EDITORIAL

It gives us immense pleasure to present to you the first edition of Emergency health management and Mass casually management handbook –a publication of The Academy of Trauma, Guwahati, and Assam.

Emergency Medicine is a dynamic science. Advances in management and therapies occur rapidly. The need of emergency medical services is much greater in Assam as this region is prone to both manmade and natural disasters. Vulnerability to natural disasters combined with socioeconomic vulnerability of the people living in the state pose a great challenge to health care services and underscores the need for a comprehensive training programme in emergency health and trauma management.

Emergency health management and Mass casualty management course is designed for health care providers who either direct or participate in the management of medical emergencies, trauma and disaster. Reflecting the continued growth of the program since its inception in 2007, the success of the program is built on the efforts of individuals who have volunteered their time and talents to present the important concepts and principles of Emergency health care.

This handbook does not present new concepts in the field of emergency medicine. Established treatment methods and a systematic concise approach to the early care of the seriously ill and injured patient is the hallmark of this program.

The course presents the health care provider with knowledge and techniques that are comprehensive and easily adapted to fit their needs. The skills presented in this manual recommend one safe way to perform each technique. The Academy recognizes that there are other acceptable approaches. However, the knowledge and skills taught in the course are easily adapted to all venues for the care of these patients. It is a concrete manifestation of our goal to provide the right care, right now.

The chapters of this book follow a uniform format and are divided on the basis of special topics (airway management, shock, burns etc). It is a multi author book written by well known practitioners in the field of emergency medicine and trauma in Assam. We have worked together as a team for more than a year and reviewed each chapter to ensure the authenticity of the information. We have taken assistance from ATLS and ACLS course manual in authoring few chapters of the handbook.

This is an important educational venture of the Academy of Trauma, Assam and we hope the book will be read by all for whom it is intended. We look forward to your recommendations for further improvement.

Dr. Chandana Sarma

Academy of Trauma

Dr Utpal Kumar Tamuli
Honorary Secretary, Academy of Trauma

Academy of trauma, Assam is an organisation of doctors of different specialties primarily treating trauma or accident cases, media persons, lawyers, teachers and some social activists. All of them have joined their hands together to work to uplift of health more specifically trauma care in natural and manmade disasters. All the doctors have formal training in trauma management in India and abroad. The team of doctors includes orthopedic surgeon, General Surgeon, Anesthetist, Emergency Physicians, Critical care, Pediatric surgeon, Gynecologist, Psychiatrist, Radiologist.

Our Mission is to improve the pre hospital care**,** to organise trauma management courses for doctors and paramedical, rehabilitate trauma victims**,** create public awareness for prevention of trauma**,** research and education in trauma care

The trauma care system is a way of planning ahead so that when someone is injured, they will be cared for by people who have been specially trained to recognize and treat trauma victims. This is an organized, coordinated effort in a defined geographic area that delivers the full range of care to all injured patients and is integrated with the local public health system. There are few basic components of trauma care system. They are pre hospital care, acute care of the injuries, injury prevention, and post hospital care or rehabilitation.

In the management of trauma, first hour is called the “Golden hour” and first ten minutes is called “the platinum ten minutes”. We aim to share the trauma management protocols with the paramedical, nurses, and other health professional and this will dramatically improve the pre hospital emergency medical service like assessment of patient, CPR, manage hemorrhage, protect C spine etc; This will also improve pre hospital triage, transfer criteria, transfer arrangements and inter hospital communications. Along with it basic life support measures, and preparedness for disaster related injuries are to be propagated amongst the students, fire people, police, teachers, industrial workers, members of other NGO, voluntary organizations and general populations as they are the first responders in most cases.

So far we have conducted more than twenty programmes in different schools, colleges, educational institutes. We have been associated with Kamrup (Metro) district initiatives to create awareness and training programme for student’s community. Along with IGNOU, we had organized training programme for students of different colleges of Guwahati at Cotton College. We offered our services to police training, TERI, AASC authority, NF railways, Delhi Public School, IGFAI, National Institute of Disaster Management (NIDM), Handique Girls College, NEGSA and EDNERU, DC Darrang, SDO Abhayapuri, DC Golaghat to create awareness about trauma victims and to provide basic life support as a non medical personal.

Management of trauma victims in hospitals are changing fast. Mentioned as “needs of the injured patients” we want to propagate the guidelines based on evidenced based protocol of ATLS among doctors and paramedical. Our project aims to achieve realistic goal to make the “essential trauma care service to all” in our region by reinforcing inputs of human resource by training and staffing. We proposed to take initiatives to bridge the gap of existing practice and worldwide accepted evidenced based trauma care system. We wish to share the recent updates of evidenced based trauma care protocols with our doctor friends in every district of North eastern states of the country by organizing trauma management courses.

So far we have conducted training programme for doctors and paramedical at Mangaldai, Abhayapuri, Dhubri. We tried to create awareness programmes in some of the private hospitals like down town hospital, GNRC, Rahman Hospitals etc. Later we also conducted similar programme in our neighbouring states namely at Itanagar (Arunachal Pradesh), Kohima (Nagaland), Agartala (Tripura). We were given the responsibility to train doctors and paramedical by Assam State Disaster Management Authority at Guwahati Assam Administrative Staff College on several occasions. Bongaigaon DDMA invited us to train 35 doctors. We have presented our experience at National forum like Indian Orthopaedic Association’s National Conference at Bangalore, and at India Disaster management Congress at New Delhi organised by NIDM. In the international level, we have presented our experience at 25th Bangladesh Orthopaedic Surgeon’s Conference at Dhaka and SAARC conference at Maldives.

In trauma prevention programmes one of the basic goals of our project is to identify and promote ways of reinforcing trauma prevention as a whole. A spectrum of activities are considered ranging from surveillance and basic research to prevent trauma from occurring as large gains are made from it. Along with it basic awareness on preparedness for disaster related injuries are to be propagated amongst the students, fire people, police, teachers, and general populations as they are the first responders in most cases.

To accomplice our goal of awareness generation several articles are published in local and national dailies and periodicals. We presented disaster management programmes in TV and other broadcast agencies, organizing seminars, school and college student's symposiums etc. It is worth mentioning that a complete chapter is being written in Assamese language on disaster medicine in the "Swasthya Biswakosh" published by prestigious Asom Sahitya Sabha.

As a research project, we are in the process of producing some splints using locally available biodegradable products. These will be very helpful in transporting the patients from the peripheral hospitals or medical centres to well organised trauma centres. These will be of very low cost, biodegradable, adequate strength to support, and will also generate financial assistance to local artisans.

During our journey of six years while interacting with various people we have learnt that people accept a bottom up approach than top to bottom approach. One needs to spend more time with the people and work in the grass root level than to be more vocal. There is ample scope for government agencies, NGOs and civil societies to work with the community people for sustainable development. The need varies from locality to locality depending upon the disasters they face. The school children particularly of teen age groups accept newer concepts with great enthusiasm. Girl students also take active part in such programmes.

If we try to evaluate our activities, we feel proud that we got telephone calls from distant places of Assam in many occasions from some of trainees. They call us to seek advice to handle individual accident victims and in few occasions to take care of several victims in bus or car accidents. Moreover, appreciating our endeavour, the Assam State Disaster Management Authority has given us an opportunity to train doctors and paramedics of seventeen districts of Assam. We feel confident that we shall be able to do justice to the task given to us.

