Ministry of Health
& Family Welfare
Government of India

Standard Treatment Guidelines for Management of Trauma

A Guidance Document for Clinical Management of Trauma in India

Trauma and Burn Division
Directorate General of Health Services
Ministry of Health & Family Welfare
Government of India

Ministry of Health
& Family Welfare
Government of India

Standard Treatment Guidelines for Management of Trauma

A Guidance Document for Clinical Management of Trauma in India

Trauma and Burn Division
Directorate General of Health Services
Ministry of Health & Family Welfare
Government of India

जगत प्रकाश नड्डा
JAGAT PRAKASH NADDA

सत्यमेव जयते

मंत्री
स्वास्थ्य एवं परिवार कल्याण
व रसायन एवं उर्वरक
भारत सरकार
Minister
Health & Family Welfare
and Chemicals & Fertilizers
Government of India

MESSAGE

Establishing and upholding Standardized Treatment Protocols that guide healthcare professionals are critical for delivery of timely and effective care.

Trauma care, in particular, requires well-defined treatment standards to ensure that patients receive prompt, appropriate and evidence-based interventions. To achieve this, it is essential to develop and implement uniform guidelines which not only streamline clinical decision-making but also enhance patient outcomes and strengthen emergency response capacities.

Standard Treatment Guidelines for Management of Trauma have been meticulously developed to serve as a comprehensive resource for healthcare providers. This document lays out a detailed list of essential Trauma Care procedures and role and responsibilities of staff posted at Trauma Care Facilities. By following these protocols, healthcare teams can improve efficiency, minimize treatment variations and optimize resource utilization.

The document has been developed in a collaborative effort of experienced clinicians from various specialties. I commend their efforts and I am sure that these guidelines have the potential to make significant improvements in the care of injured.

(Jagat Prakash Nadda)

कार्यालय: 348, ए–स्कंध, निर्माण भवन, नई दिल्ली–110011 • **Office:** 348, A-Wing, Nirman Bhawan, New Delhi-110011
Tele.: (O): +91-11-23061661, 23063513 • **Telefax:** 23062358 • **E-mail:** min-hfm@gov.in

प्रतापराव जाधव
PRATAPRAO JADHAV

सत्यमेव जयते

राज्य मंत्री (स्वतंत्र प्रभार)
आयुष मंत्रालय
व
राज्य मंत्री
स्वास्थ्य एवं परिवार कल्याण मंत्रालय
भारत सरकार

MINISTER OF STATE
(INDEPENDENT CHARGE) OF
MINISTRY OF AYUSH AND
MINISTER OF STATE OF
MINISTRY OF HEALTH & FAMILY WELFARE
GOVERNMENT OF INDIA

MESSAGE

The impact of trauma extends beyond the individual, affecting families, communities, and the healthcare system as a whole. Delays in treatment, inadequate pre-hospital care, and the absence of standardized protocols often result in preventable fatalities and prolonged recovery.

The Standard Treatment Guidelines for the Management of Trauma aims seamless coordination between pre-hospital responders, emergency teams, and surgical units, enabling timely assessment, prioritization, and efficient resource utilization to deliver quality care, regardless of location or infrastructure. Special attention has been given to vulnerable groups, including pediatric, geriatric, and pregnant trauma patients, ensuring that trauma care is inclusive and patient-centric.

Government of India under the visionary leadership of Hon'ble Prime Minister Shri Narendra Modi ji and able guidance of Hon'ble Union Minister of Health and Family Welfare, Shri Jagat Prakash Nadda ji, is committed to ensure the safety and well-being of citizens in India.

Through collaboration among healthcare professionals, policymakers, emergency responders, and communities, we can build a stronger, more resilient trauma care system. I sincerely appreciate the dedication and expertise of all those who contributed to these guidelines. These will contribute to enhancing trauma care and saving lives nationwide.

सर्वे भवन्तु सुखिनः। सर्वे सन्तु निरामयाः।

(प्रतापराव जाधव)

Office : 250, 'A' Wing, Nirman Bhavan, New Delhi-110011
Tele. : 011-23061016, 23061551, Telefax : 011-23062828, E-mail : mos-health@gov.in
Residence : 23, Ashoka Road, New Delhi-110001, Tele. : 011-23740412, 23740413, 23345478
Camp office : Khasdar Jansampark Karyalay, Jijamata Krida Sankul, Buldhana, Maharashtra-443001
Telefax : 07262-247777, E-mail : prataprao.jadhav@sansad.nic.in

राष्ट्रीय स्वास्थ्य मिशन

अनुप्रिया पटेल
ANUPRIYA PATEL

सत्यमेव जयते

राज्य मंत्री
स्वास्थ्य एवं परिवार कल्याण
व रसायन एवं उर्वरक
भारत सरकार

MINISTER OF STATE
HEALTH & FAMILY WELFARE
AND CHEMICALS & FERTILISERS
GOVERNMENT OF INDIA

Message

Trauma continues to be a significant public health concern, contributing to high rates of morbidity and mortality in India.

Addressing the critical need for a standardized approach to trauma care, the Standard Treatment Guidelines for the Management of Trauma have been developed as an essential resource for healthcare professionals. These guidelines provide a systematic framework to ensure timely and effective interventions, ultimately leading to improved patient outcomes and a more uniform trauma care system nationwide.

With a strong focus on the golden hour principle, this document outlines clear protocols for triage, resuscitation, and definitive management of various trauma scenarios, including head injuries, thoracic trauma, abdominal trauma, and musculoskeletal injuries. For optimal patient care and survival, it is imperative that all healthcare institutions adopt and implement these guidelines, ensuring prompt and coordinated responses in trauma situations.

I extend my sincere appreciation to the medical experts, trauma specialists, and public health professionals who have contributed their expertise to this important initiative. Their dedication has been instrumental in establishing guidelines that will serve as a national benchmark for high-quality trauma care.

(Anupriya Patel)

March 26, 2025
New Delhi

कमरा सं. 650, छठा तल, 'ए' विंग, निर्माण भवन, नई दिल्ली-110011, फोन : +91-11-23061998, 23062427
Room No. 650, 6th Floor, 'A' Wing, Nirman Bhawan, New Delhi-110011, Tele : +91-11-23061998, 23062427
E-mail: mosap-mohfw@gov.in

पुण्य सलिला श्रीवास्तव, भा.प्र.से.
सचिव
PUNYA SALILA SRIVASTAVA, IAS
Secretary

भारत सरकार
स्वास्थ्य एवं परिवार कल्याण विभाग
स्वास्थ्य एवं परिवार कल्याण मंत्रालय
Government of India
Department of Health and Family Welfare
Ministry of Health and Family Welfare

Message

Injuries represent a critical public health challenge worldwide, resulting in significant mortality and morbidity, and placing immense strain on healthcare systems. Recognizing the profound burden of trauma, prevention, timely intervention, and effective management are paramount.

To address this pressing issue, the "Standard Treatment Guidelines for Management of Trauma" have been developed as a comprehensive resource for clinical management across India. This document is the culmination of collaborative efforts by leading experts from esteemed institutions. It underscores the critical importance of inter-professional collaboration in trauma care and provides actionable technical guidance and targeted plans. By empowering stakeholders at all levels, we aim to ensure swift and effective responses to trauma cases.

This document is a call to action, urging all healthcare professionals, policymakers, and community members to actively participate in the implementation of these guidelines. Your commitment is essential to saving lives and building a resilient nation.

Punya Salila

Date : 02.04.2025
Place: New Delhi

(Punya Salila Srivastava)

Room No. 156, 'A' Wing, Nirman Bhawan, New Delhi-110011
Tele.: (O) 011-23061863, 23063221, E-mail: secyhfw@nic.in

प्रो.(डॉ.) अतुल गोयल
Prof. (Dr.) Atul Goel
MD (Med.)
स्वास्थ्य सेवा महानिदेशक
DIRECTOR GENERAL OF HEALTH SERVICES

सत्यमेव जयते

भारत सरकार
स्वास्थ्य एवं परिवार कल्याण मंत्रालय
स्वास्थ्य सेवा महानिदेशालय
Government of India
Ministry of Health & Family Welfare
Directorate General of Health Services

Message

Accidental deaths in India are a growing health concern, with a significant increase of 8.3% in 2022 when compared to the previous year. Over 430504 lives were lost in India due to unintentional injuries in 2022 alone. Road traffic injury was the leading cause of accidental death (45.1%). More worrisome is the fact than half of Indian states and union territories have accidental death rates exceeding the national average of 31.2 per 100,000 population.

It is imperative to understand that while injuries/trauma can be fatal, at times it results in a life time morbidity in the form of loss of function. Thus, prevention is important to reduce health burden resulting from trauma. When injuries do occur, timely and effective management is vital. Standard Treatment Guidelines for Management of Trauma is a guidance document for clinical management of trauma in India. It provides a clear, evidence-based protocol for management of a wide range of trauma cases across all levels of healthcare. It empowers our healthcare professionals to deliver standardized, optimal care, ultimately improving patient outcomes and saving lives.

This Directorate appreciates the dedicated team of experts from various organizations who collaborated to develop this invaluable resource. Their collective expertise and commitment have culminated in a document that will serve as a cornerstone for trauma care in India.

We urge all stakeholders to utilize these guidelines to develop and implement time-bound action plans at their respective levels. By working together, we can significantly reduce the burden of trauma and create a safer India for all.

(Atul Goel)

Room No. 446-A, Nirman Bhawan, New Delhi-110011
Tel. No.: 011-23061063, 23061438, Fax No.: 011-23061924, email:dghs@nic.in

Acknowledgement

The Standard Treatment Guidelines for the Management of Trauma aims for seamless coordination between pre-hospital responders, emergency teams, and surgical units, enabling timely assessment, prioritization, and efficient resource utilization to deliver quality care. I express my sincere gratitude to Prof (Dr) Atul Goel, Director General, Dte.GHS, MOHFW for his guidance and encouragement. A special note of thanks to Ms. Vandana Jain, Joint Secretary, MOHFW for her unwavering support in this endeavor.

I'm deeply grateful to our esteemed experts for their insights and the generous time they dedicated to shaping this document. In addition, I convey my heartfelt thanks to Dr Tanu Jain, Dr Manas Pratim Roy, Dr Sushma Adappa for their perseverance dedication in bringing this work to fruition.

Dr Krishan Kumar
CMO (SAG)
Dte.GHS, MOHFW
Government of India, New Delhi

Ministry of Health
& Family Welfare
Government of India

Standard Treatment Guidelines for Management of Trauma

A Guidance Document for Clinical Management of Trauma in India

Trauma and Burn Division
Directorate General of Health Services
Ministry of Health & Family Welfare
Government of India

Table of Contents

Table of Figures

List of Tables

Abbreviations

aPTT	Activated partial prothrombin time
BPS	Behavioural pain scale
CSF	Cerebrospinal fluid
CT	Computed tomography
ECG	Electrocardiograph
ED	Emergency Department
EDH	Extradural hematoma
E-FAST	Extended focussed assessment with sonography in trauma
EMT	Emergency medical technician
EN	Emergency nurse
EP	Emergency physician
GCS	Glasgow coma scale
HA	Hospital attendant
Hb	Haemoglobin
ICS	Intercostal space
ICP	Intracranial pressure
INR	International normal ratio
MCI	Mass casualty incidents
MLC	Medico legal documentation
mTBI	Mild traumatic brain injury
NCCT	Non contrast computed tomography
NOE	Naso-orbito-ethmoidal
OTT	Operation theatre technologist
POCUS	Point of care ultrasonography
PT	Prothrombin time
RBS	Random blood sugar
ROTEM	Rotational thromboelastometry
RR	Respiratory rate
SBP	Systolic blood pressure
TBI	Traumatic brain injury
TEG	Thromboelastogram
TT	Tetanus toxoid

List of Contributors

Dr Ajay Choudhary Professor & HOD, Department of Neurosurgery, Dr. RML Hospital, New Delhi	**Dr Pravesh Mehra** Professor & HOD, Oral & Maxillofacial Surgery Department, LHMC, New Delhi
Dr Ajay Shukla Professor & Acting HOD, Department of Orthopedics, Dr RML Hospital , New Delhi	**Dr. Pradeep Sharma** Professor, Dept. of Neurosurgery, Safdarjung Hospital, New Delhi
Dr Amit Gupta Professor, Trauma Surgery & Critical Care, JPN Trauma Centre, AIIMS, New Delhi	**Dr P S Bhatia** Consultant, Department of Anaesthesia, Safdarjung Hospital, New Delhi
Dr Ashok Kumar Sharma Senior Specialist, Department of Surgery, Safdarjung Hospital, New Delhi	**Dr Rajeshwari S** Professor & HOD, Department of Anaesthesiology, AIIMS, New Delhi
Dr Babita Gupta Professor, Anaesthesia, JPNA Trauma Centre, AIIMS, New Delhi	**Dr Sameek Bhattacharya** Professor & HOD, Department of Plastic Surgery, Dr. RML Hospital, New Delhi
Dr Bindu Bajaj Professor & HOD, Department of Gynaecology & Obstetrics, Safdarjung Hospital, New Delhi	**Dr Sandeep Agarwala** Professor & HOD, Department of Paediatric Surgery, AIIMS, New Delhi
Dr D K Patel Specialist Surgery, Safdarjung Hospital	**Dr Sanjay Meena** Assistant Professor, Department of Orthopaedics, LHMC, New Delhi
Dr Dhirendra Srivastava Professor, ESIC Dental College, New Delhi	**Dr Sanjeev Bhoi** Professor, Emergency Medicine, JPNATC, AIIMS, New Delhi
Dr Jitin Kharbanda Professor, ESIC Dental College, New Delhi	**Dr Satish Verma** Department of Neurosurgery, AIIMS, New Delhi
Dr Janak Raj Sabharwal Member DCI	**Dr Shaji Thomas** Professor & HOD, Department of Surgery, LHMC, New Delhi
Dr Kamran Farooque Chief, JPNA Trauma Center, AIIMS, New Delhi	**Dr Siva G Shrivastava** Assistant Professor, Orthopedics, JPNATC, AIIMS, New Delhi
Dr KB Shankar Assistant Professor, Department of Neurosurgery, Safdarjung Hospital, New Delhi	**Dr Sujata Sarabahi** Professor & HOD, Department of Plastic Surgery, Safdarjung Hospital, New Delhi
Dr Krishan Kumar CMO(SAG), Dte.GHS	**Dr Sushma Adappa** National Consultant (Trauma & Burns), WHO India
Dr Manas Pratim Roy Assistant Director General, Dte.GHS	**Dr Tanu Jain** Director, NCVBDC, Delhi
Dr Maneesh Singhal Professor & HOD, Department of Burns & Plastic Surgery, AIIMS, New Delhi	**Dr Tej Prakash Sinha** Additional Professor, Emergency Medicine, JPNATC, AIIMS, New Delhi
Dr Mohit Kumar Patralekh CMO, Department of Orthopaedics, Safdarjung Hospital, New Delhi	**Dr Vivek Trikha** Professor, Department of Orthopaedics, AIIMS, New Delhi
Dr Neeti Kapur Professor & HOD, Department of Surgery, Dr. RML Hospital, New Delhi	**Dr Vijay Nagpal** Consultant, Dept. of Anesthesia, Dr. RML Hospital, New Delhi
Dr Pinaki Ranjan Debnath Professor & HOD, Department of Paediatric Surgery, Dr. RML Hospital, New Delhi	

Chapter 1: Overview of Trauma Management in the Emergency Department

Patient flow in Emergency Department (ED)

- On arrival, in the ambulance bay, patient will be received and shifted by a trained hospital attendant maintaining cervical spine stabilisation
- In triage area, patient will be triaged by the triage nurse or a trained operation theatre technologist.
- Patient will be shifted to **Red**, **Yellow** and **Green** area based on the triage decisions
- **Red**, **Yellow** and **Green** areas should be adequately equipped and staffed based on its functionality
    - **Red area** - primarily for major trauma resuscitation
    - **Yellow area** - for observation/vitals monitoring, oxygenation and suction, and further evaluation
    - **Green area** - minor procedures and medications
- Appropriate signages and colored marking on floor for smooth patient flow
- Priority will be given to Red triaged patients *(Red - immediate care, Yellow - within 30 minutes of arrival and Green - within 1 hour of arrival)*
- Dynamics of triage and patient flow should be addressed as per mass casualty incident (MCI) management protocol

Triage

- Triage nurse will triage the patients and shift them to respective areas. In case of non-availability of triage nurse, triage will be done by a qualified operation theatre technologist (OTT).

