

MAJOR TRAUMA



AUGUST 2017



Ministry of Health & Family Welfare
Government of India





STANDARD TREATMENT GUIDELINES

MAJOR TRAUMA

AUGUST 2017

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Government of India

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ABBREVIATIONS

ABG	: Arterial Blood Gas
APTT	: Activated Partial Thromboplastin Time
CT	: Computed Tomography
FAST	: Focussed Assessment with Sonography for Trauma
FFP	: Fresh Frozen Plasma
Hb	: Hemoglobin
HES	: Hydroxyethyl Starch
i.v.	: Intravenous
INR	: International Normalized Ratio
MAP	: Mean Arterial Pressure
mmHg	: Millimeters of Mercury
PaCO ₂	: Partial Pressure of Carbon Dioxide
PT	: Prothrombin Time
RBC	: Red Blood Cell
SBP	: Systolic Blood Pressure
SpO ₂	: Oxygen Saturation of Blood
STG	: Standard Treatment Guideline

INTRODUCTION

Between 1990 and 2013, non-communicable diseases like injuries have become the main causes of mortality and morbidity across the world^[1]. Every year 5 million people die due to injuries accounting for 1/10th of world's deaths, larger than fatalities due to HIV/AIDS, TB and malaria combined^[2]. Over 90% of these deaths occur in low-and-middle-income-countries (LMICs) and if the injury death rates in these countries could be reduced, to that of high-income-countries, nearly 2 million lives could be saved every year^{[3][4]}. Consequently, there has been increased attention in the international sphere of the need to reduce mortality due to injuries. The Sustainable Development Goals (SDGs) have set the target of halving the current rates of mortality due injuries by 2030^[5]. This requires a continuum of interventions ranging from improving pre-hospital services, streamlined in-hospital care protocols and trained personnel^[6]. Out of all trauma deaths, 30-50% has been estimated to occur in hospital, highlighting the need for strengthened hospital trauma care^[7]. However, most LMICs do not have in place such capacities to deal with trauma care [8].

TRAUMA SCENARIO IN INDIA

India, the second-most populous country in the world, is in rapid epidemiological transition, with an increasing burden of noncommunicable diseases like injury^[1]. With its large population and inadequate health care system, it shares a major chunk of the trauma burden. It accounts for nearly 20% of the global injury mortality making it a key health priority with substantial scope of improvement^[9]. Injuries and trauma are rapidly increasing becoming the top causes mortality and morbidity in the country necessitating critical attention in policy and practice^{[1][10][11]}. More than half of these deaths can be prevented by improving trauma services, developing guidelines and investing resources^{[12][13]}.

WHY THIS STG IS NEEDED

While there is some acknowledgment among policy makers in India of the significant health challenge posed by trauma, the current trauma care system is largely deficient in terms of guidelines and resources to meet the growing burden of injury and trauma in the country [14][15][16]. The increasing burden of injuries would consequently result in more pressure on the healthcare system to provide adequate and quality trauma care services. Therefore, it is imperative that the healthcare system develops guidelines and protocols to better equip it to respond to this challenge. A key step is developing standard treatment guidelines for trauma which are suitable for the Indian setting by adapting and contextualizing existing guidelines already being used in other settings.

This Standard Treatment Guideline on Major Trauma aims to begin this process by developing guidelines on major trauma in the Indian health setting. This document does not seek to exhaustively cover every aspect of major trauma and would need to be periodically updated. It would be focusing primarily on major trauma among the adult population covering broad issues such as management of airway, breathing, hemorrhage, pain and other broad areas of trauma without going into definitive care. Recognizing the role played by patient carers in the healthcare system in India, it will include key information to support and guide patients and their carers.

Moreover, the resource availability both equipments and personnel is different in different settings. This document acknowledges that it cannot solve all the challenges of providing trauma care in every health facility given the differences in resources available in different facilities. But it is a tool for medical professionals to enhance the effectiveness and the quality of the services that they can provide and thereby make improvements in the management of major trauma in their own facilities with the resources that they have. Thus, the STG aims to contribute in better planning and provisioning of trauma care services to be made available in the Indian context.

SCOPE OF STG MAJOR TRAUMA MANAGEMENT

A. POPULATION

Adult Population more than 18 years of age

B. HEALTH SETTINGS

Primary, secondary and tertiary health care settings

C. KEY ISSUES THAT WILL BE COVERED

1. Prehospital care

Briefly describing the management of airway, breathing, circulation, spine and fractures in pre-hospital settings.

2. In-Hospital care

1. Airway management with cervical spine protection:
 - Definitive airway control

2. Breathing and ventilation:
 - Recognition of chest trauma (clinical assessment) and management of life saving chest trauma and pneumothorax.

- Imaging assessment of chest trauma (including choice and timing of imaging modality and imaging parameters) such as, X-ray, FAST, CT

3. Circulation with haemorrhage control:

- Assessment and management of haemorrhage and shock
- Control of external haemorrhage, non compressible haemorrhage
- Control of haemorrhage
 - ◆ Use of major haemorrhage protocols
 - ◆ Damage-control surgery
- Management of shock:
 - ◆ i.v. Access
 - ◆ Hypotensive versus normotensive resuscitation
 - ◆ Type of fluid replacement
 - ◆ Intravenous fluid therapy
 - ◆ Haemostatic agents
- Monitoring:
 - ◆ Blood tests
 - ◆ Frequency of monitoring
- Management of specific complications in hospital relating to anticoagulation reversal.

4. Head Injury management:

- Early management

5. Spine trauma management

6. Major Fracture management:

- Stabilization of Major fractures (Pelvic, long bone)
 - Assessment of Vascular complications related to fractures
7. Assessment and management of pain relief
 8. Skills to be present within the multidisciplinary team
 9. Documentation of clinical assessments and management for people with major trauma
 10. Information and support needs of patients and their families and carers when appropriate

D. CLINICAL ISSUES THAT WILL NOT BE COVERED

- a) Prevention of major trauma
- b) Any management after definitive life saving or limb saving intervention
- c) Major trauma resulting from burns
- d) Head injury (for disability relating to neurological assessment)
- e) Details of Pre-hospital management of trauma (extrication, whom to transfer, where to transfer)
- f) Trauma Rehabilitation

E. MAIN OUTCOMES

- a) Mortality
- b) Morbidity
- c) Health related quality outcomes.
- d) Time to operating theatre, time to CT scan, time to definitive control of haemorrhage (surrogate outcome of quality of care).

RECOMMENDATIONS

"Since the management of Trauma is situation based and treatment may undergo change accordingly, the guidelines are therefore recommendatory only"

1. PRE-HOSPITAL

1.1. Airway management

- 1.1.1 Consider using a supraglottic device* if the patient's airway reflexes are absent. Use basic airway manoeuvres like inserting a Guedel's airway** and bag and mask ventilation if required or if supraglottic device placement is not possible.

*supraglottic device - Laryngeal mask airway, proseal, i-gel etc.

**Guedels airway = Oropharyngeal airway/oral airway.

1.2 Chest Trauma

- 1.2.1 Use clinical assessment to diagnose pneumothorax for the purpose of triage or intervention.
- 1.2.2 In patients with an open pneumothorax: Cover the open pneumothorax with a three sided occlusive dressing and Observe for the development of a tension pneumothorax.

1.3 Haemorrhage

- 1.3.1 Use simple dressings (sterile gauze pads) with direct pressure to control external haemorrhage.