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(Registration No: KAM/240/A-8/599 of 2007)

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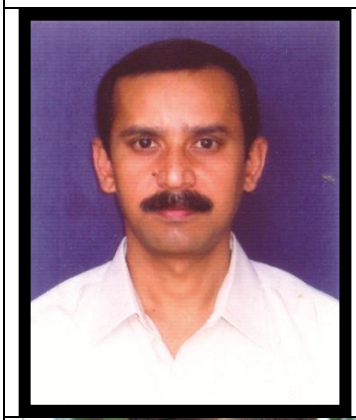	**Executive Member** **Dr DhrubaJyoti Kalita** Consultant Anaesthesiologist, Dispur Hospital MBBS (1988) DA (Manipal University), 1994 Special interest in Emergency management and critical care**.**
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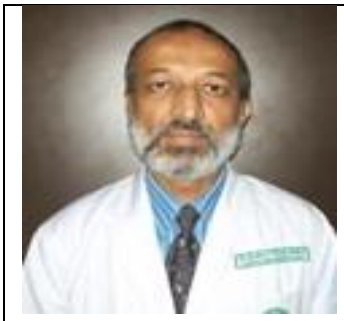
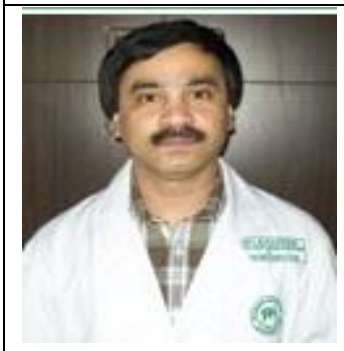
	**Dr Momd. Iftekhar Ahmed** Consultant Radiologist, HAM Memorial Hospital and Research Centre, Hojai MBBS (1981), DMRD (1986) Ex Senior Radiologist, Ministry of Saudi Arabia Ex Senior Radiologist, Ministry of Iran
	**Dr M.L.A Rahman** Managing Director, Rahman Hospitals, Guwahati Consultant Neurosurgeon. MBBS (1985), Mch (Neuro Surgery, NIMHANS) Trained in Endoscopic Neuro surgery, Germany. Special interest in Management of Spinal diseases and Head Injury.
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Trauma Management in Disasters- An Overview

Dr Utpal Kumar Tamuli MS (Ortho), PGDDM

Introduction: Oxford dictionary defines disaster as a sudden accident or natural event that causes great damage or loss of life. It may also be said that disasters are destructive event that results in the need for a wide range of emergency resources to assist and ensure the survival of stricken population.

Broadly speaking disasters are classified as natural and manmade or anthropometric disasters.

Natural disasters are classified as:

(a) Wind and/or water related disasters: Flood, Drought, Cyclone, Tsunami
(b) Climate related disasters: Heat and cold waves, global warming, Sea level rise.
(c) Mountain area disasters : Landslide, Snow avalanches
(d) Geological disasters: Earthquakes, Volcanic eruptions**.**

Manmade disasters are classified as:

(a) Accidents- rail, road, air, sea, transport of hazardous material etc.
(b) Fire- Building, coal mines, oil, forest etc.
(c) Industrial and technological mishaps- leak, fire, explosion, sabotage, plant safety failures.
(d) Nuclear Hazards- Radioactive leak, theft, transportation, waste disposal.
(e) Warfare- conventional, nuclear, chemical, biological.
(f) Poisoning- Food, water supply.
(g) Civil conflicts- Arson, sabotage, terrorist activity
(h) Ecological-Air and water pollution, disposals of waste and toxic substances, diseases and epidemics, deforestation, sea level rise, changes in ozone layers, global warming

Depending upon the nature, type, severity, location, population, vulnerability there effect of disasters will vary. But from health and medical management prospective we are more concerned about death and disabilities of trauma victims that results from different disasters.

Trauma victims, pattern of deaths, and golden hour:

Trauma patients are injured patients caused by accidents or disasters who need urgent diagnosis and prompt treatment of the acute and potential problems by a team of health care professionals in the evidenced based protocol to avoid death and disabilities. In any kind of disasters victims can die in trimordial pattern.

(a) First group die within seconds to minutes. Examples are vessel rupture, run over injuries, pericardial temponade, compound Brain injuries etc.
(b) Second group die within minutes to hours. Examples are open fractures, subdural hematoma, Splenic ruptures etc.
(c) Third group of patients die in days to weeks. They may die because of ARDS, Sepsis, multiple organ failure etc.

It is interesting to note that the first and third group of patients constitutes only 8-10 percent of victims. Major trauma victims die within hours of the injuries. Here comes the importance of effective emergency management. It is accepted worldwide that if adequate and effective care can be provided in the first hour of accidents more that 50% of death and disabilities can be prevented. Thus first hour of trauma management is called the Golden Hour of trauma management. Thus to provide the best possible management effective care must be given at the site, during transportation and at the hospitals. We must, therefore, create awareness amongst the general public, students, teachers, volunteers, police personals regarding the basic first aid procedures. At the same time the paramedics and doctors must know the evidenced based protocols to manage the trauma victims during transportation and accident and emergency wards.

Guidelines for pre hospital Management:

Coordinating with the pre hospital agency can greatly expedite the treatment of the patient in the field. The important steps that pre hospital providers can take to minimise morbidity and mortality in the major trauma patient are to secure an airway, protect cervical spine, and stop bleeding and to transfer the patient to a trauma centre.

1. On warning of treat dispatch first aid and triage team to site
2. Command post establishment
3. To take safety precautions for SSS- self, scene, survivors
4. Quick assessment of the scenario, survivors, type of casualties
5. Communication to parent hospital set up/ others, Police
6. Field triage
7. Field treatment– Follow ABC priorities.
8. Transportation of patients

Guidelines for hospital Management:

A proper hospital management plan is to be formulated to treat individual and mass casualty situations. These plans are flexible to accommodate hospital's man power, infrastructure, knowledge, availability of support systems, and training. Periodic mock drills are of vital importance.

Disaster Paradigm for hospitals:

D= Detection of internal and external hazards
I = Incident Command system activation
S= Safety of treating personals
A= Asses Hazards, Activate actions
S= Support from back up staffs, police, NGOs, other hospitals
T= Triage and treatment according to priority
E= Evacuation of victims if required
R= Relocation and recovery, and rehabilitation.

As soon as a call of mass casualty is received by the hospital immediately action card for hospital is to be activated. It means:

(a) Alert sound
(b) Communication- external and internal.
(c) Activation of the control room (Nerve centre)
(d) Activation of treatment areas
    (i) Primary-Reception, triage area, Resuscitation area
    (ii) Secondary- OT, ICU, Wards.
(e) Support Staff- Pharmacy, housekeeping, blood bank, CSSD, radiology, Laboratory, record room etc.
(f) Documentation- Patient zone, administrative zone

Triage at Hospital and management:

In cases of mass casualty management, it is of utmost importance to sort out the serious victims at the earliest. Triaging is to prioritise the patients according to their seriousness. This must be done at the accident and emergency department by an expert group of people and accordingly they must be sent to different priority areas

(A) Triage (quick sorting) of causalities into

1. Priority one: Needing immediate resuscitation
2. Priority two: Immediate surgery
3. Priority Three: Needing first-aid, possible surgery
4. Priority Four: Needing only first-aid

(B) Action:

1. Priority one will be attended to in Casualty, if needed shift to ICU
2. Priority two will be transferred immediately to casualty OT and MOT
3. Priority three will be given first-aid and admitted if bed is available.
4. Priority four will be given first-aid and discharged.

At the accident and emergency department a poly trauma patient must be treated as per the established protocol. This includes primary survey, resuscitation, secondary survey, re-evaluation, definitive care, and transfer.

Primary survey to assess vital functions and resuscitation- ABCDE Mnemonic

A- Airway establishment and cervical spine protection
B- Breathing and ventilation to restoration of mechanism of breathing
C- Circulation with control of haemorrhage
D- Disability of neurological status, musculoskeletal Disability
E- Exposure of the patient, environment, maintenance of body temperature

Secondary survey begins when primary survey (ABC) is completed, resuscitation is initiated and patients ABCs are reassessed. Head to toe examination, vital sign assessment and radiological and laboratory investigations are part of this survey.
Depending upon the physiological status, anatomic injury, concurrent diseases and prognosis the emergency team and surgeon decides if the patient requires transfer to a trauma centre or closest appropriate hospital capable of providing more specialised care.

Government Policies:

Dr Stephen Deane, ex-president of International Association for the Surgery of Trauma and Surgical Intensive Care (IATSIC) writes “Many lives can be saved through inexpensive modification in education, organization and simple piece of equipments. Such changes greatly simplify decisions and actions.”