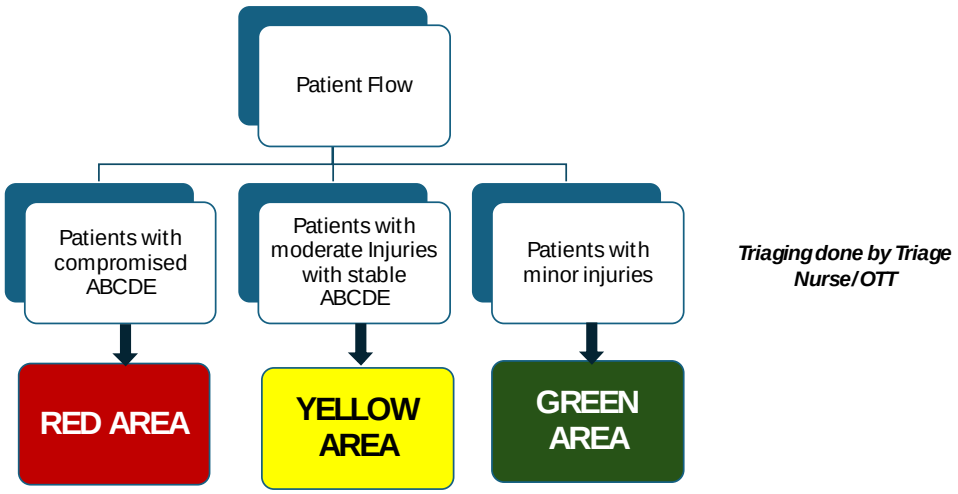


Figure 1: Triaging done by Triage Nurse/OTT

Triage Criteria: RED category patients

1. Unstable ABCD e.g. - compromised airway, gurgling sounds, laboured breathing, SPO_2< 90%, Systolic Blood Pressure < 90 mmHg, pulse >100/min, respiratory rate > 24/min, Glasgow Coma Scale (GCS) $\leq$ 12
2. Gunshot injuries
3. Penetrating injury to thorax, abdomen, neck
4. Major crush injuries
5. Vascular injuries
6. Pregnancy
7. Open long bones fractures
8. Pelvic fracture
9. Flail chest, open chest wound (sucking wound), subcutaneous emphysema, pneumothorax
10. Dangerous mechanism of injury
11. Traumatic amputation above knee or above elbow
12. Worsening clinical status on monitoring in yellow area (SPO_2<90%, SBP < 90 mmHg, pulse >100/min, RR > 24/min)

Triage Criteria: YELLOW category patients

1. Patients with normal ABCD but requires further investigation and/or observation

Triage Criteria: GREEN category patients

1. Patients with normal ABCD with minor injuries

Protocol for managing major trauma (Red triaged patients)

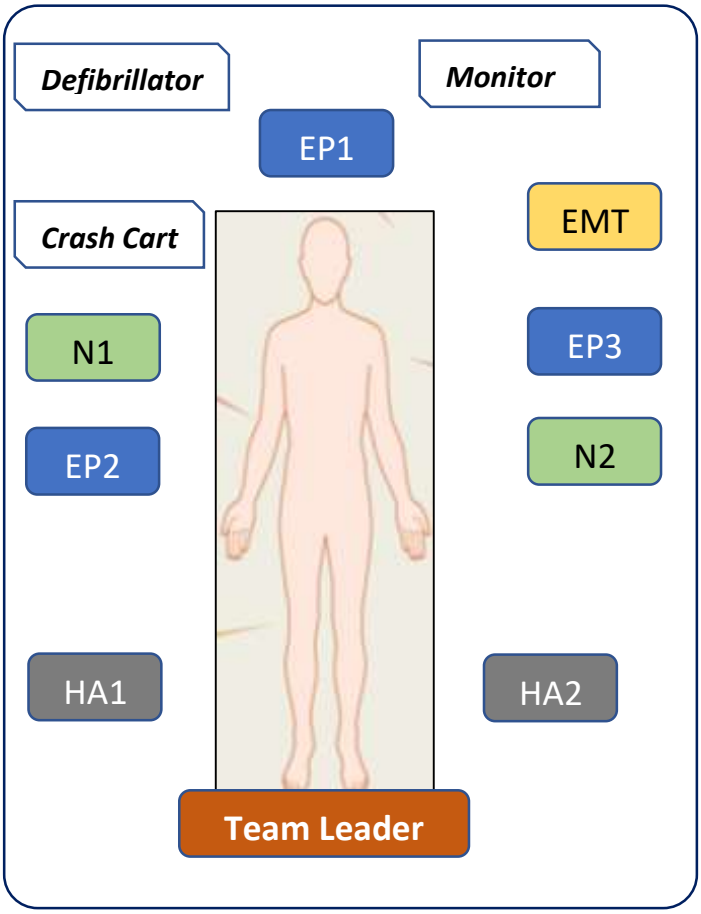
\# *Ensure Immediate resuscitation*

Management of Patients in Red Area

Trauma Team, who will manage the patients in Trauma Emergency Department (ED) for ***Horizontal Resuscitation*** at ***Level-1*** trauma care facility are as follows:

- Team Leader-1
- Doctors – 3
  - ✓ One Emergency Medicine Physician/ Anaesthesiologist – EP1
  - ✓ One Surgeon- EP2
  - ✓ One Orthopedician-EP3
- Emergency Nurses (EN) - 2 (N1 & N2)
- Hospital Attendant (HA)- 2 (HA-1 & HA-2)
- Emergency Medical Technician (EMT)- 1

Figure 2:Trauma team members



Positions of ED staff in **'RED AREA'**

Formations of trauma team is defined as individual positions of each team members based on his role and responsibilities during resuscitation

Role of trauma team members

- **Role of team leader**
  - Direct team members to their actions, establish priorities for investigations and procedure
  - Obtain history from the rescuer [family members, police or paramedic]
  - Keep track of whole state of patient
  - Receive and interpret results of all investigations
  - Order fluid and blood component administration
  - Supervise spinal manoeuvres
  - Consult and coordinate with the required speciality
  - Educate team members
  - Debrief team members
  - Triage and retriage to identify patients who are deteriorating and reaffirm the triage category
  - Documentation (blood request form, radiological and laboratory investigation forms)

- **Primary Role of EP1 (Emergency Medicine/ Anaesthesia Specialist) -**
  - Cervical spine stabilisation (manual inline stabilisation and cervical collar application)
  - Airway assessment and management (basic and advanced airway interventions)
  - Documentation

- **Primary Role of EP2 (Surgeon/ Trauma Surgeon/Emergency Medicine)-**
  - Breathing assessment and management
  - Assessment of Thorax, Abdomen, Head and Facial injuries

- Needle Thoracostomy with Intercostal Chest tube Drain insertion
- E-FAST examination
- Examine spine from back and perform *Per Rectal Examination* during log roll
- Urinary catheterization
- Assess for requirement of surgical intervention
- Documentation

- **Primary Role of EP3 (Orthopaedic Specialist/Emergency Medicine)-**
  - Assessment of pelvis, long bone fractures, spine
  - Application of appropriate splints and pelvic binder
  - Help in log roll
  - Application of pelvic binder
  - Documentation

- **Role of EN1 -**
  - Assisting EP1 in cervical collar application
  - Provide Airway management equipments [bag-valve-mask, Endotracheal tube, Drugs like Etomidate and Succinylcholine], etc
  - Assist EP in intubation, needle thoracostomy with ICD insertion
  - Documentation

- **Role of EN2 -**
  - IV access using wide bore IV cannula (16 gauge)
  - Taking blood samples for investigations, blood grouping & cross matching
  - IV fluid administration (prewarmed 1L ringer lactate)
  - Blood glucose level monitoring by finger prick sample (bedside)
  - Drug administration
  - Applying pressure bandages for controlling external haemorrhage
  - Handover all patient belongings/valuables to relatives or police
  - Documentation

- **Role of EMT -**
  - Attaching multiparameter monitor (ECG, heart rate, O2 saturation, blood pressure, ETCO2, temperature)
  - Care of ventilators, attaching the patient to ventilator
  - Taking 12 lead ECG
  - Attaching defibrillator in the event of activation of Code Blue
  - prevent hypothermia by applying warm blanket/blower
  - Help in log roll
  - Assist radiographer during bedside X-ray
  - Accompany the patient while being shifted for any investigations, procedures, etc

- **Role of HA -**
  - Assist in shifting patients on resuscitation bed
  - Cut the clothes for exposing the patient
  - Assist in haemorrhage control, splinting, log roll, application of pelvic binder

- Transport blood samples to laboratory, bringing blood components from the blood bank
- Assist EN2 in 'RED AREA'
- Giving forms to radiographers with thumb impression

- **Role of Emergency Nurse Coordinator/Trauma Nurse Coordinator -**
  - Take brief history and informs the team leader
  - Coordinates with definitive care Speciality for early disposition
  - They will inform regarding patient's management details to the patient relatives regularly
  - They will collect live data for trauma registry

Team dynamics for management of trauma patients for ***Vertical Resuscitation*** in ***Level-2 and Level-3*** facilities with limited manpower, are as follows:

During ***Vertical Resuscitation***, assessment and management of patients will be done in sequential manner of **A→ B → C → D → E**

Manpower details of trauma team (Level II & Level III TCF)

- Doctor – 1 [Trained emergency care provider (EP)]
- Emergency Nurse (EN) - 1
- Hospital attendant (HA)- 1
- Emergency Medical Technician (EMT)- 1

- **Role of trained emergency care provider -**
  - Will perform all the activities of EP1, EP2 & EP3 (as cited above) in sequential manner of **A→ B → C → D → E**
  - Will perform the activities of team leader
- **Role of emergency nurse -**
  - Will perform all the activities of EN1 & EN2 (as cited above)
- **Role of hospital attendant -**
  - Will perform all the activities of HA (as cited above)
- **Role of EMT -**
  - Will perform all the activities of EMT (as cited above)

 # Definitive management decision to be taken in consultation with General Surgeon/Orthopaedic Surgeon/Neurosurgeon/allied surgical and medical specialities (involve them early)

 # Proper Medico-legal documentation (MLC), Proper sample preservation and handover including information sharing

Investigations for major trauma patients

Mandatory Investigations:	
Haemogram (Hb, Platelets, Hematocrit)	Blood grouping & Cross Matching
Coagulation profile (PT INR, aPTT)	Blood gas analysis (arterial or venous)
Serum urea & creatinine	NCCT head
RBS (bedside, finger prick)	E-FAST examination
Urinary Pregnancy Test *	Bedside X-rays of the chest & pelvis (AP view)
Additional Investigations as per Indications	
12 lead ECG	Contrast Enhanced CT (CECT) abdomen, chest, neck, CT angiogram, etc
Color doppler - arterial	Other X-rays
Viscoelastic haemostatic assay i.e Thromboelastogram (TEG) or ROTEM if available	POCUS guided procedures & monitoring
Primary and secondary survey by Point of care ultrasound -- POCUS - ABCDE assessment	

Table 1: Investigations for major trauma patients

*For females of childbearing age group

Hb; haemoglobin, PT; prothrombin time, INR; International normal ratio, aPTT; activated partial prothrombin time, NCCT; non contrast computed tomography, E-FAST; extended Focused Assessment with Sonography in Trauma, TEG; thromboelastogram, ROTEM; Rotational thromboelastometry, POCUS; point of care ultrasonography

Management of Patients in Yellow Area

- Initial assessment and management (ABCDE based)
  - Reassure triage category
  - Apply semirigid cervical collar
  - Provide O_2 by oxygen reservoir face mask with a flow rare of atleast @ 11L/min
  - Insert wide bore IV canula and start IV fluids (ringer lactate)

- Adequate analgesia as per pain score
- Injection tetanus toxoid - 0.5 mL, IM (if indicated)
- Mandatory X-Ray chest and pelvis (AP view) and E-FAST for all patients
- NCCT head and other radiological/lab investigations, if indicated
- Documentation
- Definitive management decision to be taken in consultation with General Surgeon/ orthopaedic surgeon/ neurosurgeon/maxillofacial surgeon /allied surgical and medical specialities

 # Proper Medico-legal documentation (MLC), Proper sample preservation and handover including information sharing

Management of Green Triaged Patients

- Initial assessment and management (ABCDE based) - reassure triage category
- Most of the green triaged patients require minor wound care
- Ensure analgesia, TT, wound care and other procedures
- Identify, mitigate and have '*Zero tolerance for ED violence'* by ensuring appropriate security measures in the ED
- Documentation

 # Proper Medico-legal documentation (MLC), proper sample preservation and handover including information sharing

ED disposition and transfer protocol

- **'Red area'** patients get priority in admission, followed by patients in **'Yellow area'**
- Concerned speciality has to dispose their patients from ED by discharging or admitting the patients (within one hours for red, 6 hours for yellow from arrival)
- Failing to dispose patients within the defined time frame - block routine admissions of concerned speciality till disposition of red area patients
- **Transferring-Out:** In event of transfer-out of patients to other hospitals, ensure safe and informed transfer (e.g., stable vital functions, adequate equipment, supplies and manpower)
- **Transferring-In:** In event of informed transfer-in of patients from other hospitals; ensure proper patient details, inform the concern speciality and arrange for appropriate bed and care prior to arrival of patient.

Chapter 2: Initial Assessment and Management

Initial assessment includes the following elements:

- **Preparation**
- **Triage**
- **Primary survey (ABCDE) with simultaneous resuscitation**
- **Adjuncts to the primary survey and resuscitation**
- **Consideration of the need for patient transfer**
- **Secondary survey (head-to-toe evaluation and patient history)**
- **Adjuncts to the secondary survey**
- **Continued post resuscitation monitoring and re-evaluation**
- **Definitive care**

Preparation

It includes **prehospital and hospital phase**

- Prehospital phase:
  - Notify receiving hospital to keep necessary personnel and resources in ED
  - Emphasize on early airway maintenance, haemorrhage control, immobilization and immediate transport to nearest facility
- Hospital phase:
  - Organise airway equipment's
  - Prepare Warmed crystalloid solutions for infusion along with monitoring devices
  - Protocol to summon additional medical assistance, along with prompt laboratory and radiology personnel

Triage

- Sorting patients based on the resources required for treatment and resources that are actually available
- **Multiple-casualty incidents** - when the number of patients and severity of their injuries do not exceed the capability of the facility to render care
- **Mass-casualty Incidents (MCI)**- the number of patients and the severity of their injuries exceeds the capability of facility and staff
- Patients having greatest chance of survival with least expenditure of time, equipment, supplies, and personnel are treated first during MCI

Primary survey with simultaneous resuscitation

- Airway maintenance with restriction of cervical spine motion
- Breathing and ventilation
- Circulation with haemorrhage control
- Disability (assessment of neurologic status)
- Exposure/Environmental control

- Clinicians must quickly assess A, B, C, and D by asking the patient for his or her name, and asking the mechanism of injury .

