managing a major trauma patient. They are available to respond immediately and assist the Anaesthetist. See the Trauma ODP Standard Operating Procedure for more details.

4 Guideline for the management chest injuries and chest decompression in Adult Major Trauma

Pre-alert and team brief

If the pre-alert indicates likely chest trauma or that needle thoracostomy / surgical thoracostomies have been performed, two chest drain packs should be immediately available on arrival of the patient in the Emergency Department.

Primary survey

The Primary Survey should whenever the expertise are immediately available, include the use of the extended FAST scan with chest ultrasound.

Immediate CXR in ED should be reserved for unstable polytrauma patients, as the supine CXR is not sensitive, nor specific for the diagnosis of either pneumothorax or haemothorax in trauma. It can however aid the confirmation of correct positioning of the endotracheal tube (i.e. exclude endobronchial intubation) and may show rib fracutures and subcutaneous emphysema to aid correct side diagnoses. It is usually performed in conjunction with a pelvic X-ray in patients too unstable for transfer to trauma CT, to aid the diagnosis of immediately life threatening injuries and sources of potential major haemorrhage.

Awake and self ventilating patients who are stable (or abnormal, but deemed stable for transfer) may proceed to trauma CT to confirm diagnoses.

There should be a lower threshold for early intervention in intubated and ventilated patients, as positive pressure ventilation can rapidly lead to a tension pneumothorax. In patients with suspected head injuries, pneumothoraces should be treated without delay to ensure optimal oxygenation and ventilation and prevent any impediment to cerebral venous drainage as a result of raised intrathoracic pressure.

In cases where a pneumo / haemothorax is suspected, but the patient remains well oxygenated and haemodynamically stable, it is reasonable to proceed to trauma CT. This is a clinical decision and relies on the expertise and confidence of the trauma team accompanying the patient in transfer, and takes into account **the Mechanism of Injury (MOI) and time since the injury.**

Trauma CT remains the most specific and sensitive tool for the correct diagnoses and treatment of chest injuries [2]. However, interventions to the chest inside the CT suite should be avoided.

Needle thoracostomy

Needle thoracostomies are not without morbidity, lung lacerations may result or a pneumothorax / tension pneumothorax may remain untreated.

Current evidence suggests that there is no place for chest decompression via needle thoracostomy in hospital, unless the patient is in extremis and it is performed whilst preparing for the RSI and surgical thoracostomy [3].

Unstable patients, i.e. A, B, C or D failure, should be treated urgently – perform RSI followed by immediate chest decompression via surgical thoracostomy and re-assess. The person performing the surgical thoracostomy and ICD insertion should be scrubbing and preparing for the procedure whilst the RSI is being executed.

Self ventilating patients on whom a needle decompression had been performed in the pre-hospital phase and who present with ongoing ventilator failure, should get an immediate CXR in ED. Large pneumothoraces or tension pneumothoraces should be treated by ICD insertion prior to proceeding to Trauma CT, consideration should be given to the anticipated clinical course of the patient and performing a RSI and general anaesthesia prior to chest decompression.

Surgical thoracostomy

Any major trauma patient with chest trauma and cardiovascular instability and/or difficulty ventilating should have immediate bilateral chest decompression via surgical thoracostomy and ICD insertion.

Ventilated patients who have received a surgical thoracostomy pre-hospital, should have the thoracostomies decontaminated (Betadine / Iodine surgical solution) and explored with a sterile gloved finger to ascertain that the thoracostomy is patent and the lung fully inflated. If there is a release of air or blood from the thoracostomy site or the lung remains partially inflated, insertion of an ICD should be performed immediately. The person performing the ICD insertion should advise the anaesthetist to ensure vigilance about the early diagnosis of a possible tension pneumothorax subsequently.

In exceptional cases, the urgency of the diagnostic imaging may outweigh the risk of a tension pneumothorax occurring in the CT suite. If following exploration of the thoracostomy site, the lung is fully inflated, the incision is patent and the patient is stable, the team leader may then decide to transfer to Trauma CT without ICD insertion. The patient MUST then return to ED and ICD insertion (or closure of the thoracostomy wound) performed immediately after the CT and prior to any further referral or transfer of the patient.

ICD insertion should be performed through THE SAME incision as the original surgical thoracostomy, even if it was performed pre-hospital [4]. The only exception is in obviously soiled wounds or where the pre-hospital team handed over a concern regarding soiling and subsequent infection.