Government of India appreciates the importance of effective emergency management system and mass casualty management. Therefore, more importance is given on mitigation measures**,** public-private-people partnership**,** emerging concept of community based disaster management**,** and plan for sustainable development.

Conclusions:

Trauma is never going to end. It was there yesterday, remains today, and going to be tomorrow. As medical professions, we must take active part to combat this graded disorder so that the loss at individual level, family level and in a broader sense national level is minimized significantly.

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Pre hospital care

Dr. Atanu Barthakur, MS

Specialist in Trauma and Critical Care

In spite of the expansion in the field of medical science, the concept of pre-hospital management has still not reached the minds of the people. It is well known that the first hour after any medical emergency is the golden hour for the victim. Still, most patients are compelled to face their doom, as medical facilities at the site or in the ambulance remain a far cry for them.

The concept of delivering care at the scene of emergency was first developed by Baron von Larrey, a young French army surgeon who in 1772 devised a light vehicle to transport military surgeons and their equipment up to the front line battle during Nepoleonie wars.

Pre-hospital care is not only beneficial to victims of road traffic accident, patients suffering from burns, fire arm injuries, blast injuries, victims of disaster, but also beneficial to the medical illnesses like cerebro-vascular accident, cardiac arrest, myocardial infarction, acute severe asthma, acute abdomen, expecting mothers and pediatric emergencies..

Services involved in the pre-hospital care are:

- Police services
- Fire services
- Medical services
- Voluntary services

Systematic approach in pre hospital care

- Command & Control
- Safety
- Communications
- Assessment
- Triage, Treatment, Transport

Objective of combined response

- Save Life
- Prevent escalation of incident
- Relive suffering
- Protect the environment

Field management emphasized

- Airway maintenance with C-Spine protection.
- Breathing and Ventilation.
- Control of external bleeding and shock
- Immobilization of the limbs.
- Communication.
- Immediate transport to the closest appropriate facility

Field Management

Transportation guideline:

- Safe & rapid transport from the field to the appropriate receiving centre.
- Minimizing on-scene time.
- I-V access en route to the trauma centre
- Communication to the trauma centre

Management at the Site

- Follow a set of routine assessment and establish your priorities
- Getting appropriate help and give useful information-

(I) Details of what happened.

(ii) Number of people injured

(iii) Type of illness or injuries

(iv) Whether or not person is breathing

(v) The exact address with landmarks if possible.

(vi) A contact phone number

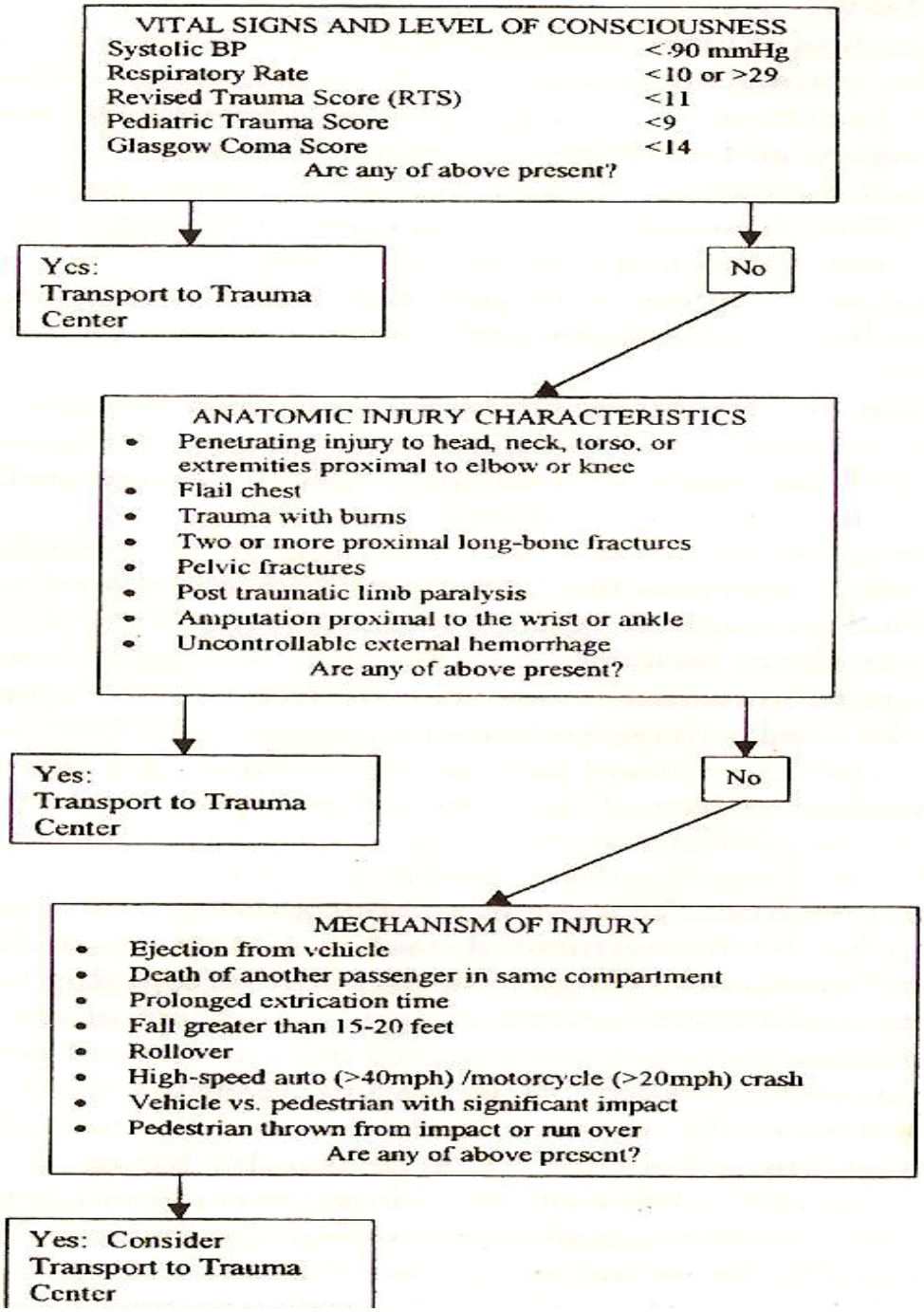
Making the scene safe

- Without endangering yourself
- Do not rush to the scene
- Walks slowly and steadily
- Looking around you for potential dangers & remove if it is safe to do so.
- And overview what has happened

Potential dangers

- At the scene of an accident- other cars, broken glass or metal or an unsafe crash vehicle.
- Chemicals, fire or electricity
- Aggressive behaviour in those who may be ill, hysterical, or as a result of drugs or alcohol.
- Sharp objects on the floor such as a knife or syringe.

TRAUMA TRIAGE IN THE FIELD



There are two basic providers of pre hospital care

First responders – they are typically law enforcement personnel or fire fighters, derived from different localities, who can make themselves available at site of accident. They are trained only in basic first aid, cardiopulmonary resuscitation (CPR) management of any obvious source of hemorrhage and protection of cervical spine.

Second responders – the crew of the ambulance and the paramedics fall in this category. They should be trained in –

- Assessment of the patient's general condition by the vital signs, the signs of morbidity and death.
- Maintenance of airway (Basic and Advance).
- Cardiopulmonary resuscitation (CPR)
- Assisted ventilation.
- Starting intravenous line and medications.
- Management of any obvious source of hemorrhage.
- Immobilization of the limbs in case of fractures and spinal injuries.
- ECG, cardiac monitoring and critical care management.
- Safe transportation of the patient from the site of accident to the nearest hospital.

A modern ambulance should be well equipped with the following:

- Folding emergency stretcher.
- Fracture splints, Spine immobilizer.
- Hand held suction.
- Portable oxygen therapy set.
- Resuscitation equipment.
- Life saving drugs and surgical equipments.
- Equipment for minor surgical procedures.
- ECG machine, Portable vital sign monitor.
- Well-trained crew and paramedics with mobile phone, well supported and guided by the qualified doctors in the accident and emergency department.

Triage and transportation of trauma patients

Anita Paul

Infection Control Nurse and Nursing Educator

Disaster

WHO defines disaster as a serious disruption of the functioning of society, causing wide spread human material of environmental losses which exceed the ability of the affected society to cope using its own resources.