Airway maintenance with restriction of cervical spine motion

Identify signs of airway obstruction: facial, mandibular, tracheal or laryngeal fractures and foreign body impaction

Management

- Suction to clear accumulated blood/secretions with jaw-thrust or chin-lift while restricting cervical spine motion
- Place an Oropharyngeal airway for patients who are unconscious with no gag reflex
- Establish a definitive airway if there is doubt about the patient's ability to maintain airway integrity or GCS score of less than or equal to 10
- Perform manual inline stabilization during airway management

Figure 3:Cervical spine motion restriction technique

Breathing and ventilation

- Assess jugular venous distension, position of the trachea and chest wall excursion to exclude the tension pneumothorax
- Expose the patient's neck and chest for inspection and palpation
- Caution: Simple pneumothorax converts to a tension pneumothorax in an intubated patient with positive pressure ventilation if not decompressed with chest tube

Circulation with Haemorrhage Control

- Consider that hypotension following injury is due to blood loss until proven otherwise

- Assess patient's response by level of consciousness, skin perfusion, pulse, blood pressure, urine output and base deficit
- Place two large-bore IV cannula (16 gauge) to administer fluid, blood, and plasma
- Identify the source of bleeding (Flow chart 1)
- Send blood samples for hematologic studies, blood type and cross matching
- Do urine pregnancy test for females of childbearing age (15-49 years)
- Obtain arterial blood gas to assess degree of shock and oxygen and carbon dioxide levels in ventilated patients
- Give bolus of 1 L isotonic crystalloid solution for shock patients before initiating blood transfusion
- Initiate massive haemorrhage protocol at the earliest for class III & IV shock
- For severely injured administer Inj Tranexamic acid (1 gram) within 3 hours of injury along with infusion for 8 hrs (1gram)

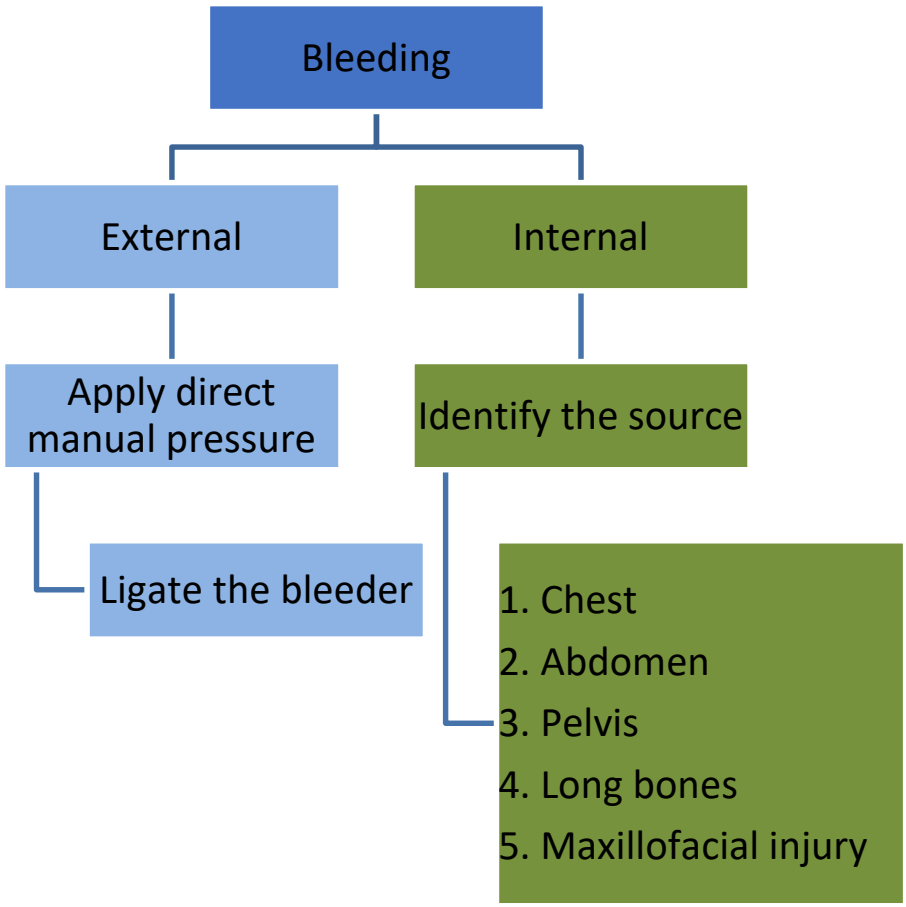


Figure 4: Measures for bleeding control

Disability (neurologic evaluation)

- Evaluate by Glasgow Coma Scale (GCS) score, pupillary size and determine spinal cord injury level

- Until proven otherwise, always presume that changes in level of consciousness are a result of central nervous system injury

Adjuncts to the primary survey with resuscitation

Attach ECG leads, Pulse oximetry, $EtCO_2$

Monitor ventilatory rate, capnography, and arterial blood gases

- Capnography can be used to confirm correct placement of endotracheal tube (Trachea vs esophagus) and also to detect dislodgement of endotracheal tube whenever patient is transported within hospital.

Urinary Catheters

- Reflect patient's renal perfusion and volume status
- Contraindicated in urethral injury, blood at urethral meatus or perineal ecchymosis
- If there is blood at the meatus refer patient to Surgeon/Trauma Surgeon for early retrograde urethrogram

Gastric Catheters

- Insert via oral route (vs nasal) to prevent intracranial passage in cribriform plate fracture patients

X-ray examinations and diagnostic studies

- Chest and pelvis X ray (AP view) performed at the bed side
- E-FAST

Consider need for patient transfer if resources are limited for patient management

Figure 5: Patient transfer

Secondary survey

- Reassess ABCDE and perform secondary survey only if primary survey is completed and vital parameters has started normalising. Continue resuscitative efforts during secondary survey
- Secondary survey is a detailed head-to-toe evaluation of the trauma patient

Take **AMPLE** history

- **A**llergies
- **M**edications currently used
- **P**ast illnesses/Pregnancy
- **L**ast meal
- **E**vents/Environment related to the injury

Head and Maxillofacial Structures

- Visual acuity and ocular mobility rule out ocular injury
- Palpate Face for all bony structures, assess for occlusion, intraoral examination, and soft tissue to rule out Maxillofacial injuries

Cervical Spine and Neck

- Presume all patients with head injury or maxillofacial injury to have Cervical spine injury until proven otherwise
- Examine neck for cervical spine tenderness, subcutaneous emphysema, tracheal deviation, and laryngeal fracture
- Auscultate carotid arteries for bruits
- Apply semirigid cervical collar in all patients until cervical spine injury is ruled out

Chest

- Palpate entire chest, including the clavicles, ribs, and sternum
- Auscultate to rule out pneumothorax, cardiac tamponade
- Rule out cardiac tamponade and tension pneumothorax in patients with distended neck veins with hypovolemia
- In case of hyperresonance on percussion rule out pneumothorax

Abdomen and Pelvis

- Ecchymosis over the iliac wings, pubis, labia, or scrotum rule out pelvic fracture
- Patient's abdominal findings can change over time hence closely observe and re-evaluate frequently

Perineum, Rectum, and Vagina

- Perform digital rectal examination to rule out presence of blood within the bowel lumen, integrity of the rectal wall, and sphincter tone.

- Perform per vaginal examination to rule out presence of blood in vaginal vaults and vaginal lacerations

Musculoskeletal System

- Palpate bones and examine for tenderness and abnormal movement to rule out occult fractures
- Log roll and examine patient's back

Neurological System

- Use GCS, pupillary size and response to early detect patient's neurological status

Adjuncts to the secondary survey

- To identify specific problem by performing CT scans of the head, chest, abdomen, spine; contrast urography, angiography, bronchoscopy, and esophagoscopy wherever indicated in consultation with definitive care speciality
- Use the Point of care USG (POCUS) guided assessment and management as adjuvant to secondary survey.

Re-evaluation

- Patients must re-evaluate constantly to ensure that new findings are not overlooked
- Continuously monitor vital signs, oxygen saturation, and urinary output (adult urinary output at rate of 0.5 mL/kg/h, paediatric patients an output of 1 mL/kg/h)
- Whenever the patient's treatment needs exceed the capability of the receiving institution, transfer should be considered at the earliest.

Chapter 3: Airway Management

Problem recognition

- Talk to the patient and stimulate a verbal response
- Positive response indicates patent airway
- Look for objective signs of threatened airway:
    - Observe patient for agitation and obtundation
    - Look for retractions and use of accessory muscles
    - Listen for abnormal sounds- snoring, gurgling, crowing, hoarseness
- Look for signs of compromised ventilation:
    - Look for symmetrical movement of chest wall
    - Listen for movement of air on both sides of chest
    - Use a pulse oximeter to look for oxygen saturation

Management Outline

- Always evaluate for predictors of difficult airway *(use LEMON law)*
- Maintain the airway patency by using techniques described below
- Follow ***Airway Decision Scheme*** as per Advanced trauma life support (ATLS)

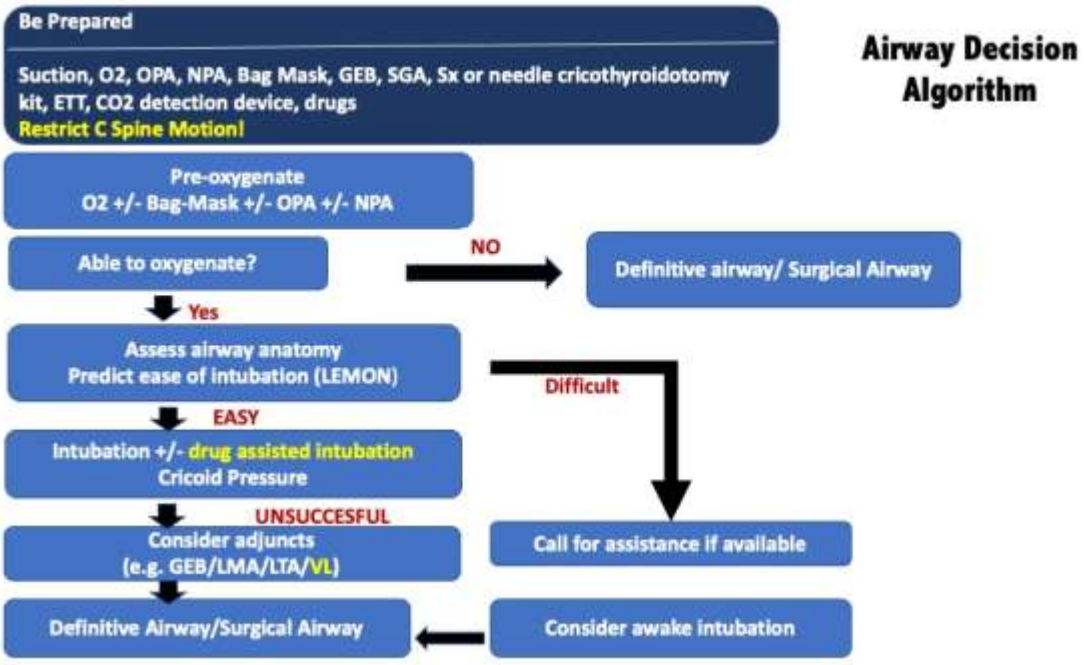


Figure 6: Airway decision algorithm

Airway maintenance techniques

- Perform jaw thrust or chin lift manoeuvre with manual inline stabilisation
- Use *Oropharyngeal airway* to open the airway
- Don't attempt Nasopharyngeal airway insertion in patients with suspected or potential cribriform plate fracture.

Figure 7: Jaw Thrust Manoeuvre is performed by grasping the angles of the mandibles and then displacing the mandible forward

Figure 8: Chin Lift Manoeuvre is performed by placing the fingers of one hand under the mandible and then gently lifting it upwards to bring the chin anterior

Figure 9: Restrict cervical spine movement during all phases of airway management

Definitive Airway

Drug assisted intubation:

- Have an alternate plan in the event of failure to secure airway that includes the possibility of performing a surgical airway
- Ensure that suction and the ability to deliver positive pressure ventilation are ready
- Preoxygenate the patient with 100% oxygen
- Administer an induction drug (e.g., Etomidate, 0.3mg/kg) or sedative, according to local protocol
- Administer succinylcholine/rocuronium intravenously
- After the neuromuscular blockade insert the endotracheal tube orotracheally
- Inflate the cuff and confirm tube placement by auscultating the patient's chest and determining the presence of CO2 in exhaled air
- If endotracheal intubation is unsuccessful, ventilate with a bag-mask device and use alternate techniques

Simultaneously call for help

- In case of failed airway involved the anaesthetist early and manage as per Failed airway/Difficult airway Algorithm

Surgical airway:

- Indicated in presence of -
    - Glottic oedema
    - Laryngeal fracture
    - Severe oropharyngeal haemorrhage
    - Inability to place endotracheal tube
- Surgical airway can be established by surgical cricothyroidotomy or needle cricothyroidotomy

Chapter 4: Management of Shock

The first step in managing shock in trauma patients is to recognize its presence. Any injured patient who is cool to the touch and is tachycardic should be considered to be in hypovolemic shock until proven otherwise.

Haemorrhage is the most common cause of shock in trauma settings.

Classification of Haemorrhagic Shock

Table 2: Classification of hemorrhagic shock

PARAMETER	CLASS I	CLASS II (MILD)	CLASS III(MODERATE)	(SEVERE)
Approximate blood loss	<15%	15-30%	31-40%	>40%
Heart rate	↔	↔/↑	↑	↑/↑ ↑
Blood Pressure	↔	↔	↔/↓	↓
Pulse Pressure	↔	↓	↓	↓
Respiratory rate	↔	↔	↔/↑	↑
Urine output	↔	↔	↓	↓ ↓
Glasgow Coma Scale Score	↔	↔	↓	↓
Base deficit3	0 to -2 m Eg/L	-2 to -6 mEG/L	-6 to -10 mEG/L	-10 m Eg/L or less
Need for blood products	Monitor	Possible	Yes	Massive Transfusion Protocol

Initial management of Haemorrhagic shock:

Primary survey

- Airway and Breathing: Establish a patent airway with adequate ventilation and oxygenation to maintain oxygen saturation >95%.

- Circulation:
  - Establish 2 wide bore intravenous (IV) cannula (preferably 16 gauge) in adults
  - Draw blood samples for type and crossmatch, appropriate laboratory analyses, blood gas analysis, toxicology studies and pregnancy testing for all females of childbearing age

- In adult 1 litre prewarmed IV fluid (Ringer lactate) should be given
- For children weighing below 40 kg, administer same fluid @ 20 ml/kg IV bolus
- Check for response to fluid/blood resuscitation in terms of responder, transient responder and non-responder
- Simultaneously identify the source of bleeding by using adjunct like chest X-ray, pelvic X-ray and E-FAST.
- In case source of bleeding could not be identified, log roll the patient during primary survey
- Initiate massive haemorrhage protocol according to degree of haemorrhagic shock at presentation or during course of treatment
- Start blood transfusion after initial fluid resuscitation or as soon as blood products are obtained in class III & IV shock. If crossmatched blood is unavailable, transfuse type O PRBCs (O negative in reproductive age group females and O positive in all others) and AB negative plasma for patients with exsanguinating haemorrhage

Note# Every hospital dealing with trauma patients must have massive haemorrhage protocol. Hospitals who do not have blood bank must have at least blood storage and round the clock dispatch of blood and blood products.

- Permissive hypotension:
  - In penetrating torso trauma maintain the systolic BP (SBP) between 85-90 mm of Hg
  - In patients with traumatic brain injury maintain the SBP between 90-95 mm of Hg
- ***Initial fluid therapy goal: (urine output)***
  - Adults 0.5 mL/kg/hr
  - Paediatric patients 1 mL/kg/hr
  - Children under 1 year of age, 2 mL/kg/hr should be maintained

Distributive shock:

Distributive shock describes pattern of cardiovascular responses characterising a variety of conditions, including septic shock, anaphylaxis and spinal cord injury. Inadequate organ perfusion is accompanied by vascular dilatation with hypotension, low systemic vascular resistance, inadequate afterload and a resulting abnormally high cardiac output.

Types of response to initial resuscitation

	RAPID RESPONSE	TRANSIENT RESPONSE	MINIMAL OR NO RESPONSE
Vital Signs	Return to normal	Transient improvement, recurrence of decreased blood pressure and increased heart rate	Remain abnormal
Estimated blood loss	Minimal (<15%)	Moderate and ongoing (15%-40%)	Severe (>40%)
Need for blood	Low	Moderate to high	Immediate
Blood preparation	Type and crossmatch	Type-specific	Emergency blood release
Need for operative intervention	Possibly	Likely	Highly likely
Early presence of surgeon	Yes	Yes	Yes

Table 3:Types of responses to initial resuscitation

- Disability:
  - Repeat neurological evaluation after restoring perfusion and oxygenation.

- Exposure:
  - Completely undress the patient for proper clinical examination irrespective of the gender while maintaining privacy and confidentiality
  - Prevent hypothermia by external radiant warmer, heating blanket and pre-warmed IV fluid.