- **PLEASE refer to the guideline on antibiotic administration in major trauma.**

Note an incorrectly placed endotracheal tube in the right main bronchus, may result in the unnecessary and/or wrong sided insertion of a chest drain. This may occur due to right main bronchus intubation with relative hyperinflation of the right lung and left lung collapse, or obstruction of the right upper lobe bronchus with relative decreased air entry in the right upper lobe. Breath sounds can be difficult to determine in the ED and should not be relied upon.

In the event of ventilatory instability or deterioration following the RSI, thoracostomy and/or ICD insertion, an immediate CXR should be considered prior to transfer for the trauma CT. Though the supine CXR is a non-specific diagnostic test in major trauma and may not provide definitive diagnoses, it will diagnose endobronchial intubation and may reveal significant haemo- or pneumothoraces that should be treated promptly.

Small pneumothoraces may only be apparent on the trauma CT. Not all require formal drainage, but a low threshold should exist for all patients who are ventilated and / or going to theatre. If a decision is made NOT to drain the pneumothorax, this information must be handed over clearly to the team responsible for ongoing care.

Seldinger chest drains have NO place in the management of chest injuries in major and/or polytrauma. A large bore 28F or above drain should be used in adult major trauma.

Summary

- Two chest drain packs should be immediately available on arrival of a patient with suspected chest trauma in ED
- The Primary Survey should whenever possible include the use of the extended FAST scan with chest ultrasound
- CXR in ED as part of the primary survey, should be reserved for unstable polytrauma patients
- The diagnostic investigation of choice in chest trauma is the Trauma CT
- With ventilatory compromise, there should be a lower threshold for intervention and decompression of the chest in patients with suspected head trauma
- Where a head injury has not been sustained and ventilation is satisfactory, it is reasonable to proceed to Trauma CT even if a pneumo-/haemothorax is diagnosed/suspected
- Surgical thoracostomy is the preferred technique for decompression of the chest in hospital, needle thoracostomy is reserved for patients in extremis whilst preparing for RSI and/or the surgical decompression
- All pre-hospital thoracostomies should be explored with a sterile gloved finger and the wound decontaminated as part of the primary survey
- Insertion of the ICD may follow the Trauma CT in cases where the thoracostomies are patent and the patient's ventilator status is satisfactory
- If there are any ventilator concerns in patients **with thoracostomies**, ICD insertion should be performed prior to Trauma CT

- Detailed information of the findings on examination and exploration of thoracostomies must be handed over on transfer of the patient to subsequent areas / persons.
- Subsequent ICD insertion should proceed through the same incision as the pre-hospital thoracostomy, unless there is obvious soiling or concerns re infection handed over by the pre-hospital team
- Where direct admission to a ward or ICU is indicated, all patients with thoracostomies MUST either have the thoracostomy wound closed if no ICD is required, or the ICD inserted and correct positioning confirmed by CXR or CT prior to transfer from ED,
- Antibiotic prophylaxis should be administered to all patients who had pre-hospital thoracostomies performed

5. Implementation (including training and dissemination)

Implementation will be the responsibility of the major trauma leads in each specialty. Resources for training and dissemination of this guideline will be available through the Trust lead for Major Trauma Education, the Staff intranet, internal major trauma courses such as TILS, Thoracotomy course, Anaesthetic Trauma Simulation courses and the "Major Trauma Booklet".

6. Process for Monitoring Compliance/Effectiveness of this policy

Compliance and effectiveness of this guideline will be monitored through the Major Trauma Clinical Governance Group (MTCGG), Where any adverse events will be reviewed as they occur.

7. Arrangements for Review of this Policy

Review of this policy will be orchestrated through the MTWG and the MTCGG. At least 3 yearly.

8. References

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4.4 UHS Major Trauma Team SOP

Major Trauma Team SOP	Version: 1
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Document Status

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Executive Summary

This interim Standard Operating Procedure (SOP) is to support the Major Trauma centre patients and Major Trauma Nurse Practitioner team whilst the long term clinical model is developed, which will include substantive appointment of Major Trauma consultant Mon – Fri, 8am – 6pm. It summarises who is will undertake the day to day decisions for these the MT patients, and the support the decision makers will have. It also summarises the role of Major Trauma Nurse Practitioner team, the major trauma Rehab coordinator and the expected attendance at the Major Trauma daily MDT.