- 1.3.2 In patients with major limb trauma use a tourniquet* if direct pressure has failed to control life threatening haemorrhage.
*(*Tourniquet can be a bandage roll, rubber tubing, crepe bandage etc.)*
- 1.3.3 If active bleeding is suspected from a pelvic fracture after blunt high-energy trauma: Apply a pelvic binder.
- 1.3.4 Use intravenous tranexamic acid as soon as possible in patients with major trauma and active or suspected active bleeding.
*(*Dose of Tranexamic acid - 1 gm i.v. over 10 min followed by 1 gm i.v. over 8 hrs)*
- 1.3.5 Do not use intravenous tranexamic acid more than 3 hours after injury in patients with major trauma.
- 1.3.6 For circulatory access in patients with major trauma in pre-hospital settings: Use peripheral intravenous access.
- 1.3.7 In pre-hospital settings, titrate volume resuscitation to maintain a palpable central pulse(carotid or femoral).
- 1.3.8 In pre-hospital settings only use crystalloids (Ringer's lactate or Normal saline) to replace fluid volume in patients with active bleeding.
- 1.3.9 Minimise ongoing heat loss in patients with major trauma.
**Blankets can be used for reducing heat loss*

1.4 Pain Management

- 1.4.1 Assess pain regularly in patients with major trauma using a pain assessment scale.
- 1.4.2 For patients with major trauma, use intravenous morphine/strong opioids as the first line analgesic and adjust the dose as needed to achieve adequate pain relief
**To be administered after medical consult.*

1.5 Spine Trauma

- 1.5.1 Carry out full in-line* spinal immobilisation.
**By placing two blocks on either side of the head. Intravenous fluid bottles can also be used to prevent movement.*

1.6 Fractures

- 1.6.1 Do not irrigate open fractures of the long bones, hindfoot or midfoot in pre-hospital settings.
- 1.6.2 Consider a saline soaked dressing covered with an occlusive layer for open fractures in pre-hospital settings.
- 1.6.3 In the pre-hospital setting, consider the following for people with suspected long bone fractures of the legs: A rigid or malleable splint or adjacent leg as a splint if the suspected fracture is above the knee.

2. IN-HOSPITAL CARE

2.0 Airway and Chest Trauma Management

2.1 Airway Assessment

- 2.1.1 A clinical examination of the thorax and respiratory function must be carried out.
- 2.1.2 The examination should include as a minimum the measurement of the respiratory rate and auscultation of the lungs. The examination should be repeated.
- 2.1.3 The following can be helpful: inspection (bilaterally unequal in respiratory excursion, unilateral bulging, paradoxical respiration), palpation (pain, crepitations, subcutaneous emphysema, instability) and percussion (hyperresonant percussion) of the thorax together with pulse oxymetry and, in ventilated patients, monitoring ventilation pressure(if available).

2.2 Securing Airway

- 2.2.1 Manual in-line stabilization should be carried out for endotracheal intubation with the cervical spine immobilization device temporarily removed.
- 2.2.2 A difficult airway must be anticipated when endotracheally intubating a trauma patient.
- 2.2.3 The multiply injured patient must be preoxygenated before anesthesia.

- 2.2.4 Use drug-assisted rapid sequence induction (RSI) of anaesthesia and intubation as the definitive method of securing the airway in patients with major trauma who cannot maintain their airway and/or ventilation.
- 2.2.5 If RSI fails, use basic airway manoeuvres and adjuncts and/or a supraglottic device until a surgical airway or assisted tracheal placement is performed.
- 2.2.6 If difficult anesthetization and/or endotracheal intubation are expected, an anesthesiologist must carry out or supervise this procedure in-hospital provided this does not cause delay in an emergency life-saving measure.

Suitable measures must be in place to ensure that an anesthesiologist is normally on site in time

- 2.2.7 After more than 3 intubation attempts, alternative methods must be considered for ventilation and securing an airway.
- 2.2.8 Alternative methods for securing an airway must be provided when anesthetizing and endotracheally intubating a multiply injured patient.

**Alternatives like emergency cricothyroidotomy or surgical airway*

- 2.2.9 Etomidate should be avoided as an induction agent due to the associated side effects on adrenal function .

**Ketamine can be used as a safe alternative as an induction agent. Dose- 1-2 mg/kg, time to effect of 45-60 seconds.*

- 2.2.10 ECG, blood pressure measurement, pulse oxymetry and capnography(if available) must be used to monitor the patient for anesthesia induction, endotracheal intubation and emergency anesthesia.
- 2.2.11 Normoventilation must be carried out in endotracheally intubated and anesthetized trauma patients.
- 2.2.12 Ventilation must be monitored and controlled by frequent arterial blood gas analyses(if available) in the hospital.

If ABG analysis not available, then keep a check clinically by observing the chest rise & four point auscultation of the chest.

- 2.2.13 In mandible and maxillofacial injuries, primary securing of the airways and hemostasis in the oral and maxillofacial region must be carried out.

2.3 Chest Trauma Diagnosis and Management

- 2.3.1 A suspected diagnosis of pneumothorax and/or hemothorax must be made if breath sounds are weaker or absent on one side (after checking correct placement of the tube). Absence of such auscultation findings largely rules out a larger pneumothorax, especially if the patient is normopneic and has no chest pain.
- 2.3.2 A suspected diagnosis of tension pneumothorax should be made if auscultation of the lung reveals no breath sounds unilaterally (after checking correct placement of the tube) and, in addition, typical symptoms are present, particularly severe respiratory disorder or upper inflow congestion combined with arterial hypotension.
- 2.3.3 Clinically suspected tension pneumothorax must be decompressed* immediately.
**Chest decompression mainly refers to tube thoracostomy/ Chest drain placement.*
- 2.3.4 Use open thoracostomy instead of needle decompression if the expertise is available, followed by a chest drain via the thoracostomy in patients who are breathing spontaneously.
**Open method of chest drain insertion to be preferred over trocar method. Needle decompression should not be attempted unless absolutely indicated.*
- 2.3.5 Observe patients after chest decompression for signs of recurrence of the tension pneumothorax.
- 2.3.6 In patients with an open pneumothorax: cover the open pneumothorax with a simple occlusive dressing and observe for the development of a tension pneumothorax.
- 2.3.7 Pneumothorax diagnosed on the basis of an auscultation finding in a patient on positive pressure ventilation should be decompressed.
- 2.3.8 Pneumothorax diagnosed on the basis of an auscultation finding in patients not on ventilation should usually be managed by close clinical observation.
- 2.3.9 Pneumothorax should be treated with a chest drain provided the indication exists.
- 2.3.10 If there are perforating chest injuries, embedded foreign bodies should only be removed during surgery under controlled conditions after opening up the chest.
- 2.3.11 A penetrating chest injury, which is the cause of hemodynamic instability in the patient, must undergo an immediate exploratory thoracotomy.

2.3.12 A thoracotomy can be performed if there is an initial blood loss of > 1,500 ml from the chest drain or if there is persistent blood loss of > 250 ml/h over more than 4 hours.

2.4 Imaging in Chest Trauma

2.4.1 Imaging for chest trauma in patients with suspected chest trauma should be performed urgently, and the images should be interpreted immediately by a healthcare professional with training and skills in this area.

2.4.2 Consider immediate chest X-ray and/or eFAST (extended focused assessment with sonography for trauma) as part of the primary survey to assess chest trauma with severe respiratory compromise.

2.4.3 Consider immediate CT for those with suspected chest trauma without severe respiratory compromise who are responding to resuscitation or whose haemodynamic status is normal.