Triage

Triage is the process of determining the priority of patient treatments based on the severity of their condition. It is derived from French word," Trier" which means "to choose or to sort".

Types of triage

1. Simple Triage – START MODEL (Simple triage and rapid treatment)
2. Advanced Triage
3. Continuous integrated triage
4. Practical applied triage
5. Reverse triage
6. Labeling of patients
7. under triage and over triage

Smart triage tags

1. Immediate (Red) Critical: Life threatening likely to survive if care is received within thirty minutes.

2. Delayed (yellow) Serious: may be life threatening, likely to survive if care is received in thirty to several hours.

3. Minor (green): Not considered life threatening; care may be delayed hours or days; this group may be referred to as the walking wounded.

4. Deceased; mortally wounded or clinically dead are not transported from the scene. They are marked with a black tag by scene personnel.

Who should triage the patients?

1. At site-Medical Incident Commander.
2. Any other person trained in disaster management.
3. Inside Hospital-emergency physician/surgeon/or trained nurses.

Transfer of trauma patients

When a patient's needs exceed available resources then the patients should be transferred for definitive care. However, there are some basic principles of transporting patients

- Move patients as little as possible after shelter is obtained.
- Initiate appropriate medical interventions as soon as feasible, based on available resources and the injuries.
- Arrange for a stretcher or litter for severely injured or unconscious patients while providing extra padding to pressure points.
- In general, place patients in a supine position.
- Place patients with thoracic injuries in a lateral decubitus position with the injured side down or in a semi –elevated position (head and chest elevated at 45 degrees).
- Splint fractures with available materials or splint them to another extremity.
- Keep patients as dry as possible and prevent hypothermia.

Transferring protocol

Where protocols for patient transfer do not exist, the following guidelines are suggested:

(1) Information from referring doctors

Patient's identification.

Brief history of incident, including pertinent prehospital data.

Initial findings in the ED.

Patient's response to therapy administered.

(2) Information to transferring personal

Airway maintenance.

Fluid volume replacement.

(3) Documentation

A written record of the problem, treatment given and patient status at the time of transfer as well certain physical items must accompany patient.

(4) Treatment prior to transfer

Patients should be resuscitated and attempts to stabilize their conditions as completely as possible based on following suggested outline:

- airway
- Breathing Circulation
- CNS: assist respiration in unconscious patients
- Immobilize head, neck, thoracic and lumbar spine injuries.

(5) Diagnostic studies

- Obtain X-rays of cervical spine, chest, pelvis and extremities.
- Hb, hematocrit, type and cross match,
- ECG and pulse oximetry

(6) Wounds

- Clean and dress wounds after controlling external hemorrhage.
- Administer Tetanus Prophylaxis.

(7) Fractures

- Apply appropriate splinting and traction.

Treatment during transportation

Monitor vital signs and pulse oximetry.

Continued support of cardio respiratory system.

Continued blood volume replacement.

Use of appropriate medications as ordered by doctor.

Maintenance of accurate records during transfer.

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Initial assessment and management of injured patients at emergency department

Dr. Atanu Barthakur, MS

Specialist in Trauma and Critical Care

All trauma patients are assessed by a Primary survey, resuscitation, secondary survey and definitive care.

The goals of these phases are as follows:

- Primary Survey: identify injuries that may be life threatening immediately or within minutes
- Resuscitation: Stabilise and / or treat this life threatening injuries
- Secondary Survey: identify injuries that are less rapidly fatal, but still potentially lethal, as well as other injuries
- Definitive Care: treatment (surgical or otherwise) of identified injuries.

I. PRIMARY SURVEY AND RESUSCITATION

The primary survey should be done in the following rapid organized sequence:

A- Airway maintenance with C-spine control

B- Breathing with ventilation and oxygenation

C- Circulation with hemorrhage control

D-Disability (GCS and pupil exam)

E- Exposure / Environmental control

A. Airway maintenance with C-spine control

Assessment

a. Assess for patency of the airway.

b. Maintain C-spine in neutral position with manual in-line stabilization or use blanket rolls or other devices for immobilization.

c. Look for obvious injury and / or obstruction.

Intervention

a. Perform chin lift or jaw thrust maneuver.

b. Clear airway with a suction device.

c. Insert oropharyngeal or nasopharyngeal airway as indicated.

d. Perform endotracheal intubation asw indicated. Consider use of Laryngeal mask Airway (LMA) or Laryngeal Tube Airway (LTA) if endotracheal intubation cannot be achieved.

e. Maintain manual in-line C-spine stabilization throughout the intubation procedure

f. Anticipate cricothyroidotomy as indicated.

B. Breathing with ventilation:

Assess for the presence and adequacy of breathing

a. Expose the chest.

b. Assess the rate and depth of breathing.

c. Auscultate breath sounds.

d. Auscultate heart tones.

e. Inspect for bilateral chest wall movement.

f. Palpate for bilateral chest wall movement and/or injury.

Intervention

a. Oxygen administration

Administer high flow 0_2 using a non-rebreather face mask.

Use bag-valve-mask device with reservoir to ventilate patients or to assist ventilation if breathing is inadequate.

b. Alleviate tension pneumothorax with needle decompression followed by chest tube insertion. The signs and symptoms of tension pneumothorax are respiratory distress, neck vein distention, tachycardia, hypotension, tracheal deviation, and absent breath sounds on the affected side.

c. Seal open pneumothorax with occlusive dressing taped securely on three sides. Signs and symptoms of an open pneumothorax is an open defect in the chest wall causing a change in equilibrium between the intrathoracic and atmospheric pressure.

d. Acute Cardiac tamponade due to trauma is best managed by thoracotomy. Pericardiocentesis may be used as a temporizing maneuver when thoracotomy is not an available option. Signs and symptoms of a cardiac tamponade are Beck's Triad which includes: venous pressure elevation (distended neck veins), decline in arterial pressure (hypotenstion), and muffled heart tones.

e. Perform intubation as needed for ventilatory support.

C. Circulation with hemorrhage control:

Assessment

a. Identify signs of hemorrhage.

b. Assess mental status.

Caution: If the patient's level of consciousness is decreased, this may indicate poor brain perfusion due to blood loss.

c. Assess pulse for quality, rate and regularity.

d. Assess skin color for pallor or cyanosis.

e. Assess skin for temperature and moisture.

Intervention

(a) Apply direct pressure to control external bleeding.
A tourniquet may be considered to control bleeding associated with limb amputation when direct pressure is ineffective.

Caution: Hemorrhage control is the primary goal. Fluid resuscitation is important but is second in priority to hemorrhage control. In penetrating trauma with hemorrhage, consideration should be given to limiting aggressive volume resuscitation until bleeding has been controlled. This careful balanced approach requires frequent reevaluation.

(b). Initiate two large gauge Ws and draw blood for type and crossmatch and baseline lab values. Consider obtaining lactate level, blood alcohol level and/or toxicology screen.

© Infuse warmed Ringer's lactate solution and/or normal saline as Indicated . Administer warmed blood as indicated.

(d) Apply pelvic stabilizing device or femur splinting device to assist with hemorrhage control. (Anticipate the need for angio-embolization and/or surgical stabilization in patients with persistent hemodynamic instability associated with pelvic fracture.)

(e) Prepare for surgical intervention if internal hemorrhage is identified.

(f)Anticipate resuscitative thoracotomy if the signs of pericardial tamponade are present. Pericardiocentesis may be used as a temporizing measure if resuscitative thoracotomy cannot be immediately performed. The signs and symptoms of pericardial tamponade are distended neck veins, hypotension, muffled heart tones (Beck's Triad), pulsus paradoxus, and narrowing pulse pressure.

Caution:
The signs and symptoms of pericardial tamponade and tension pneumothorax are similar. Careful assessment of the patient is paramount in order to differentiate these two injuries.

D. Disability (neurologic evaluation):

Assessment

a. Assess the patient's level of consciousness using the Glasgow Coma Score

b. Assess pupils for size, equality, and reactivity.