A draft SOP is will be available once the long term clinical model has been agreed

1 Scope and Purpose

This SOP applies to all areas and staff members who are caring for Major Trauma patients within UHS.
Its' aim is to clarify which speciality is responsible for each element of patient care, which clinical team the patient will be admitted under, the composition of the daily MTC MDT.

It will clarify which patients are to be admitted to the Major Trauma Unit F1.

This SOP specifically excludes patients with isolated head injuries.

The Outcomes sought are:
All patients receive that input from the appropriate specialty at the appropriate time
All patients requiring admission to the major Trauma unit are admitted to F1 Major Trauma Unit
All patients requiring multiple specialist input receive that input from all specialities

2 Definitions

Lead Consultant:
The consultant on call the day the patient is admitted following their Trauma.
In polytrauma cases, involving orthopaedic injuries, this will be the T&O COW.
In polytrauma cases, where the patient has no orthopaedic injuries, the lead consultant will be the specialty caring for the most significant injuries.
The lead consultant can expect that their request for a patient review will be undertaken as requested and if appropriate a treatment plan documented in the patients notes.

Major Trauma Centre (MTC):
UHS is the major trauma centre for Wessex Major Trauma Network. Major Trauma Units take less acute patients, more acute patients are cared for at UHS.

Major Trauma Patient:
Any patient admitted as a non elective patient, requiring the input of 2 or more specialities.

Major Trauma Unit:
The clinical area that all major trauma patients, not requiring intensive care, will be admitted to.

Multi-Disciplinary team (MDT):
Cross professional group that review / discuss patients to provide the best care / input.

Named Specialist Consultant
Consultants offering specialist management advice to the Lead Consultant, for example Thoracic surgeons offering advice to Orthopaedic surgeons.

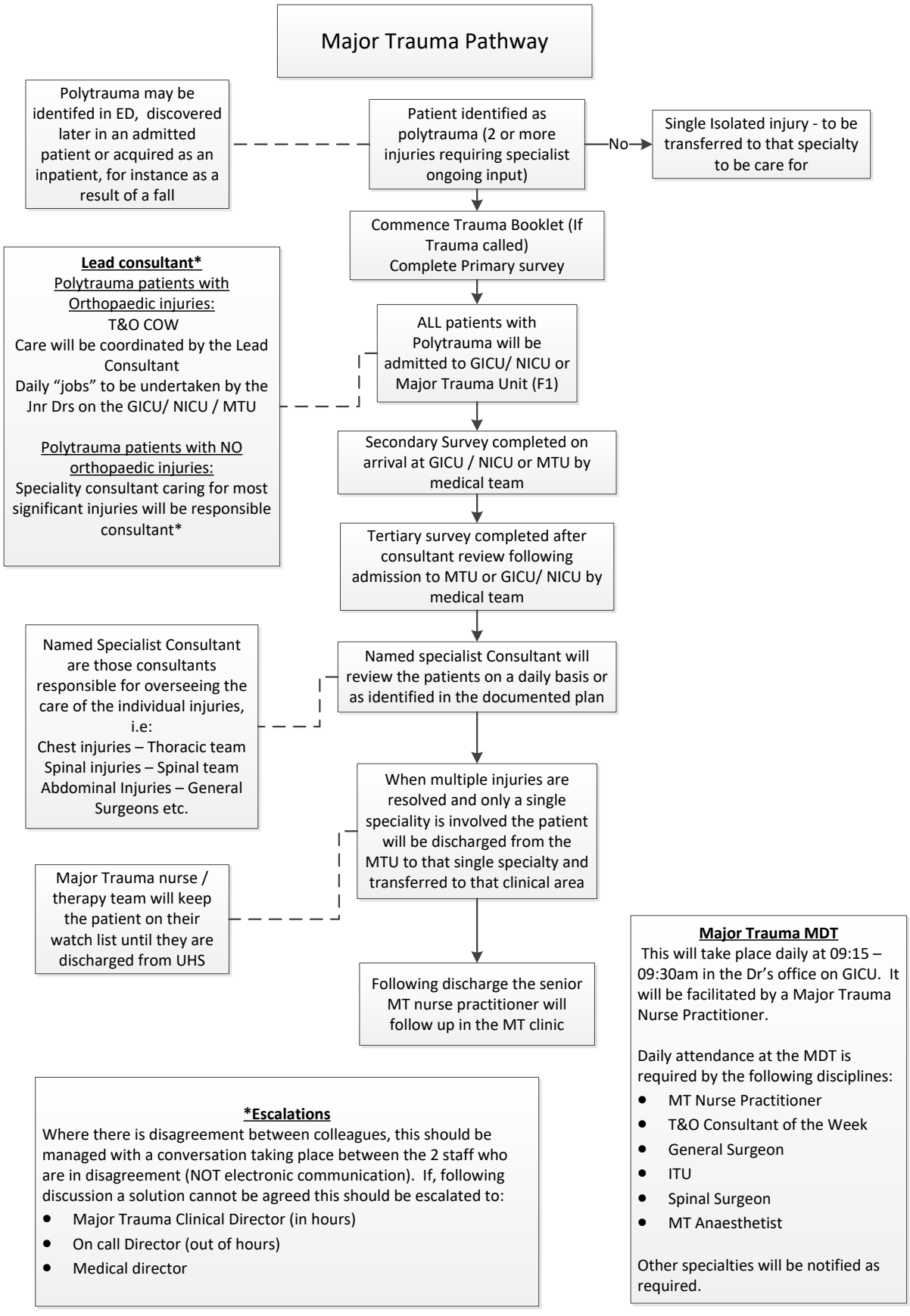
Standard Operating Procedure (SOP):
A SOP is a set of instructions to be followed in carrying out a given operation, or in a given situation, which lend themselves to a definite or standardized procedure without loss of effectiveness.