3. HAEMORRHAGE AND SHOCK

3.1 Dressings and tourniquets in hospital settings

3.1.1 Use simple dressings* with direct pressure to control external haemorrhage.

**sterile gauze pads*

3.1.2 In patients with major limb trauma use a tourniquet* if direct pressure has failed to control life-threatening haemorrhage.

**a bandage, a strip of cloth, a band of rubber, etc., that checks bleeding or blood flow by compressing the blood vessels*

3.2 Haemostatic agents in hospital settings

3.2.1 Use intravenous tranexamic acid as soon as possible in patients with major trauma and active or suspected active bleeding.

Dosage as German guidelines Tranexamic acid initially 1 g i.v. as saturation over 10 minutes + 1 g over 8 hours (CRASH 2 Trials) * Or 2 g (15–30 mg/kg)

3.2.2. Do not use intravenous tranexamic acid more than 3 hours after injury in patients with major trauma.

3.3 Anticoagulant reversal in hospital settings

- 3.3.1 Rapidly reverse anticoagulation in patients who have major trauma with haemorrhage.
- 3.3.2 FFP (10-15 ml/kg body weight) is recommended when there is bleeding associated with clotting factors deficiency and if no alternative processed products or specific factor concentrates are available.

If immediate reversal of warfarin effect is required. Intravenous vitamin K 5mg should be concurrently given for sustained reversal of warfarin effect.

**Management of bleeding following major trauma: an updated European guideline Rolf Rossaint et al.*

- 3.3.3 Consult a physician immediately for advice on adults (18 or over) who have active bleeding and need reversal of any anticoagulant agent other than a vitamin K antagonist.
- 3.3.4 Do not reverse anticoagulation in patients who do not have active or suspected bleeding.

3.4 Trauma induced coagulopathy

- 3.4.1 Trauma-induced coagulopathy is an autonomous clinical picture with clear influences on survival. For this reason, coagulation diagnostic tests* and therapy must be started immediately in the emergency room.

**Coagulation diagnostic tests - Platelets, PT/INR, APTT and Fibrinogen (if available)*

3.5 Activating major haemorrhage protocols in hospital settings

- 3.5.1 Use physiological criteria that include the patient's haemodynamic status and their response to immediate volume resuscitation to activate the major haemorrhage protocol.
- 3.5.2 Do not rely on a haemorrhagic risk tool* applied at a single time point to determine the need for major haemorrhage protocol activation.

**For example: ABC score, TASH score, PWH score, McLaughlin score, Emergency transfusion score, Shock Index etc These measure variables at a single point in time.*

3.6 Circulatory access in hospital settings

3.6.1 For circulatory access in patients with major trauma in hospital settings: use peripheral intravenous access (14 or 16 gauge intravenous cannula) or if peripheral intravenous access fails, a venous cutdown should be done.

3.7 Volume resuscitation in hospital settings

3.7.1 For patients with active bleeding use a restrictive*/balanced approach to volume resuscitation until definitive early control of bleeding has been achieved

**Restrictive resuscitation - in order to keep the circulation at a low stable level (Systolic BP: 90 mmHg or palpable central pulse) and not exacerbate the bleeding. (from the german guidelines)*

3.7.2 In hospital settings, titrate volume resuscitation to maintain a palpable central pulse (carotid or femoral).

3.7.3 For patients who have haemorrhagic shock and a traumatic brain injury: if haemorrhagic shock is the dominant condition, continue restrictive volume resuscitation or if traumatic brain injury is the dominant condition, use a less restrictive volume resuscitation approach to maintain cerebral perfusion.

3.7.4 Damage Control resuscitation:

- In patients who are actively bleeding, the goal can be set at mean arterial pressure ~ 65 mmHg and systolic arterial pressure ~ 90 mmHg until surgical hemostasis.
- Suitable measures should be taken and treatment given to avoid hypothermia.
- Acidemia should be avoided and treated by suitable treatment.

3.8 Fluid replacement in hospital settings

3.8.1 In hospital settings, only use crystalloids* to replace fluid volume in patients with active bleeding if blood components are not available.

** preferably Normal saline, Ringers lactate. Glucose containing fluid should be avoided in (a head injury) patients, during initial resuscitation.*

3.8.2 Human albumin must not be used in hospital volume replacement.

3.8.3 Colloidal solutions can be used in hypotensive trauma patients, if available and preference should be given to HES 130/0.4.

3.9 Haemorrhage protocols in hospital settings

- 3.9.1 Hospital should have specific major haemorrhage protocols for adults.
- 3.9.2. For patients with active bleeding, start with a fixed-ratio protocol (1:1:1 FFP: platelets:RBC) for blood components and change to a protocol guided by laboratory coagulation results at the earliest opportunity.
- In patients with Grade 3 and 4 hemorrhagic shock with imminent threat to life and if components are not available then whole blood can be given to stabilize the patient before transferring to a higher centre[MK5].
- 3.9.3 In an actively bleeding patient, the indication for transfusion can be made at hemoglobin levels below 10 g/dL, and the hematocrit value maintained at 30%.
- 3.9.4 In critically ill trauma patients, transfusion strategy to be employed:
- Hb concentration <7 g/dL, RBC transfusion is likely to be appropriate; however, transfusion may not be required in well-compensated patients or where other specific therapy is available.
 - Hb concentration of 7–9 g/dL, RBC transfusion is not associated with reduced mortality. The decision to transfuse patients (with a single unit followed by reassessment) should be based on the need to relieve clinical signs and symptoms of anaemia.
 - Hb concentration >9 g/dL, RBC transfusion is generally unnecessary.
- 3.9.5 Red blood cell (RBC) transfusion should not be dictated by a haemoglobin (Hb) concentration alone, but should also be based on assessment of the patient's clinical status.
- 3.9.6 Replacement of fibrinogen should be carried out, if test provisions are available, at levels < 1.5 g/l (150 mg/dl).

3.10 Haemorrhage imaging in hospital settings

- 3.10.1 Imaging for haemorrhage in patients with suspected haemorrhage should be performed urgently, using FAST, and a CT if required, and the images should be interpreted immediately by a healthcare professional with training and skills in this area.

3.10.2 Limit diagnostic imaging (such as chest and pelvis X-rays or FAST [focused assessment with sonography for trauma]) to the minimum needed to direct intervention in patients with suspected haemorrhage and haemodynamic instability who are not responding to volume resuscitation.

3.10.3 Be aware that a negative FAST does not exclude intraperitoneal or retroperitoneal haemorrhage.

**To repeat a FAST examination if clinical index of suspicion for intraperitoneal hemorrhage.*

3.10.4 Consider immediate CT for patients with suspected haemorrhage only if they are responding to resuscitation or if their haemodynamic status is normal.

3.11 Damage control surgery

3.11.1 Use damage control surgery in patients with haemodynamic instability who are not responding to volume resuscitation.

3.12 Resuscitation (Criteria for Cardiac arrest after trauma)

3.12.1 In the case of definitive cardiac arrest or uncertainties in detecting a pulse or other clinical signs that make cardiac arrest likely, resuscitation must be started immediately.

3.12.2 During resuscitation, trauma-specific reversible causes of cardiac arrest (, airway obstruction, esophageal intubation, hypovolemia, tension pneumothorax or pericardial tamponade) should be diagnosed and treated.

3.12.3 If resuscitation is unsuccessful after eliminating possible causes of cardiac arrest, cardiopulmonary resuscitation must be stopped.

3.13 Role of Emergency Thoracotomy

3.13.1 If expertise is available, emergency thoracotomy should be performed in the case of penetrating injuries, particularly if the onset of cardiac arrest is recent and vital signs are initially present.