Secondary Survey

- AMPLE history
- Log roll: look for any bleeding site from back of head, upper back, lower back and anal canal
- Proper head to toe examination for bleeding site or any obvious deformity

Reassessment

- Proper reassessment of resuscitation decreases the complications of haemorrhagic shock
- Assess for source of bleeding if required transfer for surgical intervention
- Consider other possibilities like obstructive shock, cardiogenic shock, neurogenic shock or septic shock in cases of delayed presentation.

Disposition

- Involve the surgeon early
- Shift non-responder and transient responder to operation theatre or radiologic suite for radiologic intervention.

Obstructive Shock

Tension Pneumothorax:

- Always suspect if associated rib fracture is present
- It may become evident after connecting to mechanical ventilator
- Insert a wide bore needle at 5th intercostal space mid axillary line immediately after recognition followed by intercostal tube drainage

Cardiac Tamponade:

- Perform pericardiocentesis by inserting wide bore needle from subcostal margin, preferably under ultrasound guidance

Neurogenic shock

- Suspect neurogenic shock in patient with hypotension and bradycardia, but 1st rule out haemorrhagic shock in trauma settings
- Suspect neurogenic shock in spinal cord injuries, especially to the cervical and upper thoracic vertebrae
- Initiate vasopressor support, eg- noradrenaline after initial fluid resuscitation

Chapter 5: Thoracic Trauma

Primary survey

A – Airway problems

1. **Airway obstruction**

   Diagnosis –
   Inspection – swelling around neck, vomiting, oral bleeding, stridor
   intercostal and subscapular retractions,
   Examination – Crepitus over neck, defect in sternoclavicular joint
   Management – Inspect oropharynx for foreign body and perform suctioning
   Reduce any posterior dislocation/fracture of clavicle

2. **Tracheobronchial tree injury**

   Diagnosis – Rapid deceleration mechanism, penetrating trauma,
   Haemoptysis, cervical subcutaneous emphysema,
   Definitive diagnosis – Bronchoscopy
   Management – Intubation (anticipate difficult airway and involve Anaesthesiologist early)
   Fibre optic assisted intubation
   Selective intubation of the unaffected bronchus

B – Breathing problems

1. **Tension pneumothorax**

   Diagnosis – hyper resonant percussion, deviated trachea, distended neck vein.
   Management – needle decompression followed by chest tube placement in 5th intercostal space in the anterior axillary line.

2. **Open pneumothorax**

   Diagnosis – large penetrating chest wall injury, tachypnea, pain
   Decreased air entry on the affected side
   Management – Any sterile occlusive dressing (tape it securely only on 3 sides) followed by chest tube drain

C – Circulation problems

1. **Massive Haemothorax**

   Diagnosis – Decreased breath sounds, dull percussion note
   Trachea midline, flat neck veins, E-FAST
   Management – Chest tube insertion (28-32 Fr) 5th ICS, midaxillary line

If immediate return of >1500 ml blood or continuing blood loss> 200 ml/h for 2-4 h – consider thoracotomy, Involve the Trauma surgeon/ General surgeon at the earliest.

2. **Cardiac tamponade**

   Diagnosis – muffled heart sounds, distended neck veins, Kussmaul sign, E-FAST
   Management – Thoracotomy/Sternotomy (Pericardiocentesis can be used as temporising measure),
   Involve the Trauma surgeon/CTVS surgeon at the earliest.

Secondary survey

1. **Simple pneumothorax**

   Diagnosis – Inspect for bruising, lacerations, and contusions on chest wall, decreased breath sounds on affected side, Chest X-ray
   Management – Chest tube insertion in 5th intercostal space, midaxillary line

   Indications for surgical intervention for pneumothorax include:

   - Second ipsilateral pneumothorax
   - First contralateral pneumothorax
   - Bilateral spontaneous pneumothorax
   - Pneumothorax fails to settle despite chest drainage
   - Spontaneous haemothorax: professions at risk (eg- pilots, divers)
   - Pregnancy

2. **Haemothorax** (<1500 ml)
   Manage as above

3. **Flail chest and pulmonary contusion**

   Diagnosis – crepitus, rib discontinuity on palpation, abnormal respiratory movement, Chest X-ray, lung ultrasound.
   Management – Humidified oxygen, adequate ventilation, judicious fluid administration
   Intubate if Sao2<90%, analgesia,
   Involve the Trauma surgeon/General surgeon at the earliest.

4. **Blunt cardiac injury**

   Diagnosis – Hypotension, dysrhythmias, region wall motion abnormality on 2 D Echocardiogram
   ECG – Multiple premature ventricular contraction ectopics, atrial fibrillation, bundle branch block , ST changes, sinus tachycardia
   Management – Close monitoring for initial 24 hours for dysrhythmias,

Involve the Trauma surgeon/CTVS surgeon and cardiologist (physician, if cardiologist not available) at earliest.

5. **Aortic disruption**

   Diagnosis – Decelerating force, Chest X ray, Helical contrast CT

   Management – Maintain HR<80 bpm and MAP 60-70 mm Hg with esmolol (Use Nicardipine when Beta blockers are insufficient), Involve the Trauma surgeon/CTVS surgeon/General surgeon earliest.

6. **Diaphragmatic injury**

   Diagnosis – Chest X ray (following NG tube insertion), CT, UGI contrast study

   Management - Direct repair, Involve the Trauma surgeon/General surgeon earliest.

7. **Oesophageal rupture**

   Diagnosis – Retrosternal chest pain, subcutaneous emphysema

   Pain/shock out of proportion to the injury

   Management – Wide drainage of pleural space and mediastinum with direct repair,

   Involve the Trauma surgeon/GI surgeon/General surgeon at the earliest.

Chapter 6: Abdominal and Pelvic Trauma

Recognise

Blunt abdominal injury

- Blunt abdominal injuries often managed conservatively, though interventional radiology and surgery are indicated for severe injuries

Penetrating abdominal injury

- Most patients with significant penetrating injury require laparotomy; there are differences in the management of projectiles (e.g. gunshot wounds) and non-projectiles (e.g. stabbings)
- In Blast injuries rule out injuries to the tympanic membranes, lungs, and bowel

Pelvic injury

- Pelvic fractures are important since mortality is high if not managed promptly and appropriately.
- Pelvic fractures are caused by high energy mechanism injuries.
- Can cause major haemorrhage which may be difficult to control, especially in case of open pelvic fractures .

Primary survey

- Use a coordinated team-based systematic approach aimed at identifying, prioritising and treating immediate and delayed life-threats
- Abdominal and pelvic injuries may cause life-threatening haemorrhage
- Initial examination of the abdomen is best performed in the 'C' phase of the primary survey, with the mind-set of 'Identify the source of bleeding and, stop the bleeding'
- Perform pelvic compression test to assess for pelvic instability
- Activate massive transfusion protocol at the earliest based on indication

Secondary survey (search for signs that indicate need for emergency laparotomy)

- Look for abrasions, bruising, seat belt, retroperitoneal haemorrhage: ecchymosis of the periumbilical area (Cullen's sign) and the flanks (Grey-Turner's sign)
- Check for coexistent genital trauma, blood at the meatus, scrotal or other perineal hematomas. Perform a per-vaginal (PV) exam to rule out vaginal tears.

- Do Per rectal examination for sphincter tone, rectal mucosal integrity, identifies palpable pelvic fractures and look for gross blood (indicate bowel perforation)
- In unresponsive menstruating women, do PV to rule out presence of tampons which may cause delayed sepsis
- Look for lower limb length discrepancy and malrotation
- Do retrograde urethrogram for all patients unable to void, requiring a pelvic binder, or blood at the meatus/scrotal hematoma, perineal ecchymosis by avoiding urinary catheterization

Investigation

- Monitor haemoglobin (Hb), lactate and academia rule out major haemorrhage
- CXR rule out air under diaphragm, AP pelvis x-ray rule out pelvic fracture
- E-FAST rule out free fluid in abdomen
- CT Abdomen and pelvis with IV Contrast – done in haemodynamically stable and one of the following is present:
    - Trauma patients with abdominal tenderness
    - Trauma patients with altered sensorium
    - Distracting injuries or injuries to adjacent structures
- Angiography - identifies arterial injury and to guide for embolization

Resuscitate

Coordinated team based ATLS approach to address immediate life threats and identify other potential serious injuries

Pelvic stabilization by

- Apply a pelvic binder early (binder centered over greater trochanters rather than iliac crests with lower limbs internally rotated)
- Pelvic binder should be applied before intubation (if required), as neuromuscular blockade may allow pelvic volume to expand

Figure 10: Pelvic Stabilization: Pelvic stabilization using a sheet

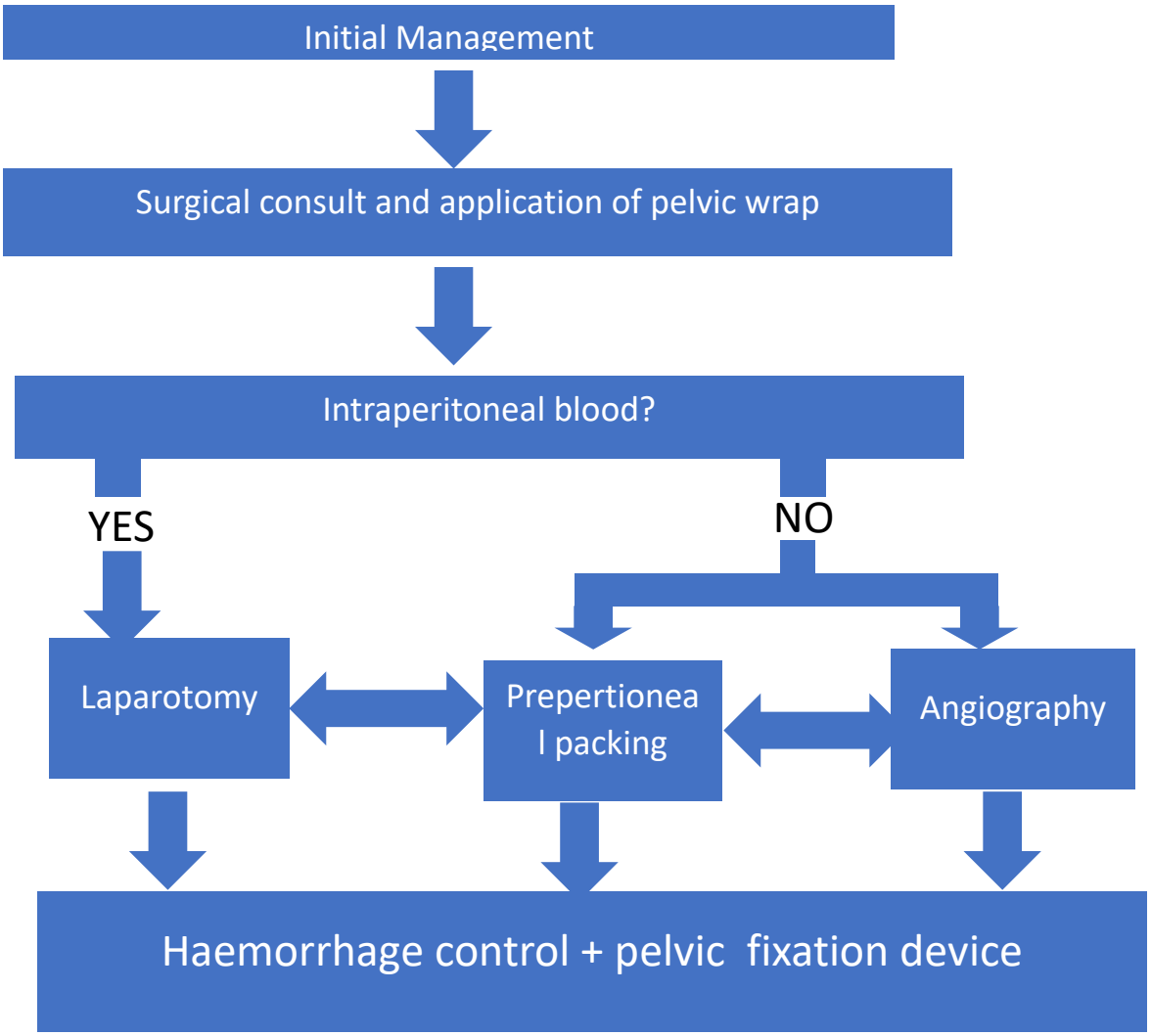


Figure 11: Pelvic fractures and Haemorrhagic shock management algorithm

Indication for emergency laparotomy is:

- Peritonism, Evisceration
- Penetrating abdominal trauma + hypotension
- Blunt abdominal trauma + hypotension with positive FAST scan, positive diagnostic peritoneal lavage (DPL) or peritonism
- Left thoracoabdominal wounds due to risk of diaphragmatic injury (17%)
- Bleeding from stomach, rectum, or genitourinary tract following penetrating trauma
- Gunshot wounds with peritoneal penetration
- Blunt or penetrating abdominal trauma with aspiration of GI contents, vegetable fibers, bile from DPL, aspiration of 10 cc or more of blood in haemodynamically abnormal patients

Damage control surgery

- Damage control surgery is limited to haemorrhage control and minimize contamination until patient has sufficient physiological reserve to undergo definitive interventions

- Damage control surgery, along with permissive hypotension and haemostatic resuscitation, is integral to the concept of damage control resuscitation

Refer

- If Expertise/Resources (including angioembolization) are not available, transfer the patients to higher level of care

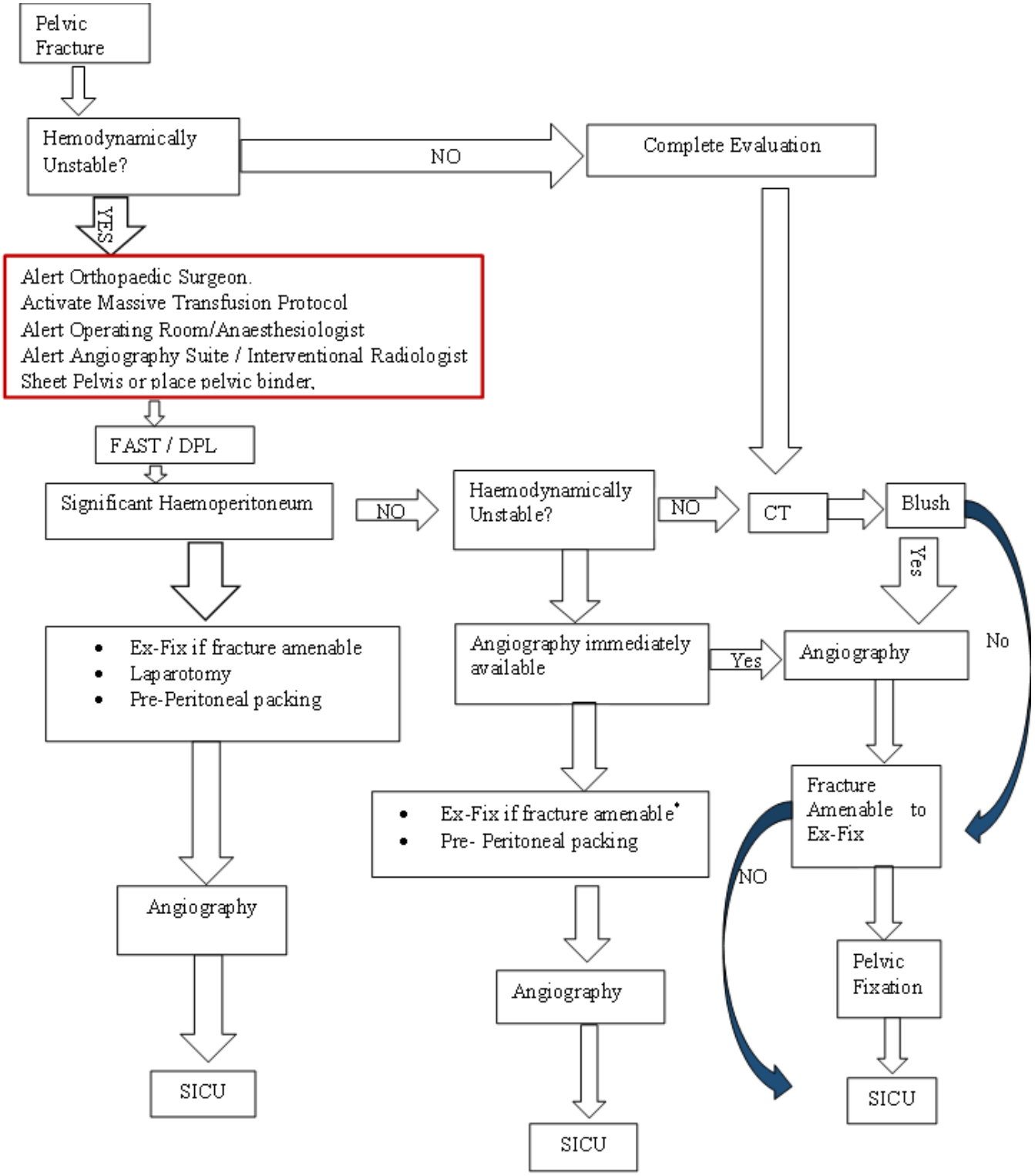


Figure 12: Management of Abdominal and Pelvic Trauma

Chapter 7: Head Trauma

Triage

Recognise the condition and triage as per the level of Glasgow coma scale and send the patient to the appropriate area for management.