Intervention

a. Anticipate intubation with ventilation if GCS less than 8.

b. Manage hypotension with fluids and blood as indicated.

c. Consult a neurosurgeon as early as possible if head injury is suspected.

E. Expose/Environmental control:

Assessment

(a) Undress and fully examine the patient.

Intervention

(a) Apply warming measures to prevent hypothermia, e.g., warm blankets, convective air heating devices.

II. Adjuncts and Other Considerations to the Primary Survey

As life threatening injuries are identified in the primary survey, they must be treated prior to proceeding to the secondary survey. Additional adjuncts and interventions to the primary survey that will be considered at this time are as follows:

A. Assess vital signs.

B. Measure pulse oximetry, core temperature, and end tidal CO2.

C. Apply the elecrocardiographic (EKG) monitor.

D. Obtain arterial blood gases.

E. Perform focused assessment sonography for trauma (FAST) or diagnostic peritoneal lavage (DPL).

F. Insert gastric tube as needed.

Caution:

If facial fractures are present, a criibriform plate fracture must be suspected. Insert tubes (oropharyngeal, endotracheal or gastric) through the mouth to prevent inadvertent insertion of the tube through the cribiform plate into the brain.

G. Insert urinary catheter as needed. Rectal exam may be selectively performed prior to insertion of a urinary catheter in patients where pelvic or genitourinary injury is suspected.

H. Obtain radiographic studies as indicated including chest, pelvis.

I. Evaluate the need for transfer.

III. Secondary Survey: The secondary survey is a systematic head-to-toe assessment with emphasis on identifying all injuries.

A. Obtain further history if possible.

B. Perform physical examination including inspection, auscultation and palpation, and NO identification of sources and location of pain.

1. Head and Skull

Assessment

- Palpate and examine the entire cranium for lacerations, contusions, bony deformities, and bleeding.
- Inspect for drainage from ears and nose.

Intervention

- Control hemorrhage with direct pressure.
- Secure all tubes in place.
- Anticipate and prepare for CT scan of head and operative intervention as indicated

2. Face

Assessment

- Reassess airway.
- Re-evaluate pupils for reactivity and size.
- Assess for ocular injury.
- Inspect for bleeding, swelling, deformities, and contusions.
- Palpate for crepitus, bony step-offs and midface instability.

. Intervention

- Maintain airway patency.
- Provide hemorrhage control.
- Remove contact lenses.

3. Cervical Spine and Neck

Caution**:** Assume C-spine fracture, unless ruled out by clinical and radiographic exams.

Assessment

- Inspect and palpate for obvious deformities, hematomas, and contusions.
- Palpate posterior cervical spine for step-offs, swelling, or deformities.
- Reassess for neck vein distention and tracheal deviation.
- Assess for hoarseness or change in voice.

Intervention

- Maintain adequate immobilization of the spine.
- Use direct pressure for hemorrhage control.
- Anticipate CT and angiography of the neck to rule out cervical and/or blunt carotid and vertebral vascular injuries in patients with cervical 1-3 fracture and cervical subluxation.

Caution:

In penetrating neck trauma, anticipate significant challenges in maintaining and securing the airway due to distorted airway anatomy, and the potential for bleeding.

4. Chest

Assessment

- Inspect for contusions, open wounds, paradoxical chest wall movement.
- Observe for equal chest expansion and symmetry.
- Auscultate lung fields and heart tones.
- Palpate the chest wall including shoulders and clavicles.

Intervention

Prepare for needle decompression as indicated to relieve tension pneumothorax followed by chest tube insertion.

Prepare for chest tube insertion to relieve pneumothorax and/or hemothorax.

Prepare for Pericardiocentesis as needed for relief of pericardial tamponade.

5. Abdomen

Assessment

- Inspect for findings that may indicate internal injury such as contusions, abrasions, or "seat belt sign".
- Inspect for distension, including gravid uterus in females.
- Auscultate for presence of bowel sounds in each quadrant.
- Palpate for tenderness and rigidity in each quadrant.

Intervention

- Anticipate and prepare for FAST as indicated.
- Assist with DPL as indicated.
- Insert gastric tube and urinary catheter prior to performing DPL.
- Select Ringers lactate as the lavage solution.
- Use non-vented IV tubing when infusing DPL solution.
- Anticipate and prepare for CT scan of abdomen and operative intervention as indicated.

6. Pelvis

Assessment

- Inspect for open wounds, and contusions.
- Palpate for pain, crepitus and instability.

Caution:

Avoid unnecessary movement of the pelvis. Minimize movement and repeated exams of the injured pelvis.

Intervention

- Immobilize the pelvis with pelvic immobilization device.
- Facilitate early orthopaedic surgical consultation.
- Anticipate angiographic intervention.

7.Perineum

Assessment

- Inspect for perineal and scrotal ecchymosis or blood.
- Inspect for blood at the urinary meatus.
- Perform rectal exam to assess for blood, prostate position, rectal wall integrity, and sphincter tone. Rectal exam may be selectively performed prior to insertion of a urinary catheter in patients where pelvic or genitourinary injury is suspected.
- Perform vaginal exam to assess for blood in the vaginal vault, vaginal wall integrity or vaginal lacerations.

Intervention

Obtain an urethrogram if a urethral injury is suspected.

Caution

Do not place a urinary catheter if there is there is blood urethral meatus or an abnormal prostate exam.

8. Extremities

Assessment

- Inspect for deformity, open wounds, ecchymosis, and swelling.
- Palpate for crepitus, pain, abnormal bony movement, and joint instability.
- Assess color, pulses, motor and sensory function of each extremity and compare bilaterally.
- Assess for shortening of an extremity as compared to the other extremity.
- Assess foe internel or external rotation of the legs.
- Identify any motor or sensory deficits.
- Monitor for signs and symptoms of compartment syndrome including paon greater than expected, paresthesia, decreased sensation, tense swelling of the involved region.

Caution:

The loss of pulses in the affected limb is late signs of compartment syndrome.

Intervention

- Apply traction splint for femur fractures as indicated.
- Apply splinting devices for other extremity injuries.
- Ascertain pulses prior to and following splint application.
- Administer analgesic as ordered; assess for effectiveness; document pain management per local protocol.
- Perform radiographic studies as indicated.
- Cover wounds with sterile dressing per local protocol.
- Administer antibiotics per local protocol.
- Facilitate orthopaedic consultation.
- Anticipate fasciotomy if compartment syndrome identified.

9. Back and posterior surfaces

Assessment

- Log roll the patient.
- Inspect and palpate the entire posterior surface of the body for contusions, hematoma, open wounds and pain.
- Palpate spine for step for step-off deformities, crepitus, and pain.

Intervention

- Maintain spine precautions.

VII. Re-evaluation

The trauma patient may have injuries that can progress to life-threatening problems. The trauma patient requires continuous re-evaluation to assure that all injuries and any deterioration in the patient's status are identified. A high index of suspicion combined with ongoing evaluation will promote early identification of deterioration of patient status.

VIII. Transfer to Definitive Care

A. Notify the receiving patient care unit or trauma center of patient information.
B. Facilitate doctor to and nurse to nurse report of transfer information.
C. Give complete report of patient's mechanism of injury, injuries, interventions, and current status and vital signs to the receiving staff.
D. Ensure appropriate documentation and radiographic films accompany the patient on transfer.
E. Ensure appropriate communication with the patient's family.

IX. Summary

The initial assessment and management of the trauma patient must occur in a timely and orderly manner thus facilitating optimal outcomes. The nurse with a solid understanding of the key concepts of advanced trauma care is an integral part of the trauma team.

Basic Life Support

Dr. Biraj Saikia, DA(RCA),MD,DNB,FFA(Ireland)

Basic life Support is a program that delivers a dynamic message of hope — the hope of saving lives. New treatments have improved the possibility of survival from cardiovascular emergencies, cardiac arrest, and stroke. Increasing public awareness of the importance of early intervention and ensuring greater public access to defibrillation will save many lives. At Academy Trauma our motto is to train people by educating healthcare providers, caregivers, and the general public on how to respond to these emergencies. BLS is generally used in pre-hospital setting and can be provided without medical equipments and drugs in contrast with the provisions of Advanced Life Support.