4. HEAD INJURY INITIAL MANAGEMENT

4.1 State of consciousness with pupil function and Glasgow Coma Scale (bilateral motor function) must be recorded and documented at repeated intervals.

4.2 The goals are normoxia*, normocapnia**, and normotension***. A fall in arterial oxygen saturation below 90% must be avoided.

*Normoxia - sPO₂ > 90%

**Normocapnia - paCO₂ = 35 - 40 mmHg {4.7kPa}

***Normotension - SBP ≥ 90 mmHg

4.3 Intubation with adequate ventilation (with capnometry and blood gas analysis if available) must be carried out in unconscious patients (reference value GCS ≤ 8).

4.4 A Cranial Computed Tomography scan must be performed in the case of polytrauma after stabilization with suspected traumatic brain injury.

4.5 A (monitoring) CT scan must be performed in the case of neurologic deterioration.

4.6 Glucocorticoids must not be administered in the treatment of TBI.

4.7 If severely elevated intracranial pressure is suspected, particularly with signs of transtentorial herniation (pupil widening, decerebrate rigidity, extensor reaction to painful stimulus, progressive clouded consciousness), the following treatments can be given:

- Hyperventilation where ABG analysis is available*
- Mannitol**

* 20 breaths per minute to maintain paCO₂ at 30-35 mm of Hg

** 20% solution at 0.5-2 gm/kg over 30 to 60 minutes

5. SPINAL INJURY MANAGEMENT

5.1 Assessment for spinal injury

5.1.1 On arrival at the hospital, use a prioritising sequence to assess people with suspected trauma, for example ABCDE:

- Airway with in-line spinal immobilisation
- Breathing
- Circulation

- Disability (neurological)
- Exposure and environment.

5.1.2 At all stages of the assessment:

- Protect the person's cervical spine with manual in-line spinal immobilisation, particularly during any airway intervention and
- Avoid moving the remainder of the spine.

5.1.3 History and thorough clinical examination for spinal injury including the functions associated with it must be carried out.

5.1.4. The spine is suspected to be stable, unless any of the following 5 criteria are present,

- Impaired consciousness
- Neurologic deficit
- Spinal pain or myogelosis
- Intoxication
- Trauma in the extremities

**myogelosis (area of hard or stiff muscle)*

5.1.5 The presence of a spinal injury must be assumed in unconscious patients until evidence to the contrary is found.

5.1.6 Carry out full in-line spinal immobilisation if any of the factors in recommendation 4.1.4 are present or if this assessment cannot be done.

5.2 Assessment of Cervical Spine

5.2.1 Assess whether the person is at high, low or no risk for cervical spine injury using the Canadian C-spine rule as follows:

- The person is at high risk if they have at least one of the following high-risk factors:
 - ◆ Age 65 years or older
 - ◆ Dangerous mechanism of injury (fall from a height of greater than 1 metre or 5 steps, axial load to the head – for example diving, high-speed motor

vehicle collision, rollover motor accident, ejection from a motor vehicle, accident involving motorised recreational vehicles, bicycle collision, horse riding accidents)

- ◆ Paraesthesia in the upper or lower limbs
- The person is at low risk if they have at least one of the following low-risk factors:
 - ◆ Involved in a minor rear-end motor vehicle collision
 - ◆ Comfortable in a sitting position
 - ◆ Ambulatory at any time since the injury
 - ◆ No midline cervical spine tenderness
 - ◆ Delayed onset of neck pain
- The person remains at low risk if they are:
 - ◆ Unable to actively rotate their neck 45 degrees to the left and right (the range of the neck can only be assessed safely if the person is at low risk and there are no high-risk factors).t
- The person has no risk if they:
 - ◆ Have one of the above low-risk factors and,
 - ◆ Are able to actively rotate their neck 45 degrees to the left and right.

5.3 Assessment of Thoracic or Lumbosacral Spine

5.3.1 Assess the person with suspected thoracic or lumbosacral spine injury using these factors:

- Age 65 years or older and reported pain in the thoracic or lumbosacral spine
- Dangerous mechanism of injury (fall from a height of greater than 3 metres, axial load to the head or base of the spine – for example falls landing on feet or buttocks, high-speed motor vehicle collision, rollover motor accident, lap belt restraint only, ejection from a motor vehicle, accident involving motorised recreational vehicles, bicycle collision, horse riding accidents)
- Pre-existing spinal pathology, or known or at risk of osteoporosis – for example steroid use

- Suspected spinal fracture in another region of the spine
- Abnormal neurological symptoms (paraesthesia or weakness or numbness)
- On examination:
 - ◆ Abnormal neurological signs (motor or sensory deficit)
 - ◆ New deformity or bony midline tenderness (on palpation)
 - ◆ Bony midline tenderness (on percussion)
 - ◆ Midline or spinal pain (on coughing)
- On mobilisation (sit, stand, step, assess walking): pain or abnormal neurological symptoms (stop if this occurs).

5.4 When to carry out in-line spinal immobilisation

5.4.1 Carry out or maintain full in-line spinal immobilisation if:

- A high-risk factor for cervical spine injury is identified and indicated by the Canadian C-spine rule
- A low-risk factor for cervical spine injury is identified and indicated by the Canadian C-spine rule and the person is unable to actively rotate their neck 45 degrees left and right
- Indicated by one or more of the factors listed in recommendation 5.3.1

5.4.2 Do not carry out or maintain full in-line spinal immobilisation in people if:

- They have low-risk factors for cervical spine injury and, are pain free and are able to actively rotate their neck 45 degrees left and right
- They do not have any of the factors listed in recommendation 5.3.1

5.5 How to carry out full in-line spinal immobilisation

5.5.1 The spinal immobilisation devices need to be adjusted. In uncooperative, agitated or distressed people, think about letting them find a position where they are comfortable with manual in-line spinal immobilisation.

5.5.2 When carrying out full in-line spinal immobilisation in adults, manually stabilise the head with the spine in-line using the following stepwise approach:

- Fit an appropriately sized semi-rigid collar unless contraindicated by:
 - ◆ A compromised airway
 - ◆ Known spinal deformities, such as ankylosing spondylitis (in these cases keep the spine in the person's current position).
- Reassess the airway after applying the collar.
- Place and secure the person on a stretcher.

5.6 When to carry out or maintain full in-line spinal immobilisation and request imaging

5.6.1 Carry out or maintain full in-line spinal immobilisation and request imaging if:

- A high-risk factor for cervical spine injury is identified and indicated by the Canadian C-spine rule or
- A low-risk factor for cervical spine injury is identified and indicated by the Canadian C-spine rule and the person is unable to actively rotate their neck 45 degrees left and right or
- Indicated by one or more of the factors listed in recommendation 4.3.1

5.6.2 Do not carry out or maintain full in-line spinal immobilisation or request imaging for people if:

- They have low-risk factors for cervical spine injury as identified and indicated by the Canadian C-spine rule, are pain free and are able to actively rotate their neck 45 degrees left and right
- They do not have any of the factors listed in recommendation 4.3.1

5.7 Diagnostic imaging

5.7.1 Imaging for spinal injury should be performed urgently, and the images should be interpreted immediately by a healthcare professional with training and skills in this area after stabilisation.

5.7.2 Perform CT in adults if:

- Imaging for cervical spine injury is indicated by the Canadian C-spine rule (see recommendation 4.6.1) or

- There is a strong suspicion of thoracic or lumbosacral spine injury associated with abnormal neurological signs or symptoms.