TARN
Trauma Audit and Research Network

WTN
Wessex Trauma Network – encompassing

- UHS as Major Trauma Centre,
- North Hampshire Hospital; Dorset county hospital, Dorchester; Queen Alexander Hospital, Portsmouth; St Mary's Hospital, Isle of Wight; Salisbury District Hospital, Poole General Hospital as Trauma Units and
- Royal Hampshire County Hospital, Winchester and Royal Bournemouth Hospital as local receiving units.
- Local ambulance and air ambulance Trusts

3 Overview of Procedure to be followed



4 Detail of Procedure to be followed

4.1 Initial Presentation

Patients will present as an emergency in the Emergency Department (ED) or possibly as a result of a hospital acquired injury (e.g. fall)
In ED the Major Trauma booklet should be commenced if the patient is trauma called

4.2 Admitting area and consultant responsibility

Patients requiring intensive care will be admitted to GICU.

Patients with a major head injury requiring ventilation will be admitted to NICU.

Patients requiring the input of 2 or more specialties, but NOT requiring intensive care will be admitted to Major Trauma Unit F1.

The secondary surveys will be completed by the GICU / NICU or T&O medical team at time of transfer. The Tertiary survey will be completed after the post take ward round by the GICU / NICU or T&O medical team.

Patients with a single isolated injury only requiring input from 1 speciality and not requiring intensive care will be admitted to that specialty.

Admission to AMU is rarely appropriate. If there are medical concerns the patient should be reviewed by a physician in ED prior to transfer to F1 Major Trauma Unit. The physician is expected to document their advice in the patient record.

4.2.1 Lead Consultant (polytrauma – with Orthopaedic injuries)

Polytrauma patients with orthopaedic injuries will be admitted under the care of T&O Consultant of the week (the Lead Consultant), daily provision of holistic care will be from the Lead Consultant. This care will be supported by the MTNP team, the T&O junior medical team, the trauma coordinators and the Major Trauma Rehab coordinator.

Polytrauma patients will have a Named Specialist Consultant responsible for each injury identified in the notes. Each consultant will formulate and document a plan for that injury with a clear plan for review as per section 4.8

The admitting consultant for the MT patients is the T&O consultant on duty at the time of the patients admission, i.e. the T&O the Consultant of the week. This will be documented in the patients notes. The patients will remain under the T&O consultant until they are discharged from T&O.

4.2.2 Lead Consultant (polytrauma – <u>no</u> orthopaedic injuries)

Polytrauma patients who have no orthopaedic injuries, but significant other system injuries will be admitted to Major Trauma Unit F1 under the specialty caring for the most significant injuries. That speciality consultant will be the Lead Consultant and will review the patient with the MTNP on a daily basis. When only one specialty is involved the patient will then be discharged from Major Trauma unit F1 and be transferred to that specialities clinical area.

4.2.3 Lead & Named Specialist Consultants – notification

As per the Trusts admission policy ED doctors will decide who the Lead Consultant is. ED will advise the Lead consultant to expect the admission via the speciality registrar.
It is expected that ED will advise ALL registrars of the Named Specialist Consultants of the patients admission and the requirement for review and document who this is in the patient notes. If ED are unable to do this they must advise the T&O / GICU Reg on call.
It is expected that most patients will be admitted under the T&O COW
The named specialists are to be documented in the Trauma booklet.