Classification of Head Injury

Classification of Head Injury is based on Modified Glasgow Coma Scale (GCS):

- Mild: 13 – 15
- Moderate: 9 – 12
- Severe: 3 – 8

REVISED SCALE	SCORE
Eye Opening (E)	
Spontaneous	4
To sound	3
To pressure	2
None	1
Non-testable	NT
Verbal Response (V)	
Oriented	5
Confused	4
Words	3
Sounds	2
None	1
Non-testable	NT
Best Motor Response (M)	
Obeys commands	6
Localizing	5
Normal flexion	4
Abnormal flexion	3
Extension	2
None	1
Non-testable	NT

Table 4: Modified Glasgow coma scale

Primary Survey

Airway and Breathing

- Give 100% Oxygen by face mask

- Perform Endotracheal Intubation in severe TBI (GCS < 8)
- Goals:
    - SpO2 > 98%
    - PaO2 > 100 mmHg
    - pCO2: Around 35 mmHg (avoid hyperventilation)

Circulation

- Hypotension in TBI – Isolated TBI is unlikely to cause hypotension search and treat for causes of haemorrhagic shock
- Always establish euvolemia with blood products and isotonic fluids
- Monitor fluid status, sodium levels frequently
- Goals:
    - SBP > 100-110 mmHg
- Correction of anticoagulation

Disability assessment

- Neurological examination in a hypotensive patient is unreliable
- Establish neurological status only after normotension
- To examine: GCS, Pupils, Focal neurological deficits
- Always follow GCS motor response (like before intubation, after any procedure, etc)
- Never attempt Doll's Eye Testing until cervical spine is cleared
- Always try to achieve 'Goals in Treatment' in Severe TBI
- Management of raised intracranial pressure (ICP) and Seizures (see Severe TBI)

Management of Mild Traumatic Brain Injury (mTBI)

- GCS: 13 – 15
- Manage ABCDE
- AMPLE history: particularly, anticoagulant use
- Indication of NCCT Head with C-spine:
    - Age > 65 years
    - Vomiting > 2 episodes
    - Loss of consciousness > 5 minutes
    - Retrograde amnesia (> 30 minutes)
    - Dangerous mechanism of injury
    - GCS < 15 at 2 hours after incident
    - Suspected open/depressed skull fracture
    - Signs of basilar skull fracture (Racoon eyes, Ear bleed, CSF otorrhoea, CSF rhinorrhoea, Battle's sign)
    - Anticoagulants use
- Disposition (Admission criteria for mTBI)
    - Abnormal CT scan

    - All penetrating head injuries
    - Deteriorating consciousness
    - Drug/alcohol intoxication
    - No reliable companion at home
    - Abnormal GCS (<15)
    - Persistent Functional Neurological Disorder
- Discharge the patients if no admission criteria fulfil, patient is haemodynamically stable and a reliable companion in home to take care of the patient
- Discharge instructions:
    - Symptomatic treatment for headache, fever, etc
    - Immediately bring the patient to hospital if any of the below mentioned symptom is present:
    - Inappropriate drowsiness (check every 2 hourly)
    - Vomiting
    - Seizures
    - Bleeding or watery discharge from ear or nose
    - Severe headache
    - Weakness in any limbs, facial deviation, abnormal sensation in any limbs
    - Unusual breathing pattern

Management of Moderate TBI

- GCS: 9 – 12
- Manage ABCDE
- Focussed neurological examination
- NCCT head in all cases
- Baseline blood investigations
- Admit or transfer to a facility capable of definitive neurosurgical care
- If patient deteriorates, manage according to severe TBI

Management of Severe Traumatic Brain Injury

- GCS: 3 – 8
- Manage ABCDE
- NCCT head in all cases after stabilisation of vitals
- Intubate all patients
    - Prepare all instruments (with rescue devices)
    - Pre-treatment: Inj Fentanyl – 1-2 ug/kg
    - Positioning: remove anterior portion of cervical collar, manual inline stabilisation during intubation
    - Preoxygenate with 100 % O2 for 3-5 minutes
    - Induction agent: inj Etomidate 0.3mg per Kg
    - Paralytic agent: Inj Rocuronium 1mg/kg, IV
    - Post intubation Analgesia inj Fentanyl 1mcg/Kg/hr IV infusion or intermittent bolus

- Keep the sedation level to Richmond agitation sedation scale at -2 (minus two).

- 'Goals of Treatment':

Clinical parameters:	Laboratory parameters:
• SBP >100-110 mmHg • Normothermia (36 – 38 C) • Oxygen Sat - >95% • EtCO2 - 35	• RBS: 80 – 180 mg/dL • Hb > 8 g/dL • Platelets > 75,000/dL • INR < 1.4 • Na – 135 – 145 mEq/L
Arterial blood gas: • pH: 7.35 – 7.45 • SaO2: 95% • PaCO2: Around 35 mmHg	

Management of raised Intracranial Pressure:

- Suspect raised ICP in case of: deteriorating GCS, focal neurological deficit, dilatation of pupils
- Steroids must not be given (contraindicated)
- Administer:
  - Normotensive patient: Inj Mannitol – 1g/kg IV, over 5 minutes; then 20 g (100 mL), TDS (keep the serum osmolality < 320 mos/L). **Don't give in extradural hematoma (EDH) patients**
  - Hypotensive patients: Inj Hypertonic (3%) saline – 200 mL over 10 minutes (keep the serum sodium less than 155 meq/L)

Management of seizures:

- Inj Phenytoin/Fosphenytoin – 15-20mg/kg slow over 30 minutes. In adults, give 1 gram loading dose followed by 100 mg eight hourly.

ED management of head injury

Scalp wounds

- Scalp wound bleeds profusely – apply direct pressure, clean the wound and suture
- See for underlying skull fracture – if present, consult neurosurgeon

Depressed skull fracture

- NCCT head with C-spine must be done.
- Consult neurosurgeons

Intracranial mass lesions

- Manage ABCD, raised ICP
- Consult neurosurgeons
- Relevant surgical procedure by trained specialist (Surgeon) if neurosurgical facility is not readily available

Penetrating brain injuries

- NCCT head with C-spine must be done
- Prophylactic broad-spectrum antibiotics, e.g., Inj Ceftriaxone-1g, IV, Inj Amikacin 500mg i/v BD, Inj Metronidazole 500 mg i/v TDS or as per local policy
- Do not disturb the penetrating object
- Consult neurosurgeon

Chapter 8: Oral and Maxillofacial Trauma

Introduction

The basic principles of primary care in maxillofacial trauma are airway management followed by definitive treatment like management of fracture and soft tissue injuries. If basic principles of primary care are applied immediately, this contribution can benefit the patient and enhance his chances of survival and decrease mortality and morbidity during the golden hour.

Recognizing Oral Maxillofacial Injuries in Accident Emergency Department

Recognize

- Facial lacerations
- Tongue lacerations
- Oral lacerations
- Gross oedema of face
- Ballooning/moon face
- Circumorbital oedema and ecchymosis/racoon eyes
- Depressed nasal bridge/nasal disfigurement
- Epistaxis/nasal bleeding
- Occlusal derangement
- Step / mobility of bony fragment
- Anterior open bite
- Posterior gagging of occlusion
- Posterior and downward displacement of maxilla
- Reduced mouth opening
- Haematoma of floor of the mouth
- Tooth fracture
- Tooth Avulsion
- Luxated teeth
- Oral bleeding
- Tooth mobility
- Crepitus on palpation
- CSF rhinorrhoea
- Frontal bone depression
- Restricted eye movement
- Step deformity at infraorbital margin
- Subconjunctival haemorrhage
- Hypoglobus
- Enophthalmos
- Diplopia
- Tele- canthus

Resuscitation

- Primary survey of the trauma patient done by ABCDE of STG of Trauma
- Recognize causes of respiratory obstructions related to oral maxillofacial injuries.
- Inhalation of blood clot, vomit, saliva, thick mucosa or portions of teeth, bone and dentures
- Inability to protrude the tongue, because of the posterior displacement of the anterior fragment of the mandible (Bilateral para symphysis mandibular fracture)
- Occlusion of oropharynx by the soft palate after fractured posterior-inferiorly displaced maxilla
- Loose teeth due to trauma which might get aspirated and worsen the airway obstruction

Follow the primary guidelines for Trauma for the resuscitation of Oral & Maxillofacial trauma patient

Referral

Facial and oral lacerations

Posterior gagging of occlusion

Posterior and downward displacement of maxilla

Posteriorly displace mandible B/L para symphysis

Displaced / dislocated fractured segment

Tooth avulsion / fracture / mobility / luxation

Oral / Nasal bleeding

IMMEDIATE

Crepitus on palpation of bones

Reduced mouth opening

Dish faced deformity

Gross oedema of the face

Hematoma on floor of mouth

Anterior open bite

Step at infraorbital margin

Ballooning of face

Circumorbital ecchymosis

Occlusion derangement

DELAYED REFERRAL

Resuscitation

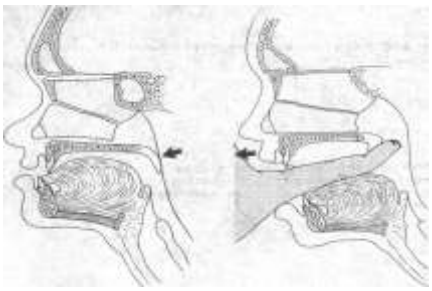
The patient with multiple injuries may have injuries of the head, face and neck that are life threatening or sufficiently serious to require specialist advice and management. In the initial assessment such patients may present with airway obstruction or hypovolaemic shock due to profuse and continuous bleeding from the facial skeleton or its surrounding soft tissues. Once the maxillofacial injuries requiring immediate attention due to airway compromise and haemorrhage have been managed, the definitive management of soft and hard tissue of the face and neck may be deferred until other life-threatening injuries have been dealt with. However, it should be noted that facial trauma can be operated simultaneously when cranial trauma is being managed. The team of doctors in the Accident Emergency Dept. must be aware of these problems and be able to initiate manoeuvres to prevent mortality in patients before the arrival of the Oral maxillofacial surgeon.

The priority of the resuscitation team in the Accident and Emergency Dept.is to secure and maintain an airway, but this action is in close proximity to the site of oral & maxillofacial injuries, which may be compromised with badly bruised, lacerated and avulsed soft tissue, fractured teeth and artificial dentures, and pieces of fractured bone.

There are some specific life-threatening issues associated with oral & maxillofacial injuries which may affect the airway:

1. **A fractured maxilla may be displaced posteroinferiorly along the inclined plane of the base of the skull, blocking the nasopharyngeal airway.**
   Management

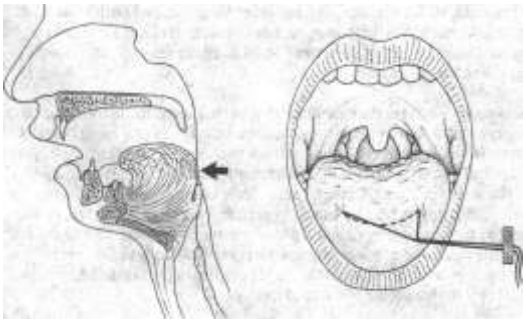
   Disimpact the maxilla by forward traction by placing the index and middle fingers behind and above the soft palate and the thumb over the area of the incisor teeth.



2. **In patients with a bilateral anterior or symphyseal mandibular fracture, the tongue may fall back in a supine patient, resulting in blockage of the oropharynx.**
   Management

   Pull the anterior part of the mandible forward manually using the index finger and thumb or use a towel clip to pull the tongue forward, till one can insert a deep traction

suture (“0” black silk) transversely through the dorsum of the tongue and pull the tongue forward - sideways and tape the suture on to the side of the face.



3. **Teeth, dentures, bone fragments, vomitus, haematoma, and other foreign bodies may block the airway at any site from the oral cavity through the oropharynx, larynx, and trachea down to the bronchi, especially the right main bronchus.**
   Management

   - Clear the oral cavity by using a gloved finger to displace the debris out of the oral cavity.
   - Use a large bore suction catheter with adequate light to aspirate the oral cavity.
   - Use the laryngoscope and large bore suction catheter (ignoring any pain from facial fractures) to examine and clean the oropharynx, larynx including the oral cavity.

4. **Haemorrhage or profuse bleeding may result from various causes.**

   i. Open wounds.

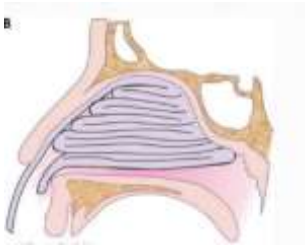
   Management

   Apply moist gauge with pressure onto the wound. Request cross - matching of blood, and plan for definitive treatment.

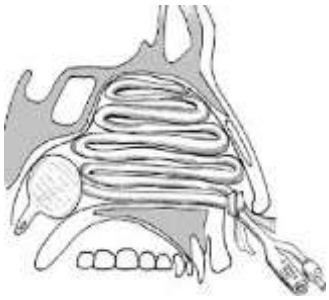
   ii. In case of Nasal fracture or injuries to the nose.

   Management

   a) Nasal bleeding can be stopped by using ribbon gauze packing soaked in 1:1000 adrenaline for anterior nasal packing. In some cases, posterior nasal packing may be necessary if nasal bleeding is not controlled.



ANTERIOR PACKING with gauze begins with the application of anesthetic to the nasal mucosa with cotton balls or via inhalation. Prepare a length of ribbon gauze impregnated with petrolatum jelly. Use bayonet forceps and a nasal speculum to place the gauze in a layered, accordion fashion, packing it from posterior to anterior. The gauze should be placed as far posteriorly as is possible.



POSTERIOR PACKING - Apply local anesthetic ointment 2% to the Foley catheter, and insert the device into the nostril. Visualize the catheter tip in the back of the throat. Inflate the balloon with up to 10 mL of sterile water. Withdraw the balloon gently until it seats posteriorly. Pack the anterior nasal cavity with a balloon device, nasal tampon or layered ribbon gauze. Apply a padded umbilical clamp across the catheter to prevent alar necrosis and to keep the balloon from dislodging.

b) Bleeding from bone - fractured segment should be repositioned and splinted for bleeding control.

Note# After dealing with these immediate problems consider orotracheal intubation.

5. Soft tissue swelling and oedema.

Injuries to the face and oral cavity cause gross swelling around the upper airway. This rarely presents an immediate problem, but the oedema may worsen over a few hours leading to an acute airway emergency.

Once the airway has been secured in position and hemorrhage controlled the definitive management of soft tissue and bone trauma of the oral & maxillofacial region may be deferred until life threatening neurosurgical, thoracic, abdominal, and neurovascular limb injuries have been dealt with. It may be appropriate, however, to perform simultaneous procedures or even combined operations, particularly when cranial trauma is combined with Oral and Maxillofacial trauma.

Examination and definitive management

Adequate exposure should be made by cleaning the head and facial wounds with an antiseptic solution.

No hard or soft tissue fragment should be discarded.