C spine xray should be considered if CT is not available with caution of high false negative rate.

5.7.3 If, after CT, there is a neurological abnormality which could be attributable to spinal cord injury, advice MRI.

5.8 Lumbosacral Spine Imaging

5.8.1 Perform an X-ray as the first-line investigation for people with suspected spinal column injury without abnormal neurological signs or symptoms in the thoracic or lumbosacral regions (T1–L3).

5.8.2 Perform CT if the X-ray is abnormal or there are clinical signs or symptoms of a spinal column injury.

5.8.3 If a new spinal column fracture is confirmed, image the rest of the spinal column.

5.8.4 After circulatory stabilization and before transfer from the emergency room, a spinal injury should be cleared by clinical examination or imaging . (if available).

5.9 Medications

5.9.1 Do not use the following medications, aimed at providing neuroprotection and prevention of secondary deterioration, in the acute stage after acute traumatic spinal cord injury:

- Methylprednisolone
- Nimodipine
- Naloxone.

5.9.2 Do not use medications in the acute stage after traumatic spinal cord injury to prevent neuropathic pain from developing in the chronic stage.

6. PELVIC FRACTURE MANAGEMENT

6.1 Using a pelvic binder

- 6.1.1. An acute life-threatening pelvic injury must be excluded when the patient is admitted to the hospital.
- 6.1.2 The stability of the patient's pelvis must be clinically examined.
- 6.1.3 If active bleeding is suspected from a pelvic fracture following blunt high-energy trauma, apply a pelvic binder.

6.2 Pelvic imaging

- 6.2.1 During the diagnostic study a pelvic survey radiograph should be taken and/or computed tomography (CT) be performed once patient is stabilized*.
**Unstable patients do portable X-Ray if available*
- 6.2.2 Use CT (if available, otherwise X-ray) for first-line imaging with suspected high-energy pelvic fractures once patient is stabilized
- 6.2.3 Unstable patients with suspected active bleeding from pelvic fracture, use:
 - Pelvic packing to stabilize the patient.

6.3 Removing a pelvic binder

- 6.3.1 For people with suspected pelvic fractures and pelvic binders, remove the binder as soon as possible if:
 - There is no pelvic fracture, or
 - A pelvic fracture is identified as mechanically stable, or
 - The binder is not controlling the mechanical stability of the fracture, or
 - There is no further bleeding or coagulation is normal.

Remove all pelvic binders within 24 hours of application.

6.4 Log rolling

- 6.4.1 Do not log roll people with suspected pelvic fractures before pelvic imaging unless:
- An occult penetrating injury is suspected in a person with haemodynamic instability
 - Log rolling is needed to clear the airway (for example, suction is ineffective in a person who is vomiting).
 - When log rolling, pay particular attention to haemodynamic stability.

7. MANAGEMENT OF OPEN FRACTURES AND COMPLICATIONS

7.1 Open fractures

- 7.1.1 Do not irrigate open fractures of the long bones, hindfoot or midfoot in the emergency department before debridement.
- 7.1.2 Consider a saline-soaked dressing covered with an occlusive layer (if not already applied) for open fractures in the emergency department before debridement.
- 7.1.3 In the emergency department, administer prophylactic intravenous antibiotics immediately to people with open fractures if not already given.
- 7.1.4 Do not base the decision whether to perform limb salvage or amputation on an injury severity tool score.
- 7.1.5 Perform emergency amputation when:
- A limb is the source of uncontrollable life-threatening bleeding, or
 - A limb is salvageable but attempted preservation would pose an unacceptable risk to the person's life, or
 - A limb is deemed unsalvageable after orthoplastic assessment
- 7.1.6 Perform debridement:
- Immediately for highly contaminated open fractures
 - Within 24 hours of injury for all other open fractures management

7.2 Vascular injury

- 7.2.1 Use hard signs (lack of palpable pulse, continued blood loss, or expanding haematoma) to diagnose vascular injury.
- 7.2.2 Do not rely on capillary return or Doppler signal to exclude vascular injury.
- 7.2.3 Perform immediate surgical exploration if hard signs of vascular injury persist after any necessary restoration of limb alignment and joint reduction. Do not delay revascularisation for angiography in people with complex fractures

7.3 Compartment syndrome

- 7.3.1 In people with fractures of the tibia, maintain awareness of compartment syndrome for 48 hours after injury or fixation by regularly assessing and recording clinical symptoms and signs in hospital

8. PAIN MANAGEMENT IN MAJOR TRAUMA

- 8.1.1 Assess pain regularly in patients with major trauma using a pain assessment scale suitable for patients cognitive function.
- 8.1.2 For patients with major trauma, use intravenous morphine/opioids as the first-line analgesic and adjust the dose as needed to achieve adequate pain relief.

Dose of Morphine – 2.5-5 mg/kg q 4h

Pentazocine Dosing: Adult IV: 30 mg every 3-4 hours.

Butorphanol:IV: Initial: 1 mg, may repeat every 3-4 hours as needed.

Buprenorphine:Slow IV: Initial: 0.3 mg every 6 to 8 hours as needed;

- 8.1.3 Consider ketamine in analgesic doses as a second-line agent.

**Dose of Ketamine 1-4.5 mg/kg (medscape)*

8.2 Efficacy of Analgesic Modalities in blunt thoracic trauma

- 8.2.1 Epidural analgesia is the preferred mode of analgesia delivery in severe thoracic trauma.

9. PROVIDING SUPPORT AND INFORMATION TO PATIENTS & RELATIVES PROVIDING INFORMATION ABOUT PATIENTS TO THE NEXT LEVEL HOSPITAL/ CASUALTY

9.1 Providing support

9.1.1 When communicating with patients, family members and carers

- Manage expectations and avoid misinformation
- Answer questions and provide information honestly, within the limits of your knowledge
- Do not speculate and avoid being overly optimistic or pessimistic when discussing information on further investigations, diagnosis or prognosis
- Ask if there are any other questions.

9.1.2 The trauma team structure should include a clear point of contact for providing information to patients, their family members and carers.

9.2 Providing information

9.2.1 Explain to patients, family members and carers what is happening and why it is happening. Provide:

- Information on known injuries
- Details of immediate investigations and treatment, and if possible include time schedules.

9.2.2 Offer people with fractures the opportunity to see images of their injury, taken before and after treatment.

9.2.3 Provide people with fractures on the following when the management plan is agreed or changed:

- Expected outcomes of treatment, including time to returning to usual activities and the likelihood of permanent effects on quality of life (such as pain, loss of function and psychological effects)

- Amputation, if this is a possibility
- Activities they can do to help themselves
- Home care options, if needed
- Rehabilitation, including whom to contact and how (this should include information on the importance of active patient participation for achieving goals and the expectations of rehabilitation)
- Mobilisation and weight-bearing, including upper limb load bearing for arm fractures.

9.2.4 Document all key communications with patients, family members and carers about the management plan.

9.2.5 Ensure that all health and social care practitioners have access to information previously given to people with fractures to enable consistent information to be provided.

9.3 Providing information about transfer from an emergency department

9.3.1 For patients who are being transferred from an emergency department to another centre, provide verbal and written information that includes:

- The reason for the transfer
- The location of the receiving centre and the patient's destination within the receiving centre
- The name and contact details of the person responsible for the patient's care at the receiving centre (if possible)
- The name and contact details of the person who was responsible for the patient's care at the initial hospital.