For polytrauma patients it is expected that the accepting registrar will inform the T&O bed manager (Bleep holder out of hours) to arrange a bed on the MTU for the patient.

4.2.3.1 Out of Hours

To avoid ambiguity the processes highlighted in sections 4.2.2 and 4.2.3 will be implemented both in and out of hours.

In areas of disagreement, the T&O COW will have the final say which specialty the patient will be admitted.

The T&O Consultant of the week will also provide trauma advice and guidance to the WTN trauma units as required.

4.2.4 Patients with single isolated injuries

If the patient has a single isolated injury the patient will not be cared for by the T&O consultants and should be admitted under that speciality. In areas of disagreement, the T&O consultant of the week will have the final say which specialty the patient will be admitted.

4.2.5 Escalation

Where there is disagreement between colleagues, this should be managed with a conversation taking place between the 2 staff who are in disagreement (NOT electronic communication).
If, following discussion a solution cannot be agreed this should be escalated to:

- Major Trauma Clinical Director (in hours)
- On call Director (out of hours)
- Medical director

4.2.5.1 Escalation for patient review

When there is reluctance to review a MTU patient. The MTU nursing staff should escalate this to the T&O Matrons and Care group management team as soon as this becomes apparent. The T&O management team and Matrons will escalate as appropriate to ensure the patient receives a timely review.

4.3 Major Trauma Unit (F1)

All poly trauma patients, not requiring intensive care should be admitted to the Major Trauma unit (MTU). The major trauma unit is currently F1. When the T&O registrar is notified of the patient by ED, it is expected that they will ask the T&O bed manager (Bleep holder our of hours) to arrange a bed on the MTU.
The MTU should always have 1 empty bed to be able to accommodate trauma needing admission from ED or ICU.

There are 12 hyper acute Trauma beds (2 bays) where the staffing is uplifted to enable more acute patients to be transferred from ICU when a patient no longer requires the hyper acute care they should stay within the MTU.

The MTU ward round will take place following the Major Trauma Centre MDT (see section 4.4)

Outliers will be reviewed after the ward round is completed in Orthopaedics. The MT Rehab Coordinator will rejoin the ward round for outliers.

4.4 MTC Multi - Disciplinary Team Meeting (MDT)

All patients admitted with Major Trauma in the previous 24 hours and those that require further discussion, will be discussed at the MTC MDT. This will take place daily at 09:15 – 09:30am in the Dr's office on GICU. It will be facilitated by a Major Trauma Nurse Practitioner.

4.4.1 MTC MDT composition

Daily attendance at the MDT is required by the following disciplines:

- MT Nurse Practitioner
- MT Anaesthetist
- T&O Consultant of the Week
- General Surgeon
- ITU
- Spinal Surgeon

In addition to these any other specialties will be co-opted when required. The MT administrator will contact the nurse practitioner teams of these specialities and advise that attendance is required.

Documentation of the MDT discussions will be undertaken by the ICU lead during the MDT on Metavision.

Any disagreements at the MDT should be escalated as per section 4.2.5

4.5 Role of Major Trauma Anaesthetist

The major trauma anaesthetist will provide advice and support to the Lead consultant, the junior Dr's and the major trauma nurse practitioner team. The major trauma anaesthetist will also attend the MT MDT and Trauma Calls. The major trauma anaesthetist will carry the major trauma anaesthetist bleep.

4.6 Role of Major Trauma Nurse Practitioners

The major trauma nurse practitioners are a highly skilled and highly trained, small team of nurses. They provide a 7 day service from 7am – 7pm, with a maximum of 2 MTNP's on duty from 7am – 5pm on Mondays and Fridays. This team of nurses will work with the major Trauma team to ensure that all patients requiring review
The Major Trauma Nurse Practitioners will attend any Trauma calls
To work with the Major Trauma Rehab coordinator to ensure that all Major Trauma patients are reviewed appropriately and referred to most appropriate team / centre for ongoing care.

4.7 Role of the Major Trauma Rehab Coordinator

In conjunction with the Major Trauma Nurse practitioners, the Orthopaedic consultant and the Major Trauma Rehab consultant to manage own caseload of patients across the Trust, ensuring that that the patients are reviewed by the appropriate specialities and the MT consultant as required.
Support the ward staff in completing the Rehab prescriptions in time for the patients transfer.
Ensure that patients are referred on for continuing rehabilitation.