I. **Scalp** - examine for lacerations and bruises while taking care of immobilisation for c-spine injury

II. **Eye**- examine for visual acuity, Diplopia, limitation in ocular movements, pupillary levels, direct and consensual reflex, proptosis, periorbital swelling, enophthalmos, exophthalmos, subconjunctival haemorrhage etc. Refer to ophthalmologist for further management. Orbital signs may be suggestive of trauma to floor/walls of the orbit and Zygomatico-maxillary complex fractures. Evaluate and Refer to Oral & Maxillofacial Surgeon.

III. **Nose**- evaluate for any deformity, pain, mobility and difficult breathing. Manage bleeding as described in section above. CSF leak if present, do not pass a nasogastric tube or endotracheal tube. Administer antibiotics prophylactically as advised for prevention of meningitis. Measure the intercanthal and inter-pupillary distance. Any increase is suggestive of Naso-orbito-ethmoidal (NOE) fracture.

IV. **Ear** - examine for bleeding and Cerebrospinal fluid leak. Refer to specialist

V. **Soft tissue**- examine for sensory nerve deficit (consider for immediate repair or late repair). Presence of emphysema is suggestive of communication between the facial spaces and the sinus. Administer adequate antibiotics to prevent infection. It will eventually resolve. However, emphysema in the neck should be an alarming condition in view of injury to larynx, trachea and lungs.

VI. **Maxilla** - increase or decrease in the vertical height of face is suggestive of bilateral maxillary fractures. Also, other signs like circumorbital ecchymosis and dish-face deformity should be documented.

VII. **Orbit** - the bony orbit should be palpated for any step deformity.

VIII. **Mandible** - Palpate the mandible externally from the condyle and along the lower border for tenderness, step deformity and crepitus.

IX. **Intra-oral examination** - for hematoma, lacerations, bleeding, fractured and missing teeth, dentures and occlusion. Any patient not able to bite his teeth properly or not able to open or close his mouth should be referred to an Oral & Maxillofacial Surgeon.

X. **Appropriate radiographs** should be made for adequate diagnosis and management of injuries.

Chapter 9: Spine Trauma

Screening of spine injury

Suspected cervical spine injury

- Presence of weakness of any limb
- Use NEXUS criteria and Canadian C-spine Rule to clinically clear the spine
- Never force the patient's neck
- Do cervical spine imaging in all altered sensorium patients

Suspected thoracolumbar spine injuries

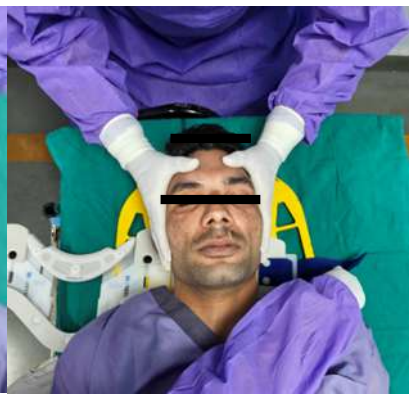
- Presence of paraplegia or a level of sensory loss on abdomen or chest
- Keep the patient on spine board (but not more than 2 hours)

Spinal Motion Restriction

- Prevent spinal movement: use semirigid Cervical collar, long & short spine board
- Do not attempt to reduce obvious deformity
- Carefully perform log roll manoeuvre for secondary survey while maintaining spinal motion restriction

Figure 13: Cervical Collar application

While one provider applies in-line stabilization, other provider slides posterior part of the collar behind patient's neck. Maintain in-line stabilization until full immobilization of patient has been done.



Front part of the collar is placed under the patient's chin. Collar should be well supported by the chin. Difficulty position of collar indicates improper size and need of smaller collar.

Attach the Velcro of the posterior part of collar to the anterior part of the Velcro hook. Recheck proper alignment of position oof patient's head. Tighten the collar until proper immobilization and support obtained.

Radiographic evaluation

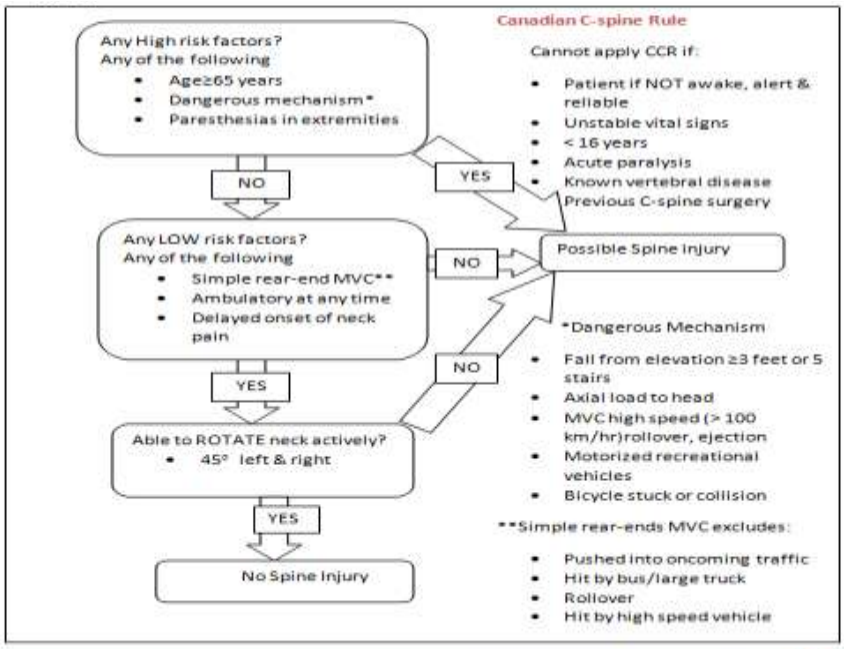
Modalities

- **CT spine** – best (from occiput to T1 sagittal – for cervical spine)
- **Plain radiographs:**

- In lateral view: base of skull, all seven cervical vertebra and first thoracic vertebra should be visible
- Open mouth odontoid view to visualize atlantoaxial and atlanto-occipital joints
- AP and lateral views for thoracolumbar spine

For Cervical spine

- Use clinical decision tools (NEXUS criteria and Canadian C-spine rule) to rule out cervical spine injuries and avoid the need of imaging



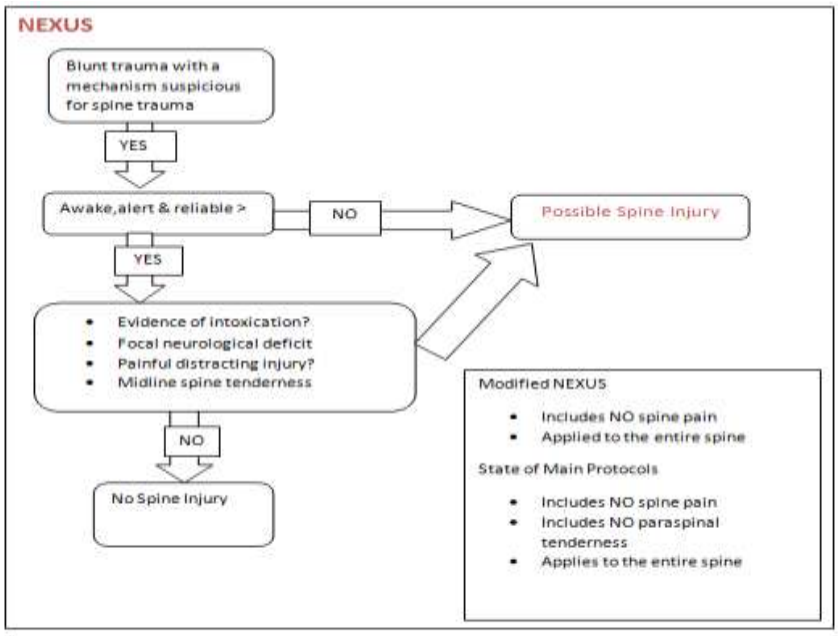


Figure 14: Canadian C-spine rule and NEXUS criteria

Supportive management

Airway and breathing

- **Intubate the patient if C5 or above is fractured**
    - Clinician should assess the situation on its merits and are advised to have a **low threshold for intubation for patients with fracture at C5 and above**.
- **Assessment of adequacy of ventilation by Single Breath Count**
    - These patients should be assessed by Single Breath Count, which will act as a **triaging tool** in such cases.
    - If Single Breath Count is less than 20, shift the patient to Red area. If Single Breath Count less than 15, intubate the patient immediately, irrespective of saturation level and other indicators.

Circulation

- Suspect Neurogenic shock if-
    - Persistent hypotension without active haemorrhage
    - Bradycardia with hypotension
- Give fluid challenge of 1L maximum
- If not improving, start vasopressor/s

Medications

- Do not give of steroids

Figure 15: Logroll of patients for secondary survey

At least four people are required for logrolling a patient. **A.** One person stands at the patient's head end to control the head and c-spine, while two persons are at patients side and control the body and the extremities **B.** Patient is rolled with three people maintaining the alignment of the spine (note the crossing of hands of both persons performing logroll) while **C.** the fourth person removes the board and also examines the back. **D.** Once the board is removed, the patient is returned to the supine position while maintaining spine alignment by three persons.

Chapter 10: Musculoskeletal Trauma

Primary Survey

- Manage ABCD as discussed
- During assessment of circulation, cause of haemorrhagic shock must be identified
- Musculoskeletal injuries where circulation compromise can occur are discussed below
- Immobilize life threatening fractures in primary survey

Major Arterial Haemorrhage

- **Assessment:** Look for external bleeding, loss of a previously palpable pulse, and changes in pulse quality and ankle/brachial index (ABI)
- **Stepwise scontrol** *(go to next step, if bleeding is not controlled)*
    - Apply manual pressure to the wound
    - Put pressure dressing using a stack of gauze pads
    - Occlude the proximal artery
    - Apply a manual tourniquet
    - Realign the fractures, reduce the joints and immobilise (may need expert help)
- Seek orthopaedics and surgical consultation
- Early transfer to Trauma Centre

Bilateral Femur Fracture

- Manage as advised in 'Major Arterial Haemorrhage' section above
- After initial stabilisation, transfer to Trauma Centre with vascular and orthopaedics facilities

Crush Syndrome

- **Suspect:** If extensive limb damage associated with AKI or amber coloured urine
- **Diagnose:** with the help of Raised Serum CK-MM (>10,000 U/L)
- **Management:**
    - Aggressively resuscitate with IV Fluids (NS only) - with the goal of 200 to 300 mL of urine output each hour

Secondary Survey

History

- Ask about Mechanism of Injury, Environment of accident and AMPLE history

Physical Examination

- Look for Life threatening injuries and Limb threatening injuries
- Visually inspect colour, perfusion of limb; wounds; deformity of limb
- Palpate the extremity for Tenderness, Sensory abnormality
- Check the joint mobility
- Palpate distal pulses, capillary refilling time of limbs, pulse discrepancies
- Measure Ankle-Brachial Index - < 0.9 indicates vascular compromise

X-Ray Examination

- Should be done once ABCD is stabilised
- Suspect the site of fracture or dislocation and take at least two X-Ray views at 90 degrees

Pain Control (never miss this aspect)

- Immobilise the injures part appropriately
- Assess pain score using ED validated Defence and Veterans scale
- Use multimodal analgesia (Drugs, Blocks).

Limb Threatening Injuries

Open Fracture and Open Joint Injuries

- Remove gross contamination by irrigating with NS
- Immobilise appropriately
- Give Tetanus prophylaxis
- Give IV Antibiotics within 3 hours of injury, as per ATLS protocol

Vascular Injuries

- Absent or feeble pulse distal to injury suggests vascular compromise
- Gently immobilise (not too tight) the fracture and/reduce the joint(s)
- Consult surgeon immediately

Compartment Syndrome

- **Suspect** *(if any of the signs/symptoms is/are present):*
    - Pain greater than expected and out of proportion to the stimulus
    - Pain on passive stretch of the affected muscle
    - Tense swelling of the affected compartment
    - Paresthesias distal to the affected compartment
- **Management:**
    - Remove all constrictive dressings, casts or splints

- Immediately obtain a surgical consultation for *Fasciotomy*

OPEN FRACTURES	FIRST-GENERATION CEPHALOSPORINS (GRAM-POSITIVE COVERAGE) CEFAZOLIN	IF ANAPHYLACTIC PENCILLIN ALLERGY (INSTEAD OF FIRST-GENERATION CEPHALOSPORIN) CLINDAMYCIN	AMINOGLYCOCIDE (GRAM-NEGATIVE COVERAGE) GENTAMICIN	PIPERACILLIN TAZOBACTAM (BROAD-SPECTRUM GRAM-POSITIVE AND NEGATIVE COVERAGE)
Wound <l cm; minimal con-Contamination or soft tissue damage	<50 kg l gm Q 8 hr 50-100 kg-2 gm Q 8 hr >100 kg- 3 gm Q 8 hr	< 80 kg-600 mg Q 8 hr >80 kg – 900 mg Q 8 hr		
Wound l-10 cm Moderate soft Tissue damage; Continuation of fracture	<50 Kg :lgm Q 8 hr 50-100 kg: 2 gm Q 8 hr >100 kg : 3 gm Q 8 hr	< 80kg:600 mg Q 8 hr >80 kg: 900 mg Q 8 hr		
Severe soft- tissue damage And substantial Contamination with Associated vascular injury	<50 kg: l gm Q 8 hr 50-100 kg: 2 gm Q 8 hr >100 kg : 3 gm Q 8 hr	< 80 kg: 600 mg Q 8 hr >80 kg:900 mg Q 8 hr	Loading dose in ER: 2.5 m/kg for child (or <50 kg) 5 mg/kg for adult (i.e. l50-lb pt=340 mg)	
Farmyard, soil or standing water, irrespective of wound size or severity				3.375 gm Q 6 hr (<100 kg) 4.5 gm Q 6 hr(>100 kg)

Table 5:Treatment by antibiotics

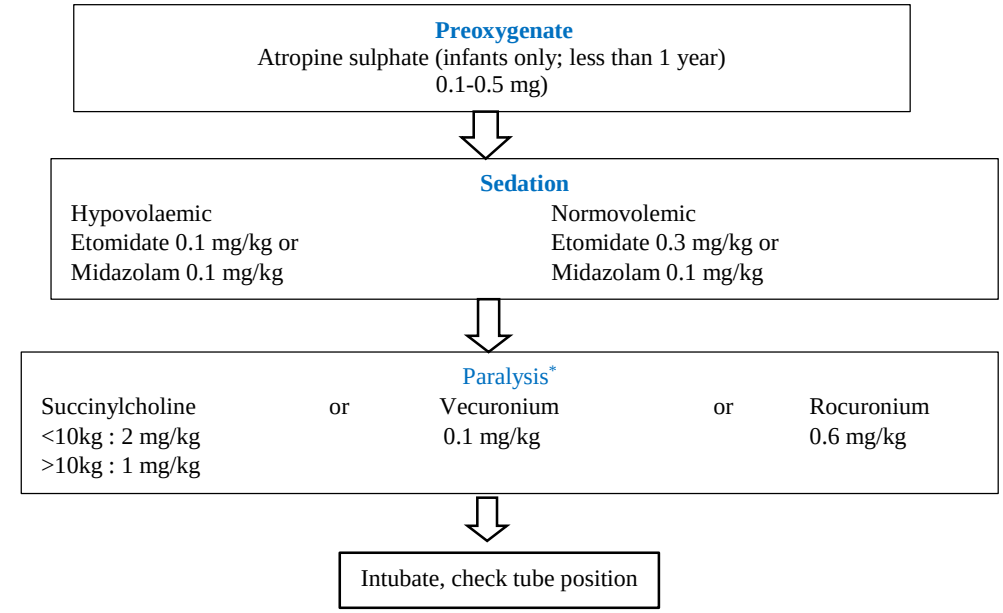
Chapter 11: Paediatric trauma

Primary survey:

Airway and cervical spinal motion restriction

- If spontaneously breathing – place plane of face parallel to plane of stretcher
- To open airway – use jaw thrust and bimanual inline spinal motion restriction
- Clear secretions provide supplemental oxygen
- Oral airway – insert gently and directly into oropharynx
- Do not rotate 180 degrees
- If definitive airway required, use ***Broselow tape*** for device size, drug doses
- ***Follow drug assisted intubation algorithm as per ATLS guidelines***

Figure 16: Resuscitation Tape/Broselow® Paediatric Emergency Tape: A length-based resuscitation tape can rapidly determine weight based on length for appropriate fluid volumes, drug doses, and equipment size. B. Detail, showing recommended drug doses and equipment requirements for paediatric patients based on length.