9.4 Recording information in before transferring to definitive care settings

9.4.1 Record the following in people with major trauma in hospital settings:
ABCDE (airway with in-line spinal immobilisation, breathing, circulation, disability [neurological], exposure and environment)

- History and Examination.
- 9.4.2 If possible, record information on whether the assessments show that the person's condition is improving or deteriorating.
- 9.4.3 Record pre-alert information using a structured system and include all of the following:
- The patient's age and sex
 - Time of incident
 - Mechanism of injury
 - Injuries suspected
 - Signs, including vital signs and Glasgow Coma Scale
 - Treatment so far
 - Estimated time of arrival at emergency department
 - Special requirements
 - The ambulance call sign, name of the person taking the call and time of call

9.5 Training and skills

- 9.5.1 Ensure that each healthcare professional within the trauma service has the training and skills to deliver, safely and effectively, the interventions they are required to give as per this guideline.

Training in the form of ATLS, NTMC, EMTC etc

9.6 Receiving information in hospital settings

- 9.6.1 Casualty Medical Officer/Trauma team leader in the emergency department should receive the pre-alert information, and determine the level of trauma team response according to agreed and written local guidelines.
- 9.6.2 The trauma team leader should be easily identifiable to receive the handover and the trauma team ready to receive the information.

9.6.3 The pre- hospital documentation, including the recorded pre-alert information, should be quickly available to the trauma team and placed in the patient's hospital notes.

9.7 Sharing information in hospital settings

9.7.1 Follow a structured process when handing over care within the emergency department (including shift changes) and to other departments. Ensure that the handover is documented.

9.7.2 Ensure that all patient documentation, including images and reports, goes with the patient when they are transferred to other departments or centres.

9.7.3 Produce a written summary, which gives the diagnosis, management plan and expected outcome and:

- Is aimed at and sent to the patient's referring physician/surgeon/primary or secondary care hospital within 24 hours of admission
- Includes a summary written in plain English/local language that is understandable by patients, family members and carers
- Is readily available in the patient's records.

WAY FORWARD FOR INDIA

It is hoped that this document can lead to the development of further standard treatment guidelines for specific areas of trauma management for the Indian context. It seeks to improve the quality of trauma care services, intends to advocate for changes in health policy and decisions towards better outcomes for trauma.

Trauma can occur to anybody, anywhere and therefore, it is imperative for a nation as large as ours to holistically work with the government and non-government organizations including all sectors of the society to bring awareness and management skills to every individual to handle a situation in a calm and accurate way.

In view of the increasing burden of trauma in India and the rising cost of management of these patients, we would need to look into decreasing this burden and cost by a systematic management approach in each of the following parts:

1. Prevention if done properly, it would lead to **more effectiveness with less expenditure**.
 - Implementation of rules during driving motored vehicles along with swiftness of penalty for disobeying it is must, like:
 - ◆ Helmets even for bicyclists and a separate area for them.
 - ◆ Seat belts compulsory.
 - ◆ Speed limits and breaking signals to be taken seriously.
 - ◆ Driver education on basic first aid must be done in driving tests, etc)
 - Proper checks and policing on alcohol and drug abuse in vehicle drivers.

- Road quality to be improved, especially in prone areas, like improving lighting, filling potholes.
- Access improved for health care facilities, especially in the rural areas of India.
- Implementation of safety rules along with regular drills and checks in large organizations like factories, mines, schools, offices, hospitals, railway stations, etc.
- Safety measures to prevent burns, falls, electrocution and prevention of railway accidents (simply closing the doors of local trains should be made compulsory).
- Identification of risks, research and injury surveillance projects to be undertaken regularly.
- Violence minimization in high risk groups like adolescents, alcoholics and drug abusers by awareness sessions to prevent them from entering into abusive relations with society and enabling them to make informed decisions.
- Children, aged, mentally and physically challenged, and pregnant women are more prone to injury and hence, infrastructure should be made with them in mind.
- Awareness programmes to be increased using all forms of media to reach maximum population.

2. Pre-hospital care :

- Training of paramedical staff to give life saving safe treatment en-route to hospital.
- Training and awareness sessions for the general public, including schools and colleges, to be propagated on First Aid and CPR could save a lot of lives in the golden hour.
- Enabling better ambulance facilities to manage emergencies by:
 - ◆ Proper and functional equipment of oxygen cylinders.
 - ◆ Trained personnel to apply pelvic and spine stabilizers.
 - ◆ Essential emergency drug provision and training to use them.

3. In-Hospital :

- System changes to make sure each of the necessary process measures (time to CT, Time to Operation/intervention) is carried out in time.

- Trauma team - Comprising minimum of a surgeon, anesthetist, trauma nurse, blood bank officer and an administrator. In addition to this, the super specialty team should be a part of the trauma team wherever available.
 - Training - Ensure compulsory training provided by the Government/hospital, in recognised national or international courses in advance trauma management for all personnel working in emergency department.
 - Forming local and National Trauma registry.
4. Trauma rehabilitation : is an integral part in getting a seriously injured patient back to productivity and decreasing morbidity.

GUIDELINE DEVELOPMENT PROCESS

BACKGROUND

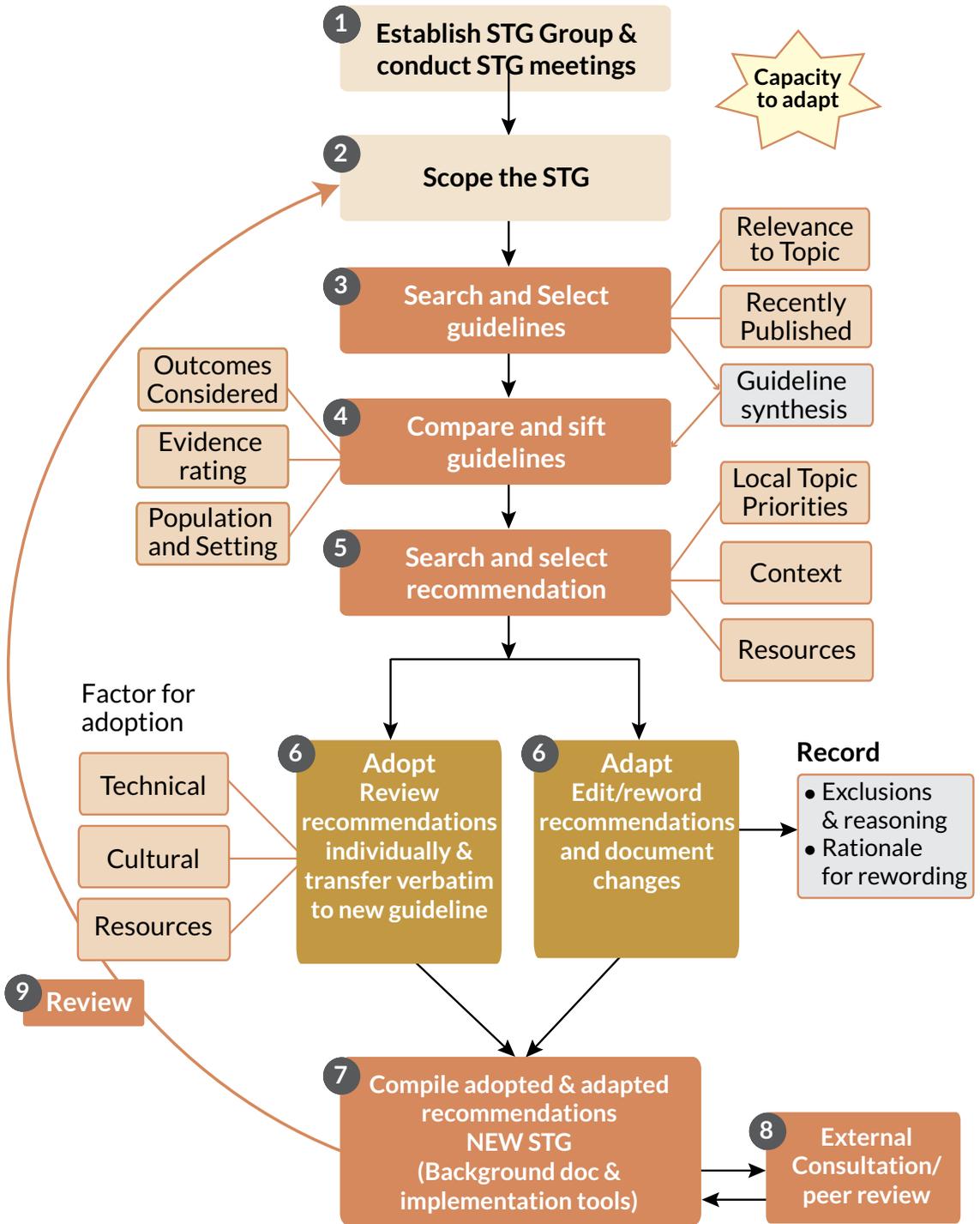
A Task Force was constituted in December 2014 to guide the development of Standard Treatment Guidelines (STG) in India. The Task Force subsequently approved the draft STG development manual of India (Part 1) for development of adapted guidelines. This taskforce essentially decides the clinical subgroup topics as per the public health needs of the country. Each Clinical subgroup is headed by a facilitator which forms the guideline choosing his writing team and expert group for that particular topic.