4.8 Named Specialist Consultant Review

Many patients will have numerous specialists involved in their care. It is expected that each Named Specialist Consultant will provide a clear plan and this will be documented in the patients notes, including but not limited to; a clear schedule of review (i.e. daily / every other day), when the team should be contacted and how and which clinical area the patient can be transferred to if their speciality is the remaining specialty requiring input.
If the Lead Consultant requests a review of the patient from a specialty it is expected that this will be undertaken.

4.9 MT Nurse Practitioner Clinic

All patients that have been under the care of the MTNP team that will be followed up by the MT Nurse Practitioners. The MTNP clinic is a telephone review clinic. Each patient should be reviewed approximately 6 weeks after discharge from hospital. During this clinic the MTNP will ensure that the patient has received all their required outpatient appointments with the specialities involved in their care.

5 Roles and Responsibilities

Site Managers and bed managers for arranging beds in appropriate areas
T&O consultants for accepting the care, admission of these patients and coordinating the holistic care of these patients
Major Trauma Nurse practitioners for coordinating the care of these patients with the Orthopaedic consultants
All consultants for attendance at, or ensuring a suitable deputy attends, the daily MTC MDT.

6 Communication Plan

T&O Trauma leads for dissemination within T&O
To COO, Medical director and deputy for cascade to DCD's
To all DDO's for information
To all DCD's for cascade to all care group clinical and leads consultants
To all Care Group Major Trauma leads for dissemination
Focused communication within T&O, ED and Anaesthetics via DCD, DDO's, care group managers, matrons, to all consultants, bed managers, ward clerks and nursing staff

7 Process for Monitoring Compliance/Effectiveness

The purpose of monitoring is to provide assurance that the agreed approach is being followed – this ensures we get things right for patients, use resources well and protect our reputation. Our monitoring will therefore be proportionate, achievable and deal with specifics that can be assessed or measured.

Key aspects of the procedural document that will be monitored:

What aspects of compliance with the document will be monitored	What will be reviewed to evidence this	How and how often will this be done	Detail sample size (if applicable)	Who will co-ordinate and report findings (1)	Which group or report will receive findings
Trauma patients nursed on GICU or F1	e-Camis, patient ward	Quarterly	All TARN patients for previous ¼	MTC operations Manager	MTC management team and care Group trauma leads
Attendance at MTC MDT	Attendance lists	Quarterly	N/A	MTC operations Manager	MTC management team and care Group trauma leads
MT Nurse practitioner available 7am – 5pm 7 days / week	MTNP roster	Monthly	N/A	MTC operations manager and lead MTNP	MTC management team and care Group trauma leads
All patients requiring specialty review receive review as planned	Notes review for plan and actual review	Quarterly	25 patients	MTC Operations Manager and Director for MTC	MTC management team and care Group trauma leads
All patients cared for by the MTNP are reviewed in MTNP clinic	Admissions and follow up letter	Quarterly	25 patients	MTC Operations Manager and Director for MTC	MTC management team

(2) State post not person.

Where monitoring identifies deficiencies actions plans will be developed to address them.

8 Arrangements for Review of the Policy

This SOP will reviewed when the clinical model for the MTC patients has been agreed and recruited to.

9 References

NICE Major Trauma guidelines – February 2016

Major Trauma Team SOP	Version: 1

Document Monitoring Information	
Approval Committee:	Division D Governance
Date of Approval:	Insert Date
Ratification Committee:	Policy Ratification (PRG)
Date of Ratification:	Insert Date
Signature of ratifying Committee Group/Chair:	Insert Signature or name (Chair of PRG if Level 1 document)
Lead Name and Job Title of originator/author or responsible committee/individual:	Emma Bowyer – MTC manager Mark Baxter – MTC Clinical Director
Policy Monitoring (Section 6) Completion and Presentation to Approval Committee:	6/04/2020
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Key words:	Major Trauma, Medical Model, admissions, medical ownership, lead specialties
Main areas affected:	T&O, all Surgical specialties, Critical care areas, CV&T, Neuro, ED, Spinal surgery
Summary of most recent changes if applicable:	New document
Consultation:	T&O, ED, all Trust Trauma Leads, Medical Director, COO
Number of pages:	10
Type of document:	SOP
Does this document replace or revise an existing document	No
Should this document be made available on the public website?	No
Is this document to be published in any other format?	No