Professional Medical bodies in respective countries have formulated their BLS guidelines. The guidelines outline algorithms for the management of number of conditions such as cardiac arrest, choking and drowning. CPR provided in the scene increases the time available for higher medical responders to arrive and provide ALS care. An important advance in providing BLS is the availability of the AED.

BLS consists of a number of life saving techniques focussed on Circulation, Airway and Breathing.(CAB vs ABC). Initial recognition and response to heart attack and stroke are considered part of BLS.

New Changes:-

1. Immediate recognition of Sudden Cardiac Arrest (SCA) based on assessing unresponsiveness and absence of normal breathing

2. Encourage Hands only chest compression for the untrained lay rescuer and increased focus on methods to ensure the high quality effective chest compressions.

3 .Sequence change to chest compression before rescue breath

4. Continue de-emphasis on pulse check for health care providers.

5. Recommendation of a simultaneous choreographed approach for chest compressions,

airway management, rescue breathing, rhythm detection and shock by an integrated team of highly trained rescuers in appropriate setting.

Chain of Survival

Sudden Cardiac arrest(SCA) has many aetiologies,(cardiac or non cardiac), circumstances(witnessed or unwitnessed) settings(in hospital or out of hospital).This heterogeneity suggest that a single approach to resuscitation is not practical but a core set of actions provides a universal strategy for achieving successful resuscitation and this Chain of Survival.

- Immediate recognition of cardiac arrest and activation of the emergency response system
- Early CPR that emphasizes chest compressions.
- Rapid defibrillation if indicated.
- Effective advanced life support
- Integrated post cardiac arrest care.

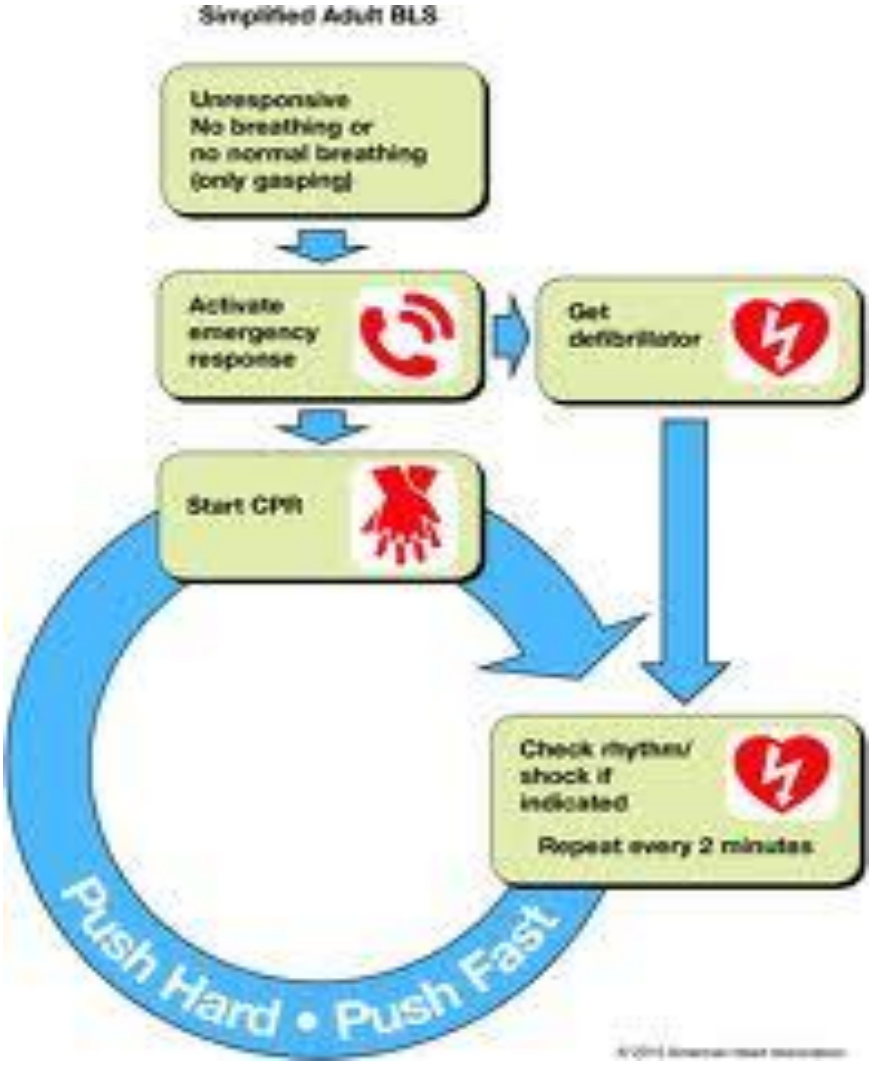
When these links are implemented in an effective way survival rates can approach 50% following witnessed out off hospital ventricular fibrillation arrest. Confusion on the part of a rescuer can result in a delay or failure to activate the emergency response system or to start CPR. Precious time is lost if bystanders are confused to act. Therefore these adult BLS Guidelines focus on recognition of cardiac arrest with appropriate set of rescuer actions.

Activating the Emergency Response System

Emergency medical dispatch is an integral component of the EMS response. Bystander should immediately call local emergency number to initiate a response anytime they find an unresponsive victim. Information should include bystanders name, location of the victims, status of the victim (breathing present or absent), or nature of injury. Dispatchers often advice hand only CPR by lay rescuer.

Adult BLS Sequence

Immediate Recognition and activation of the Emergency Response System: -



If a lone rescuer finds an unresponsive adult or witness an adult who suddenly collapses, after ensuring that the scene is safe the rescuer should check for response by tapping the victim on shoulder and shouting at the victim and activate the emergency response system(doctors, casualty or 108). If the victim also has absent or abnormal breathing or gasping the rescuer should assume the victim is in cardiac arrest. Ideally dispatcher should able to guide the lay rescuer through the check for breathing and steps of CPR if needed. After activation of the emergency response system all rescuers should immediately begin CPR for a adult victims. When phoning 108 the rescuer should answer the dispatcher's question about location of the incident, the events of the incident, the number and condition of the victims and type of aid provided.

Pulse Check: - Lay rescuer should not check pulse and assume that cardiac arrest is present if an adult suddenly collapses or an unresponsive victim not breathing normally. Health care provider should take no more than 10 seconds to check for a pulse, if doubt start chest compressions.

Early CPR

Chest Compressions:- Chest compressions consist of forceful rhythmic application of pressure over the lower half of sternum. These compressions create blood flow by increasing intrathoracic pressure and directly compressing the heart. It generates blood flow and oxygen delivery to the myocardium and brain.

Adult BLS Sequence

- To provide effective chest compressions, push hard and push fast at 100/min/ with compressions depth at least 2 inches(5cm). Rescuers should allow complete recoil of the chest after a compression to allow the heart to fill.
- Rescuer should attempt to minimize the frequency and duration of interruptions in compressions.
- Rescue Breath:- A compression-ventilation ratio of 30:2 is recommended. 2010 AHA Guidelines for CPR and ECC is to recommend the initiation of Compression before Ventilation. Beginning CPR with 30 compressions rather than 2 ventilation leads to a shorter delay to first compression.
- Deliver each rescue breath over 1 second
- Give sufficient tidal volume to produce visible chest rise
- Mouth to mouth or bag Mask ventilation equally effective in providing oxygenation and ventilation.

Early Defibrillation with an AED

After activating the emergency response system the lone rescuer should next retrieve an AED (if available nearby) and use the AED. The rescuer then provides high quality CPR. When two rescuers are present, one rescuer begin chest compression and the other activate EMS system and get the AED and it should be used as rapidly as possible.

Defibrillation Sequence

- Turn the AED on
- Follow the AED prompts
- Resume chest compressions after the shock.

Rescuer Specific CPR Strategies

- Untrained Lay Rescuer: -Untrained bystander should provide Hand Only CPR, with an emphasis on "**Push Hard and fast"** or follow directions of dispatcher until an AED arrive and ready for use or healthcare take over care of the victim.