A meeting was held on 12th May 2016 at National Health System Resource Centre (NHSRC) and management for Major trauma guideline was finalized for the surgery clinical subgroup.

METHODS OF STG DEVELOPMENT IN INDIA

The NHSRC with technical support from National Institute for Health and Care Excellence (NICE), United Kingdom (UK), carried out a training workshop in May 2015 to guide the STG group members and chairs on the methodology to follow in developing adapted STGs suitable for the Indian context. This workshop was conducted on 29th & 30th May, 2015 and two members (NR, MK) of the surgery clinical subgroup team attended. Subsequently, NHSRC facilitated the STG development process by providing resources approved by the Ministry of Health & family welfare to the expert group.

The processes and methods used in developing this STG were drawn on those outlined in the STG development manual of India (Part 1) for development of adapted guidelines and summarized in the Stepwise guide on STG development.



The figure below contains a schematic of the process followed and each of the steps is detailed in subsequent sections below for the formation of Major trauma management guideline.

HOW THIS STG WAS DEVELOPED

Establish the STG group and conduct STG Meetings

The STG on Major trauma management was developed by a team of experts, subject matter experts, patient representative undertook the development of this STG on Major trauma management. Official letters of invite were sent from NHSRC head office. One of the members who were invited could not attend the meetings and so was subsequently dropped and new experts were invited. The following are the names of the group members, their roles in the development of the STG on Major trauma, along with their specialties and organization are listed below,

Major Trauma Group Members			
Roles	Name	Title	Specialist Area
Facilitator	Prof. Nobhojit Roy	Professor & Head, Department of Surgery, BARC Hospital (HBNI University), Mumbai	Surgeon, Public Health Specialist
Expert	Dr. Manjul Joshipura	President, IATSIC (International Association for Trauma and Surgical Intensive Care) Director of Academy of Traumatology, India	Orthopedic Surgeon
Private Practitioner	Dr. Sudheer Ambekar	Consultant, Division of Skullbase and Cerebrovascular Surgery, Department of Neurological Surgery, Jaslok Hospital and Research Centre, Mumbai	Neurosurgeon
Physician Expert	Kapildev Soni	Assistant Professor in Critical & Intensive care, JPN Apex Trauma Centre, AIIMS, New Delhi	Anesthetist and Critical Care Specialist
Paramedic	Dr. Ganesh Auti	Training Manager and Instructor, Life Supporters Institute of Health Sciences, Mumbai	Pre Hospital Emergency specialist

Major Trauma Group Members			
Rehabilitation Expert	Dr. Swagatika Mishra	Prosthetics & Orthotics Unit and laboratory, Mahatma Gandhi Mission (MGM) Hospital	Orthotist
Primary Care Practitioner	Dr. Aditi Kashikar	MGIMS, Wardha	General Practitioner
Patient Representative	Siddharth David	Tata Institute of Social Sciences	Public Health Researcher
NGO/Patient Rights Group	1. Dr. Raman Kataria 2. Dr. Sushil Patil 3. Dr. Nandakumar Menon	1 and 2. Jan Swasthya Sahyog, Ganiyari Village, Bilaspur District, Chhattisgarh 3. Ashwini, Gudalur, Tamil Nadu	1. Pediatric Surgeon 2. Hospital Administrator 3. Secondary Care Surgeon
Writing Team	1. Dr. Monty Khajanchi (Lead) 2. Dr. Bhakti Sarang 3. Dr. Vineet Kumar 4. Dr. Deepa KV	1. Assistant Professor Surgery, Dept. of Surgery, Seth GSMC and KEM Hospital, Mumbai. 2. Assistant Professor Surgery Dept. of Surgery, Raigad Hospital and Research Centre, Karjat. 3. Assistant Professor Surgery, Dept of Surgery, LTMMC and LTMG Hospital, Mumbai. 4. School of Habitat, Tata Institute of Social Sciences, Mumbai.	General and Trauma Surgeons

Expert Advisor

1. Dr. Nitin Gadgil - Additional Professor, Department of Pathology, LTMMC and LTMG Hospital, Mumbai.
2. Dr. B. Suprabhat S - Assistant Professor, Radiology Terna-Sahyadri Hospital (MUHS University).
3. Françoise Cluzeau – National Institute for Health and Care Excellence, United Kingdom.

The STG Subgroup met once face-to-face and all meetings (including the smaller weekly ones) were quorate (50%=8 members). The working group met every Friday evening, over

a period of three months. Some of the members joined the small group meetings via video-conference. In the induction and orientation session held on 29th July, 2016 the facilitator (Chair) welcomed all the members of the subgroup, and set up the rules of operation based on the STG development manual, on the consistent use of terminology and definitions, using the structured powerpoint presentation provided by NHSRC/NICE.

Also, the individual members in the writing team kept in touch via e-mails and Whatsapp.

Scope of the STG

To develop the scope of this STG we followed the principle of what the scope will include and exclude. It also identifies only the key aspects of care that “must” be included, set the “boundaries” of the development work and provide a clear “framework” to enable work to stay within the agreed priorities, inform the development of the clinical questions and search strategy, inform “professionals” and the “public” about expected content of the guideline, keep the STG to a “reasonable size” to ensure that its development can be carried out within the “allocated period”. Based on these principles, the scope of the STG underwent multiple revisions.

Selection and Comparison of Guidelines

Before the first face-to-face meeting of the STG sub-group, the working group searched guidelines.gov, NICE, World Health Organization and Google for guidelines based on the scope defined. In addition, the selected guidelines were compared in terms of relevance to the topic and key clinical issues listed in the scope, evidence ratings, target population and also their applicability or relevance to the Indian context. Currency of the selected guideline was ensured by including only guidelines published/ updated in the last 5-8 years. After sifting through all the available guidelines, the group selected four guidelines as the primary source guidelines (Guidelines no. 1-4). The selected four guidelines were subsequently approved as source guidelines by the full STG sub group on Major trauma. Some of these guidelines were not included in the guidelines.gov site or in the NICE site and these were selected if their evidence was graded as per the AGREE II method (Appraisal of Guidelines Research and Evaluation). These guidelines were – Guideline on Treatment of Patients with Severe and Multiple Injuries, German Trauma Society.