***Proceed according to clinical judgement and skill/experience level**

Figure 17: Drug assisted intubation algorithm for paediatric patient as per ATLS guidelines

If cannot intubate, cannot ventilate situation arises – use rescue airway devices

- LMA
- Intubating LMA
- Needle cricothyrotomy

- Surgical cricothyrotomy can be considered in children > 12 years old

Breathing

- In tension pneumothorax – use 14 – 18 G needle and perform needle thoracostomy in second intercostal space at mid-clavicular line
- Perform tube thoracostomy for pneumothorax, heamothorax, heamopneumothorax in fifth intercostal space anterior to mid-axillary line
- Use chest tube size according to age and weight

Circulation

- Obtain two wide bore peripheral IV access
- If unable to obtain peripheral line in 90 seconds or if two attempts fail – obtain an intraosseous access
- Look for
  - Heart rate
  - Peripheral pulses
  - Capillary refill time
  - Skin color
  - Body temperature

    - Mental status
- Hypotension is present if systolic BP is less than ***70 +(2 *age in years) mm Hg***
- Give initial bolus 20 ml/kg body weight of pre-warmed IV isotonic crystalloids and assess response
- Repeat one or two bolus
- If ongoing bleeding present, give 10 ml/kg of PRBC
- Responders – do not requires blood products
- Transient responders or non-responders
    - Give crystalloids
    - Activate massive transfusion protocol if available
    - Obtain early surgical consultation for definitive management
- Urine output goal:
    - Infants – 1-2 ml/kg body weight
    - 1yr-adolescents – 1-1.5ml/kg body weight
    - Teenagers – 0.5ml/kg body weight

Disability

- Level of consciousness – use paediatric GCS
- Look for focal deficits and do a pupillary examination
- Pupillary examination

Exposure

- Prevent hypothermia

Involve general surgeons/paediatrics surgeon early.

Secondary survey

- Do a detailed head to toe examination
- Look for evidence of child abuse and report to higher authorities.

Specific Paediatrics trauma

Chest trauma

- Manage ABCDE
- Perform tube thoracostomy if indicated
- Involve Trauma Surgeon/Paediatric Surgeon at the earliest.

Abdominal trauma

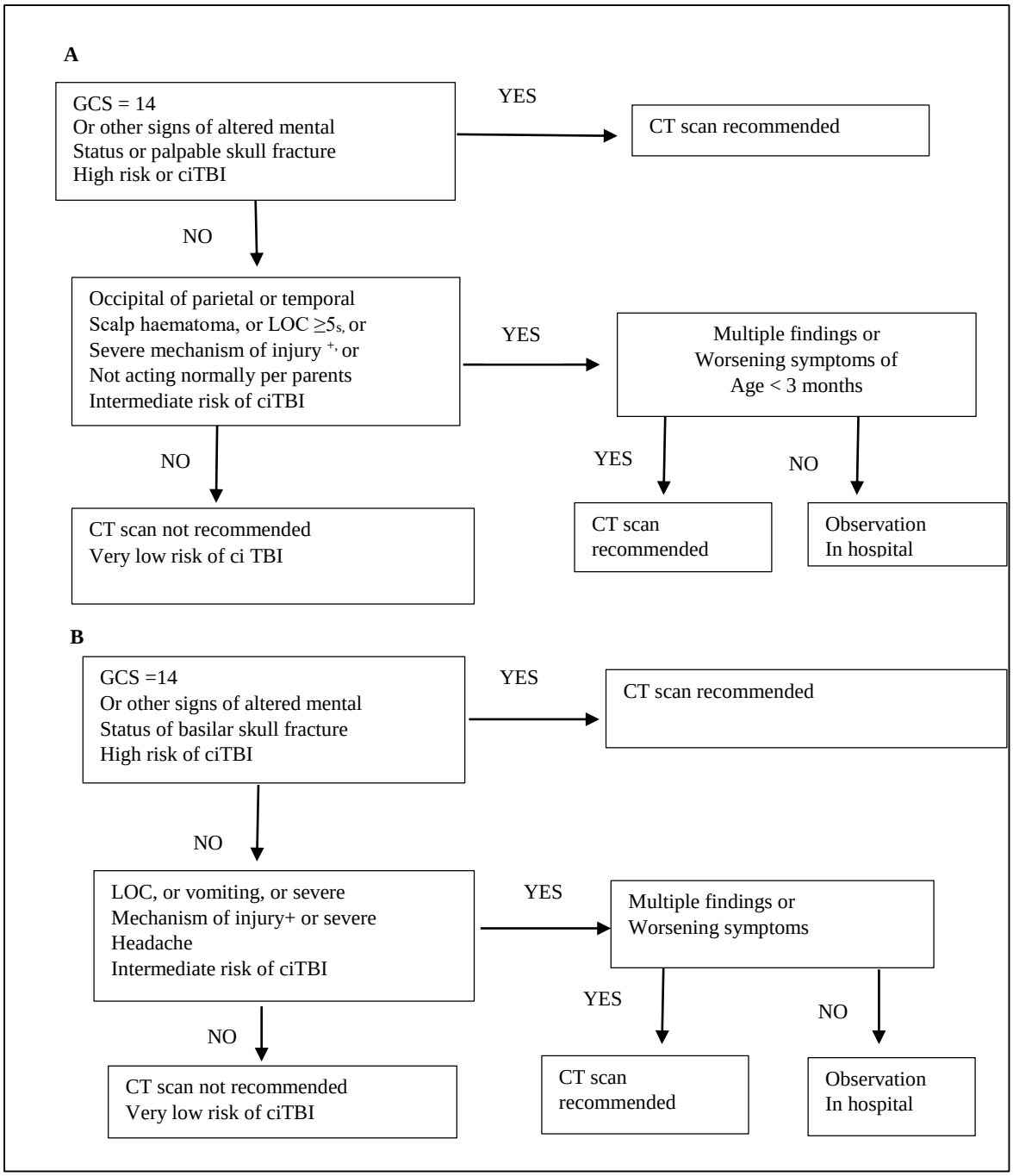
- Manage ABCDE
- Perform per abdomen examination
- If distended – perform gastric decompression by nasogastric or orogastric tube insertion
- Decompress urinary bladder by foley's catheter insertion
- Diagnostic adjuncts for abdominal trauma – CT, E-FAST
- Involve Trauma Surgeon/Paediatric Surgeon at the earliest.

VERBAL RESPONSE	V-SCORE
Appropriate words or social Smile, fixes and follows	5
Cries, but consolable	4
Persistently irritable	3
Restless, agitated	2
None	1

Table 6: Modified verbal score for children below 4 years

Head trauma

- Manage ABCDE
- Use GCS to assess TBI. Use modified verbal score for children below 4 years.
- If raised ICP features present – give hypertonic saline or mannitol
- Use Paediatric Emergency Care Applied Research Network (PECARN) rule to decide regarding need for CT head
- Involve neurosurgeon at the earliest



ci-TBI: risk of clinically important TBI needing acute intervention, based on PECARN validated prediction rules

Figure 18: PECARN rule for CT scan

Musculoskeletal trauma

- Look for greenstick fractures, torus/buckle fractures
- Management similar to adults
- Involve Trauma Surgeon/Orthopaedic at the earliest.

Chapter 12: Geriatric Trauma

Follow ABCDE management as per ATLS guidelines

Specific consideration in Geriatric trauma patient:

 # Consider comorbidities and ongoing medications

 # Looks for evidence of elderly abuse.

Bleeding and head injury:

- Reverse the anticoagulation profile in patient with intracranial bleed
- Admit patients in ICU with neurosurgical support

Rib fractures and respiratory failure:

- Pain control and adequate ventilatory support is the key in geriatric trauma patient
- Maintain a low threshold for admitting elderly patients with rib fractures for a period of observation until good pain control and pulmonary toilet are assured

Consider prompt tracheal intubation:

- Respiratory rates >40 breaths/min
- Partial pressure of arterial oxygen is <60 mm Hg
- Arterial carbon dioxide is >50 mm Hg

Shock

- Elderly patients age >65 years, Systolic BP < 110 mm of Hg considered it as shock
- Identify occult shock in a stable vital sign patient
- Keep a low threshold for imaging to find out life threatening causes in trauma
- Do early volume resuscitation with blood and blood products

Hypothermia

- Elderly patient more susceptible to hypothermia
- Keep the patient covered as much as possible to maintain body heat and provide external heat source near bed

Disposition

Admit the following geriatric trauma patients in ICU:

- Polytrauma
- Significant chest wall injuries
- Abnormal vital signs
- Evidence of overt or occult hypoperfusion

Chapter 13: Trauma in Pregnancy

 # Follow ABCDE as per ATLS guidelines

Specific consideration

Primary survey:

Mother:

- Airway –
  - Intubate if indicated
  - PaCO2 goal – 30 mm Hg (in late pregnancy)
- Breathing –
  - Give 100% oxygen by face mask
  - Goal oxygen saturation – 95%
- Circulation –
  - Obtain two wide bore peripheral IV access
  - Give 50% more IV fluids (crystalloids) as compared to non-pregnant females
  - Obtain type specific blood products as early as possible
  - If > 20 weeks of gestation – consider possibility of supine hypotension
  - Place a wedge under right hip – tilt the patient approximately 30 degrees to the left

Figure 19: Proper Immobilization of a Pregnant Patient.

Foetus:

- Perform maternal per-abdomen examination
    - Look for uterine tenderness
    - > 3 contractions / hour indicate uterine irritability
    - Loss of uterine contour or easily palpable fetal parts – suspect uterine rupture
- > 20 weeks – initiate continuous monitoring with tocodynamometry as soon as possible
- If risk factors for fetal loss
    - Present – monitor for 24 hours
    - Absent – 4-6 hours
- Risk factors for fetal loss –
    - Maternal HR > 110 per minute
    - Fetal HR > 160 or < 120 per minute
    - Injury severity score > 9
    - H/o ejection from vehicle
    - Motorcycle or pedestrian collisions
    - Evidence of placental abruption

Adjuncts to primary survey and resuscitation –

- Obtain Chest X ray and pelvic X ray – do not refrain
- Look for evidence of uterine rupture –
    - Extended fetal extremities
    - Abnormal fetal position
    - Free intraperitoneal air
    - Tender uterus,
    - Superficial fetal parts and
    - Vaginal bleeding
- Obtain immediate obstetric consultation if :
    - Abnormal fetal heart rate
    - Frequent uterine activity
    - Fetal decompensation
    - Repetitive decelerations
    - Absent acceleration / beat-to-beat variability
- If obstetric services unavailable, consider prompt transfer to trauma centre with obstetrical capability

Secondary survey –

- Similar to non-pregnant patient
- Look for per vaginal bleed
- Perform pelvic examination only after ultrasound localization of placenta
- If fluid in vagina is present and pH is more than 4.5 consider rupture of chorioamniotic membrane
- Investigations – CBC, Coagulation profile – look for fibrinogen levels

Definitive care –

- Administer tetanus immunoglobulin
- Administer 1 ampoule of RH immunoglobulin (300 microgram) intramuscular within 72 hours of injury in all Rh negative injured patients

Disposition –

- Minor trauma –
    - 4-6 hrs of observation and fetal monitoring
    - Prompt obstetrics follow up
- Multisystem trauma / potentially serious injuries
    - Admission
    - Maternal and fetal monitoring
    - Trauma surgeon and obstetrician involvement in care

Perimortem caesarean section –

- Consider in non-hypovolemic cardiac arrest
- If > 20 weeks gestation and ROSC not achieved within 4 min of CPR consider delivery of viable fetus

Chapter 14: Acute Pain Management Protocol

Patient Care Objective in Pain Management

i. Pain should be added as fifth vital sign
ii. Relief of pain as an integral part of trauma care
iii. Pain must be managed holistically by psychological, non-pharmacological and pharmacological method.
iv. Pain management is a team approach
v. Emergency healthcare providers must acquire and maintain the knowledge and skills to assess and manage pain effectively.
vi. Special care and attention must be given to high-risk populations (Paediatric, Geriatric and Pregnant) when assessing and managing pain.

Management of pain

1. Assessment of Pain:

Recommended pain assessment tool in adult trauma Emergency is Defense and Veterans score (adult and paediatric in verbal age group):

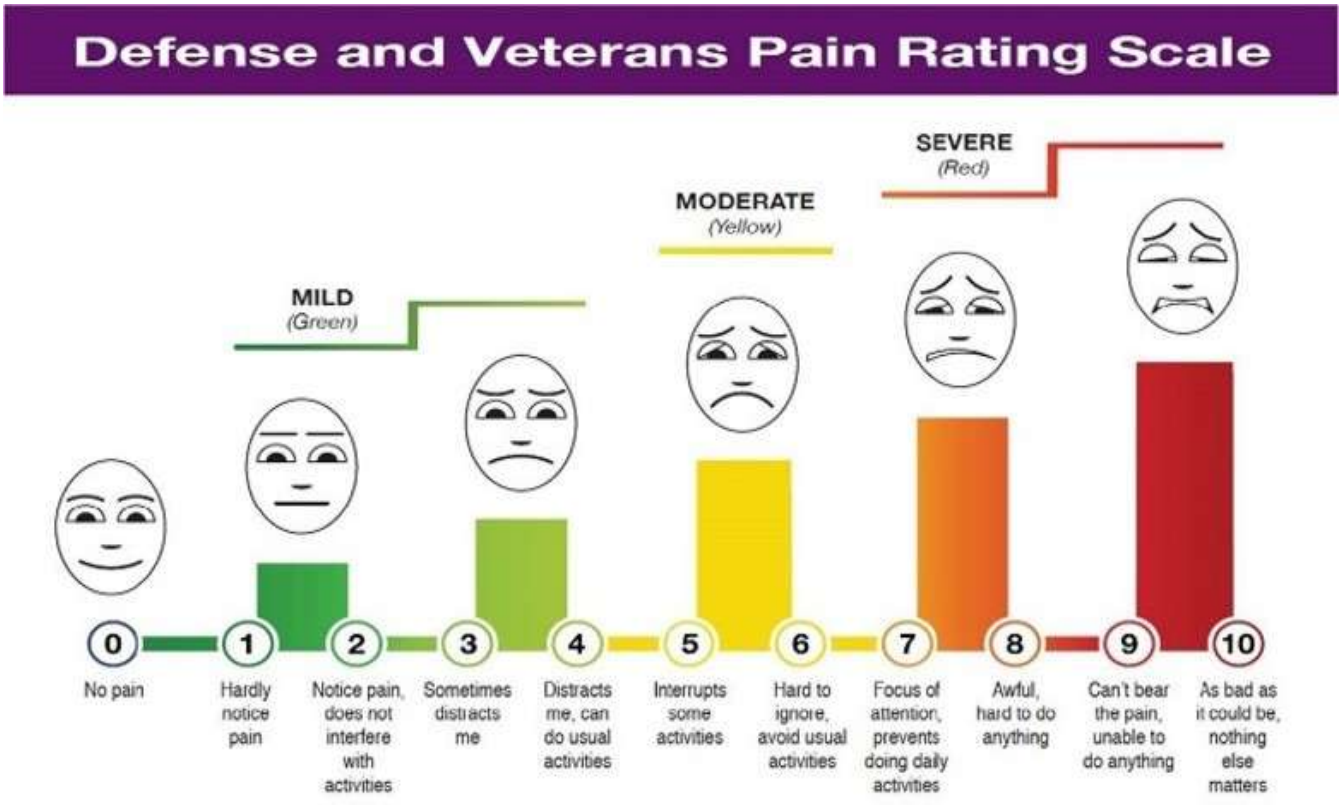


Figure 20: Défense and Veterans Pain Rating Scale

Pain assessment must be done by assessment of the expressions, rating by number, right questions and clinical examination.

Recommended pain assessment tool for Intubated unconscious patients in resuscitation area is behavioral pain scale:

Behavioural Pain Scale (BPS)		
	Description	Score
Facial expression	Relaxed	1
	Partially tightened	2
	Fully tightened	3
	Grimacing	4
Upper limbs	No movement	1
	Partially bent	2
	Fully bent with finger flexion	3
	Permanently retracted	4
Compliance with ventilation	Tolerating movement	1
	Coughing but tolerating ventilation for most of the time	2
	Fighting ventilator	3
	Unable to control ventilation	4
Pain grade: presence of pain ≥6/unacceptable pain >7/objective <6.		