- Trained Lay Rescuer: - All trained lay rescuer should provide 30 chest compressions and 2 rescue breath either by mouth to mouth or bag and Mask ventilation till AED arrive and ready for use or EMS take over care of the victim.
- Health Care Provider: -Optimally all health care provider should be trained in BLS. In this trained population it is reasonable for both EMS and in hospital professional rescuers provide chest compressions and rescue breaths for cardiac arrest. 30:2 compression and ventilation continued till dynamic airway is placed and 1 breath is provided after 6 to 8 seconds with minimum interruption between procedures.

Adult BLS Skills

Compressions

- Correct position of the hand over the sternum
- Correct compression and relaxation.
- Minimum interruption between procedures.
- Rescuer fatigue may lead to inadequate compressions or depth.Significant fatigue and swallow compressions are common after 1 minute of CPR although rescuers may not recognize that fatigue is present for 5 minutes. Consider switch over in every 2 minutes if second rescuer is present.

Managing the Airways

- Deliver rescue breath over 1 minute
- Give sufficient tidal volume to produce visible chest rise
- Use compression to ventilation30:2
- With advance airway in place during 2 pewrson CPR give 1 breath in 6-8 seconds

Open the Airway:: -

Head Tilt and Chin Lift Manoeuvre for trained rescuer and health care providers. Untrained rescuer use hand only CPR. Passive ventilation is possible if neck is extended provided no neck injury is present.

Steps in resuscitation are now DRS CAB in these sequences.

- Check for **D**angers
- Check for **R**esponse
- **S** is for send for help
- **C** directs rescuers to perform 30 chest compressions who are unresponsive and not breathing normally followed by 2 rescue breath
- **A** directs rescuer to open the Airway
- **B** directs rescuer to check Breathing but no need to deliver rescue breaths
- **D** directs rescuer to attach AED as soon as available and flow prompt.

If unwilling or unable to perform rescue breathing, then perform compression only CPR as any attempt at resuscitation is better than no attempt at all.

BLS Training in India

In India BLS and CPR training and certification are provided many Medical Colleges. The American Heart association also organizes Two Days Certification Courses throughout years

References

1. Resuscitation Council UK
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3. European Resuscitation Council Guidelines

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Airway Management and Ventilation

Dr Shabbir Ahmed

Introduction:

The first priority in management of any seriously ill patient is a protected, unobstructed airway with adequate ventilation as inadequate delivery of oxygenated blood to the brain and other vital organs is the quickest killer of injured patients.

Definition:

Airway is the path that air takes from the nasal cavity to the lungs. Any obstruction in the path that air takes might lead to either a threatened or compromised airway which can cause death in seconds.

Anatomy:

Airway starts from the nasal cavity and ends up in the lungs.

Oral/Nasal cavities -Tongue/Turbinates- Tonsils/Adenoids-Palate-Oropharynx-Epiglottis- False and true vocal cords-Larynx-Trachea-Lungs

Types of Airways:

An airway can be either—Patent, threatened or compromised.

If a patient is able to communicate verbally, then the airway is not like to be in immediate jeopardy but repeated assessment is to be performed to ensure that airway remain patent and immediate management is instituted in case of any deterioration.

Airway management objectives:

(1) To maintain patent airway

A patent airway is the prime requisite of any resuscitative measure undertaken. The airway of a seriously ill/injured patient might be in jeopardy and action should be taken to maintain its patency.

(2) To relieve airway obstruction

A person with anxiety, audible wheezing, stridor, and coughing may be having an obstructed airway and steps must be taken to relieve the obstruction

(3) To maintain adequate oxygenation and ventilation

Even with a patent airway patient may not be benefitted oxygenation of the tissue may not be adequate so proper ventilation is required.

Airway Problem recognition:

The first step in managing potentially life threatening airway compromise is to identify that there is airway compromise

(A) At risk airways

Obstructed Airway:

Look for objective signs of airway obstruction and manage accordingly

Look for	Listen for	Feel for
Patient is agitated	Noisy breathing	Location of the trachea In midline Shifted to right Shifted to left
Retractions of Intercostal Muscles	Snoring/gurgling	
Use of Accessory Muscles	Stridor	
Cyanosis	Hoarseness	

(B) Maxillofacial Trauma:

Trauma to the face demands aggressive airway management. Facial fractures can be associated with hemorrhage, increased secretion, dislodged teeth which causes additional difficulties in maintaining a patent airway.

(C) Neck Trauma:

Penetrating injury to the neck can cause vascular injury with significant hemorrhage which can result in displacement and obstruction of airway. Blunt injury can cause hematoma which can evolve and do the same. Urgent definitive airway is required. Early surgical airway might be needed

(D) Laryngeal Trauma:

Fracture of larynx can present with acute airway obstruction. The following triad indicates laryngeal injury:-

1. Hoarseness.
2. Subcutaneous emphysema.
3. Palpable fracture.

(E) GCS < 9:

Patients with altered level of consciousness are at particular risk for airway compromise and often require a definitive airway.

Ventilation Problem Recognition:

Recognition of problems with ventilation and objective signs of inadequate ventilation must be looked into after managing airway.

Precipitating factors

Airway obstruction
Altered ventilatory mechanics
Central nervous system depression
Chest trauma
Elderly patient with preexisting pulmonary dysfunction
Cervical spine injury

Objective Signs of Inadequate Ventilation

Look for	Listen for	Use
Symmetrical chest rise	Movement of air on both sides of chest	Pulse oximeter
Asymmetry Flail chest Splinting of rib cage	Decreased or absent breath sound indicates Thoracic injury	
Labored breathing		

Management of Obstructed Airway:

Airway Opening Manoeuvres:

- Jaw Thrust Maneuver
  Jaw thrust maneuver is done in trauma patients to open the airway. It is done by grasping the angles of the lower jaw, one hand on each side, and displacing the mandible forward

- Head tilt/chin lift Maneuver
  This maneuver is used in non-trauma patient to open the airway. It involves lifting of the chin by placing the fingers of one hand under the mandible which is then gently lifted upwards to bring the chin anterior.

Airway Adjunct

These are devices which are used to maintain the patency of an airway and provide adequate oxygenation and ventilation

- Oropharyngeal Airway (Guedel) –

OPA is used in unconscious patient with absent gag reflex. It is inserted into the mouth behind the tongue. The preferred method is to use a tongue blade to depress the tongue and then insert the airway posteriorly, taking care not to push the tongue backward.

- Nasopharyngeal Airway –

NPA is used in conscious or semi conscious patient with intact gag reflex. It is inserted in one nostril and passed gently into the posterior oropharynx. It should be well lubricated and is introduced into nostril which is not obstructed.

- Bag valve mask unit

It is a self inflating bag with a non- rebreathing valve that can be attached to a face mask. BVM ventilation requires a good seal with a patent airway. It can be attached to oxygen or used with room air. The E-C technique is used for adequate seal. A 2.5-L reservoir bag with an oxygen flow of 15L per minute will theoretically deliver 100% oxygen.

- Oesophageal airways

These are devices which are used when endotracheal intubation is not a viable option. Placed in apneic unconscious adults only.

- Oesophageal Obturator Airway.
  It is a rarely used device now a day and has been supplanted by better devices.
- Pharyngotracheal Lumen Airway.
  It is a two tube, cuffed airway that seals the oropharynx proximally and occludes the oesophagus distally, allowing for ventilation through the short tube.
- Oesophageal Tracheal Combitube.
  It is a plastic twin lumen tube with a proximal low pressure cuff that seals the pharyngeal area and a distal cuff that seals the oesophagus, allowing ventilation between the cuffs.
- Tracheoesophageal Airway.
  It is a standard endotracheal tube attached to a ventilation mask with two ports, one for the ETT and other for the oropharyngeal mask ventilation. It is designed to function equally well if inserted into the trachea or oesophagus.