In addition to the four source guidelines there were 3 other guidelines selected by the group from whom a few recommendations could be adopted/adapted which fitted the scope of this guideline.

The following guidelines were selected:

- 1) National Clinical Guideline Centre. Major trauma assessment and initial management. London (UK): National Institute for Health and Care Excellence(NICE); 2016 Feb 17. 22 p. (NICE guideline; no. 39).
- 2) National Clinical Guideline Centre. Spinal Injury assessment and initial management. London (UK): National Institute for Health and Care Excellence (NICE); 2016 Feb 17. 23p. (NICE guideline; no. 41).
- 3) National Clinical Guideline Centre. Fractures (Complex): assessment and management. London (UK): National Institute for Health and Care Excellence (NICE); 2016 Feb 17. 18p. (NICE guideline; no. 37).
- 4) S3- Guidelines on treatment of patients with severe and multiple injuries. English version of the German guideline S3- Leitlinie Polytrauma/ Schwerverletzten- Behandlung (AWMF- Registry No. 012/019).
- 5) Singapore: Singapore Ministry of Health. Clinical blood transfusion. Singapore: Singapore Ministry of Health; 2011 Feb. 90 p.
- 6) National Blood Authority. Patient blood management guidelines: module 4-critical care. Canberra ACT (Australia): National Blood Authority; 2012. 78 p.
- 7) Management of pulmonary contusion and flail chest, Journal of Trauma and Acute Care Surgery, 2012.

Search & select recommendations

The working group created a draft table with proposed recommendations (adopted/ adapted) selected from the selected source guideline. Each key clinical issue defined in the scope of the STG was reviewed and relevant recommendations were searched for in each of the 4 selected guidelines. None of the 4 guidelines individually covered the whole STG scope, so recommendations from all 4 guidelines were used, found best to the Indian setting (for example available expertise and resources for implementing them in practice) and keeping in mind the scope of the guidelines. Each recommendation listed in the draft was circulated 3 days before the meeting and at first the working group discussed these recommendations at length (in meeting 3, 4 and 5). A systematic approach was followed to ensure high quality of the process. The group either adopted/adapted a recommendation and if adapted reasons for the same were mentioned and documented.

Implementation challenges were considered when decisions were made to adopt or adapt recommendations. Factors considered included public/ private health infrastructure available and affordability and primary, secondary and tertiary care.

- a) **Adopted recommendation** - this entailed transferring a recommendation verbatim to the new STG.
- b) **Adapted recommendation** - This ranged from a minor edit in order to ensure local compatibility with India, or adding precisions to the wording to clarify the recommendation. It is important that when adapting a recommendation the evidence underpinning the recommendation remains intact.

Review

Review I: Peer review received on 16th January 2017, from NHSRC internal peer-review committee and Prof. R.S. Mohil

The STG team members over email resolved these comments. All these comments were in track changes mode in the Microsoft word document. The suggestions have been carried out and appropriate changes made in the relevant places in the documents.

Review II: A meeting was held on 13th January 2017 at 2.30 P.M. in Room no. 441-A wing, Nirman Bhawan, under the Chairmanship of Dr. Anil Manaktala, DDG (P) to discuss the draft Standard Treatment Guidelines of Major Trauma.

ANNEXURES

DEFINITIONS

1.	Chest decompression	mainly refers to tube thoracostomy/ Chest drain placement.
2.	Hemorrhagic Risk Tools	ABC score, TASH score, PWH score, McLaughlin score, Emergency transfusion score, Shock Index etc. These measure variables at a single point in time.
3.	Myogelosis	An area of hard or stiff muscle
4.	Normocapnia	PaCO ₂ = 35 mm Hg {4.7kPa}
5.	Normotension	SBP > 90 mm Hg
6.	Normoxia	SpO ₂ > 90%
7.	Restrictive resuscitation	Fluid infusion in order to keep the circulation at a low stable level (Systolic BP: 90 mmHg or palpable central pulse) and not exacerbate the bleeding. (from the german guidelines)
8.	Simple dressings	sterile gauze pads
9.	Supraglottic device	Laryngeal mask airway, proseal, i-gel etc.
10.	Tourniquet	can be a bandage roll, rubber tubing, crepe bandage, that checks bleeding or blood flow by compressing the blood vessels.

GRADES OF HAEMORRHAGE

Class of haemorrhagic shock				
	I	II	III	IV
Blood loss (mL)	Up to 750	750-1500	1500-2000	> 2000
Blood loss (% blood volume)	Up to 15	15-30	30-40	> 40
Pulse rate (per minute)	< 100	100-120	120-140	> 140
Blood pressure	Normal	Normal	Decreased	Decreased
Pulse pressure (mm Hg)	Normal or increased	Decreased	Decreased	Decreased
Respiratory rate (per minute)	14-20	20-30	30-40	> 35
Urine output (mL/hour)	> 30	20-30	5-15	Negligible
Central nervous system/ mental status	Slightly anxious	Mildly anxious	Anxious, confused	Confused, lethargic

DIAGRAMS AND IMPORTANT INFORMATION

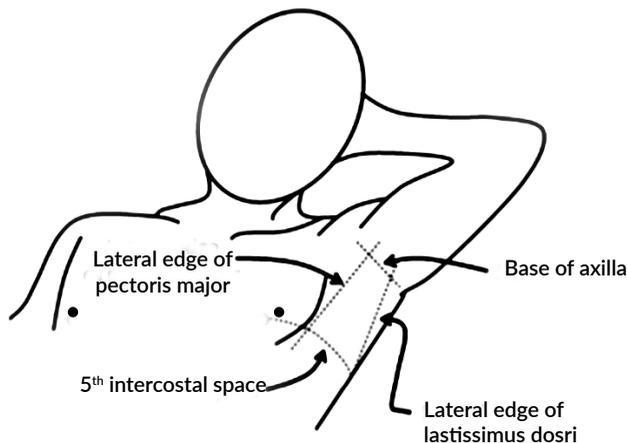
1. Where to Insert Chest Tube?

Triangle of safety is the recommended site for chest tube insertion.

Boundaries are- Anterior- Lateral border of pectoralis major.

Lateral- Lateral border of latissimus dorsi.

Inferior- 6th rib or line of 5th intercostal space.



DOSES

1.	Buprenorphine	Initial: 0.3 mg i.v. every 6 to 8 hours as needed(slow)
2.	Butorphanol	Initial: 1 mg i.v. may repeat every 3-4 hours as needed
3.	FFP(Fresh Frozen Plasma)	10-15ml/kg body weight
4.	Ketamine	1-2 mg/kg i.v or 5-6mg/kg im after ruling out raised intracranial pressure
5.	Mannitol	20% solution at 0.5-2 gm/kg over 30 to 60 minutes
6.	Morphine	0.1-0.2 mg/kg q 4-6h i.v
7.	Pentazocine	15-30 mg i.v. every 3-4 hours
8.	Tranexamic acid	Dosage as German guidelines- Tranexamic acid initially 1 g as saturation over 10 minutes + 1 g over 8 hours (CRASH 2 Trials) * or 2 g (15-30 mg/kg BW)
9.	Vitamin K	i.v. 5mg bolus

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