Table 6: Behavioral Pain Scale

Use Wong-Baker facial scale in paediatric patients in non-verbal age group.

2. Therapeutic approach

i. Non pharmaceutical

Providing a wheelchair, trolley, ice pack, cervical collar immobilization, splints, dressing and bandaging with pharmaceutical methods should be done

ii. Reassurance and psychological support

- Patients should be reassured and counselled regarding pain relief.
- Listening and communicating should be done to understand each patient's experience of pain with a personal touch and interaction.

- Shared decision making should be done by Involving patient in his/her own treatment.
- He/she should be provided with choices, pro and cons of treatment

iii. Pharmacological

Basic principle of any pain management remains same as per WHO ladder of pain management.

Pain Ladder for Adult trauma patients (initial therapy)

	Pain score 0	Mild Pain 1-3	Moderate Pain 4-6	Severe Pain 7-10
Suggested route & type of analgesia	No analgesics Non-pharmacological methods	Oral analgesia NSAIDS (Unless contraindicated) Paracetamol (IV/IM) Diclofenac(IV/ IM)	IV NSAIDS Diclofenac (IV/IM) Ketorolac (IV/IM)	Fentanyl (IV) Morphine (IV)
Initial Assessment of pain	Within 20 mins of arrival			
Re-evaluation	Within 60mins of initial assessment	Within 60mins of analgesia	Within 60mins of analgesia	Within 30 mins of analgesia

Figure 21: Pain ladder for adult trauma cases

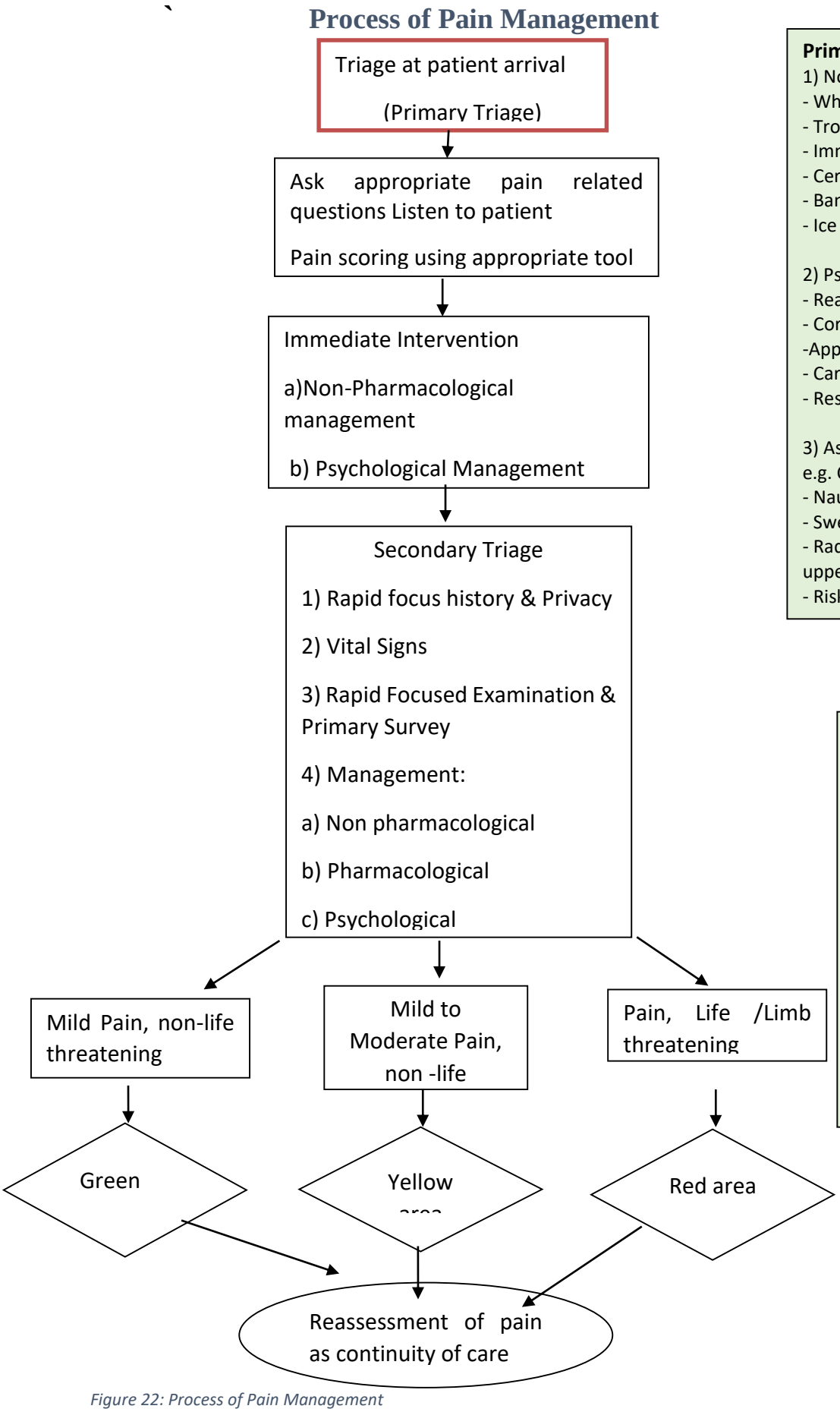


Figure 22: Process of Pain Management

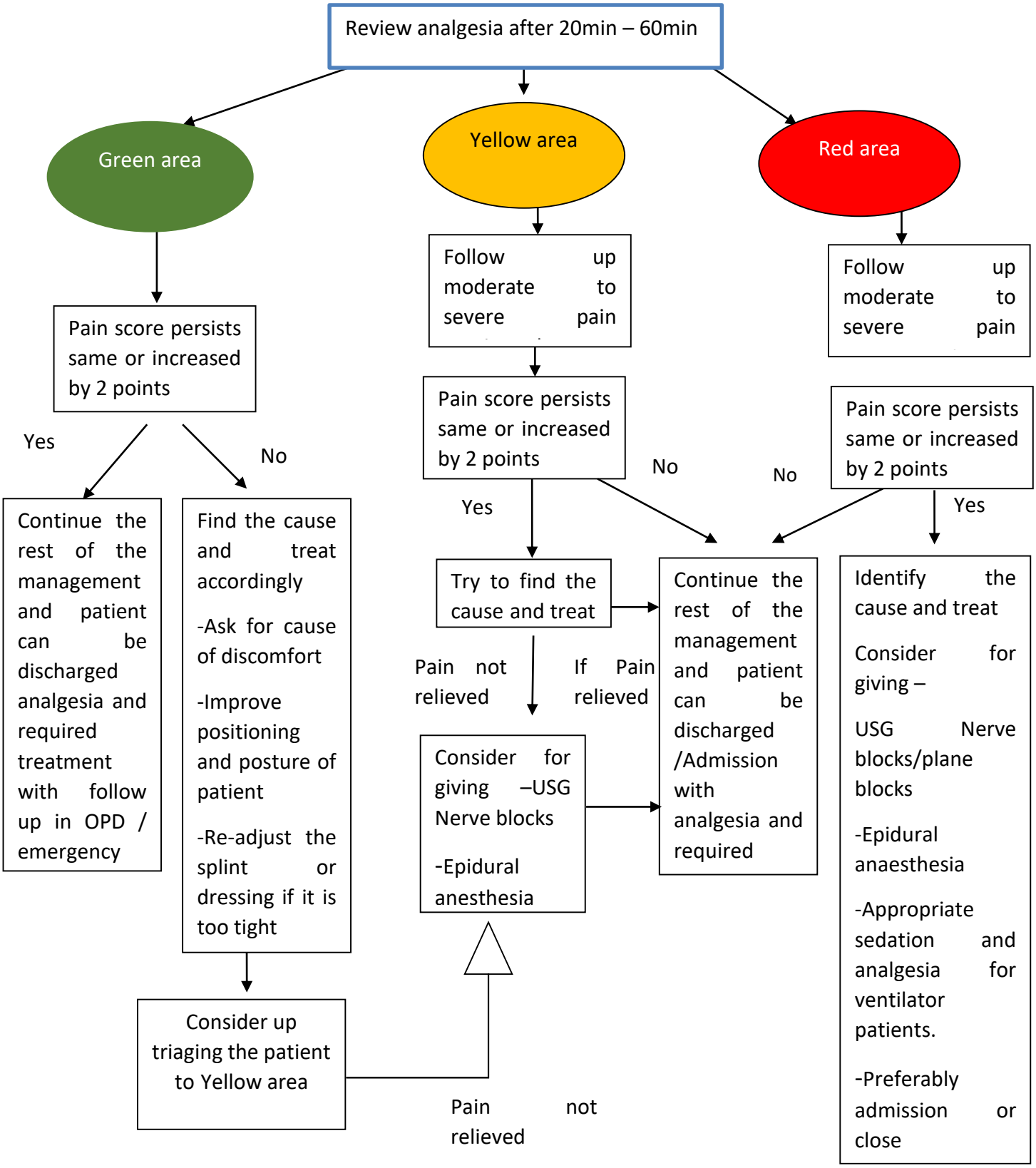


Figure 23: Analgesia review

Drugs and Dose

Sl No	Drug	Oral	Intravenous
1	Paracetamol	650 mg PO 4-6 hourly up to maximum dose of 4000 mg per day	15mg/kg IV every 4-6hours (<50kg)
2	Ketorolac	Age <65yrs and Wt >50Kg: 15-30mg 6hourly (maximum 120mg/day for up to 5 days). Age <65yrs and <50Kg :15mg every six hours (maximum 60mg/day for up to 5 days).	
3	Ibuprofen	400mg PO 4 hourly (maximum: 2.4gm/day)	400-800mg 6 hourly (maximum 3.2gm/day)
4	Fentanyl		Loading dose: 1to 2mcg/Kg intravenous. Maintenance dose: 1 - 3mcg/kg/hour infusion. Monitoring: Blood pressure and respiratory rate, if BP <100mmHg, stop infusion and give IV fluids Respiratory rate < 10 or SPo2 < 94%, stop infusion and give IV Naloxone 2mg stat
5	Morphine		Loading dose 2mg Intravenous Maintenance dose : 2-4mg every 1-2 hours intermittent or 2-30mg/hour infusion Monitoring: Blood pressure and respiratory rate, if BP <100mmHg, stop infusion and give IV fluids Respiratory rate < 10 or SPo2 < 94% , stop infusion and give IV Naloxone 2mg stat

Table 7: Drug and dose of pain medications

Ultrasound guided Blocks for acute pain and procedures in Emergency department

Note#: All nerve blocks/neuraxial blocks should be performed by an Anaesthesiologist

Upper limb: Brachial plexus block

Lower limb: Sciatic Nerve block, Tibial Nerve block, Posterior tibial nerve block.

Indications:

Rib fractures (For 2 or more than 2 ribs): Thoracic epidural analgesia, Serratus Anterior plane block, Erector spine plane block

Fascia illiaca Compartment Block: Hip fracture with pain score ≥7

Femoral Nerve block: Fracture shaft of Femur with pain score ≥7

Chapter 15: Patient Transfer

Assess own and hospital capabilities and limitations, and consider transfer to higher centre accordingly

Make early differentiation between patients who may be safely cared for in the local hospital and those who require transfer for definitive care.

Resuscitated and attempt to stabilize their conditions as much as possible before transfer as mentioned below:

1. Airway

a. Insert an airway or endotracheal tube, if required. Keep a low threshold to intubate patients with altered GCS, even more than 8

b. Provide suction.

c. Inssert gastric tube in all patients with evidence of gastric distention.

2. Breathing

a. Administer supplementary oxygen.

b. Provide mechanical ventilation when required.

c. Insert a chest tube if needed.

3. Circulation

a) Control external bleeding , note time of placement if tourniquet is used.

b) Establish two large-bore intravenous lines and begin crystalloid solution infusion.

c) Restore blood volume losses using crystalloid fluid and blood to achieve balanced resuscitation and continue replacement during transfer.

d) Insert foleys catheter to monitor urinary output.

e) Monitor the vital parameters.

f) Transport patients in advanced pregnancy, with left side tilt

g) Ensure the receiving hospital is capable of treating both the mother and baby.

4. Central nervous system

1. Administer mannitol or hypertonic saline, if needed. Discuss with the receiving doctor.

2. Restrict spinal motion in patients who have or are suspected of having spine injuries.

5. Perform appropriate diagnostic studies (Avoid sophisticated diagnostic studies, such as CT and aortography; if indicated, do not delay transfer in obtaining these studies).

1. Obtain x-rays of chest, pelvis, and extremities.
2. Obtain necessary blood investigations.
3. Determine cardiac rhythm and hemoglobin saturation (electrocardiograph [ECG] and pulse oximetry).

6. Wounds (Note: Do not delay transfer to carry out these procedures.)
    1. Clean and dress wounds after controlling external hemorrhage.
    2. Administer tetanus prophylaxis.
    3. Administer antibiotics, when indicated.
7. Fractures

    a. Apply appropriate splint and traction.

Speak directly to the receiving hospital's doctor.

Trained personnel should transfer the patient, based on the patient's condition and potential problems.

Clear documentation of all details is essential

All test results must accompany the patient.

Digital media may be transmitted to the referring facility to expedite the transfer of information and make imaging available for review before patient arrival

Management during transport

Trained EMT/OTT to accompany the patient for transport. Doctor to accompany if required. During transport:

- Monitor vital signs and pulse oximetry
- Continue support of cardiorespiratory system

Give proper handover to receiving doctor

Table 9: ATLS 11th Edition Update

X	• **New Priority**: Rapid hemorrhage control takes precedence over airway in patients with massive bleeding, redefining the classic ABCDE to **xABCDE**. • **Tourniquets and Hemostatic Agents**: Emphasis on early use of tourniquets and hemostatic dressings in hospital setting. • Emphasis on the application of tourniquet for extremity wounds with rapid bleeding from large vessels or with multiple sites of bleeding (e.g., "mangled" extremities).
A	• **Context-Based Approach**: Encourages **individualized airway decisions—not all trauma patients benefit from immediate intubation**. Drug-assisted intubation in patients with circulatory compromise must consider hemodynamics first. • **Modified RSI** is the preferred intubation technique, with: o **Preoxygenation** and **apneic oxygenation** via nasal cannula o Avoidance of over-sedation and hypotension through careful **drug selection and dose adjustment (Drug-facilitated intubation).** o **Etomidate and ketamine** preferred for their cardiovascular stability o Use of **vasopressors** preemptively if patient is hypotensive • **If oxygenation and ventilation are adequate**, the manual advises **delaying definitive intubation** until conditions are optimal (e.g., personnel, equipment, hemodynamic stabilization). • **Video Laryngoscopy**: Promoted as a preferred technique in complex airways when available.
B	• **Thoracostomy Decisions**: Removed strict volume criteria. Surgical decisions now prioritize **clinical and physiologic assessment**. • **Smaller-Gauge Needles for Needle Thoracotomy**: Highlighted for needle decompression in thinner patients or children. Emphasis on depth and catheter length especially in obese patients. • **Point-of-Care Ultrasound (POCUS)**: Recommended for rapid diagnosis of pneumothorax and hemothorax
C	• **x is Major**: Reinforces that massive hemorrhage can precede all other steps. • **Minimized Crystalloids**: Advocates limiting crystalloids to avoid dilutional coagulopathy and acidosis. • **Balanced Transfusion**: Encouragement of early use of **1:1:1 ratio** blood product transfusion (RBCs, plasma, platelets) for hemorrhagic shock over crystalloid use.
D	• **ASIA Impairment Scale**: Now the standard for spinal cord injury classification, allowing detailed documentation and prognostication. • **Early Recognition of Spinal Cord Injury Syndromes**: Detailed syndromes (Brown-Séquard Syndrome, central cord, anterior cord syndrome) described for earlier diagnosis.
E	• Hypothermia and hyperthermia updated to include better assessment.

Table 9: ATLS 11th Edition Update