- Supraglottic Airways
  - Laryngeal Mask Airway (LMA).
    It is blindly placed yet can provide a positive pressure airway. The LMA consists of a tubular oropharyngeal airway similar to the ETT, but it is shorter and had a distal silicone laryngeal mask that inflates and provides a seal around the larynx.
  - Laryngeal Tube Airway (LTA).
    It is similar to LMA and placed without direct visualization of the glottis and doesn't require significant movement of the head and neck for placement.

Definitive Airway: A definitive airway is a tube in the trachea with the cuff inflated, the tube connected to some form of oxygen-enriched ventilation, and the airway secured in place with tape. Indications of definitive airway are

Need For Airway Protection	Need For Ventilation And Oxygenation.
Unconscious	Apnea • Neuromuscular paralysis • Unconscious
Severe maxillofacial fractures	Inadequate respiratory efforts • Tachypnea. • Hypoxia. • Hypercarbia. • Cyanosis.
Risk for aspiration Bleeding, Vomiting	Severe closed head injury with need for brief hyperventilation.
Risk for obstruction • Neck hematoma • Laryngeal or tracheal injury • Stridor	Massive blood loss and need for volume resuscitation.

The different types of definitive airways are:-

- Orotracheal Intubation

  It is the preferred method in injured patients to establish a definitive airway. Drug assisted intubation is done in emergency department. Precaution with cervical spine immobilization should be followed.

- Nasotracheal Intubation

  It is a blind procedure and needs spontaneous breathing. It requires expertise to carry out the procedure. Facial, frontal sinus, basilar skull and cribriform plate fractures are relative contraindication of nasotracheal intubation.

- Surgical airways

  The inability to intubate the trachea is a clear indication for creating a surgical airway. A surgical airway is created when edema of the glottis, fracture of the larynx, or severe oropharyngeal hemorrhage obstructs the airway or an endotracheal tube cannot be placed through the vocal cords.

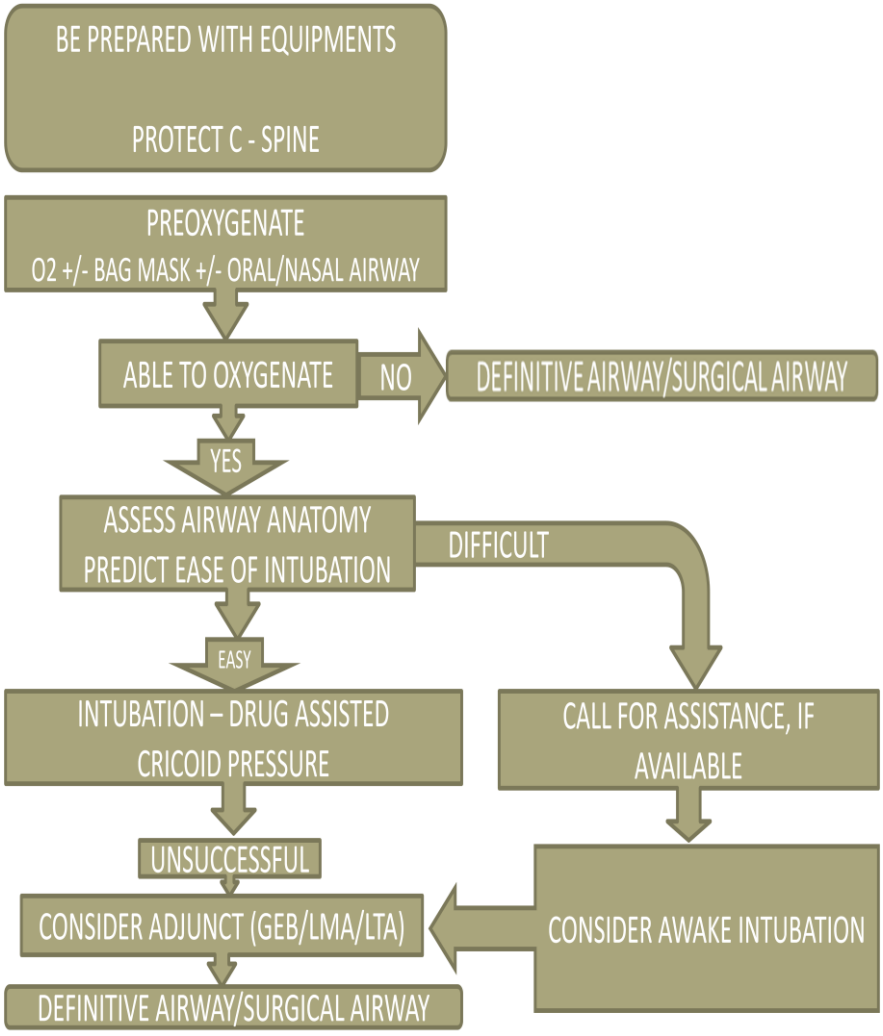
The different surgical airways are

- Cricothyroidotomy is creating a hole in the cricothyroid membrane and giving oxygenation through it. It is done in emergency situation
  - Needle cricothyroidotomy is done in emergency situation by placing a needle through the cricothyroid membrane. It is not a definitive airway and can provide adequate oxygenation for 30-45 mins only.
  - Surgical cricothyroidotomy is done my making a skin incision that extends through the cricothyroid membrane through which a small tracheostomy tube or ET tube can be placed.
- Tracheostomy is not useful for emergency situation as it requires time to perform and a controlled environment. It is best done in the OR.

Drug Assisted Intubation:

Ensure proper working of suction and ventilation device.

Pre-oxygenate the patient with 100 % oxygen.
Apply pressure over cricoid cartilage (Sellick's maneuver).
Administer drugs (propofol/succinylcholine).
After the patient relaxes, intubate the patient oro tracheally.
Release cricoid pressure.
Ventilate the patient



AIRWAY DECISION SCHEME

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AN OVERVIEW OF ACLS GUIDELINES -2010 IN THE MANAGEMENT OF ADULT CARDIAC ARREST

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Advanced cardiovascular life support (ACLS) impacts multiple key links in the chain of survival that include interventions to prevent cardiac arrest, treat cardiac arrest, and improve outcomes of patients who achieve return of spontaneous circulation (ROSC) after cardiac arrest.

ACLS interventions aimed at preventing cardiac arrest include airway management, ventilation support, and treatment of bradyarrhythmias and tachyarrhythmias.

In October 2010 the American Heart Association released their new guidelines for BLS and ACLS. There were some major changes to BLS Guidelines and minor changes to ACLS Guidelines. This Article will review changes that occurred with the release of the 2010 ACLS Guidelines.

The article content was developed from information released by the American Heart Association in their Executive Summary: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care and cited references from the executive summary.

Although the optimal approach to CPR may vary , depending on the rescuer , the victim and the available resources ,the fundamental challenge remains : how to achieve early and effective CPR. Given this challenge , recognition of arrest and prompt action by the rescuer continue to be priorities for the 2010 AHA guidelines for CPR and Emergency Cardiovascular Care .

Key changes from the 2005 ACLS Guidelines include

- Continuous quantitative waveform capnography is recommended for confirmation and monitoring of endotracheal tube placement.
- Cardiac arrest algorithms are simplified and redesigned to emphasize the importance of high-quality CPR (including chest compressions of adequate rate and depth, allowing complete chest recoil after each compression, minimizing interruptions in chest compressions and avoiding excessive ventilation).

- Atropine is no longer recommended for routine use in the management of pulseless electrical activity (PEA)/asystole.
- There is an increased emphasis on physiologic monitoring to optimize CPR quality and detect ROSC.
- Chronotropic drug infusions are recommended as an alternative to pacing in symptomatic and unstable bradycardia.
- Adenosine is recommended as a safe and potentially effective therapy in the initial management of stable undifferentiated regular monomorphic wide-complex tachycardia.

Overview of Airway Management.

The purpose of ventilation during CPR is to maintain adequate oxygenation and sufficient elimination of carbon dioxide. However, research has not identified the optimal tidal volume, respiratory rate, and inspired oxygen concentration required during resuscitation from cardiac arrest.

Because both systemic and pulmonary perfusion is substantially reduced during CPR, normal ventilation-perfusion relationships can be maintained with minute ventilation that is much lower than normal.

Ventilation and Oxygen Administration during CPR

During low blood flow states such as CPR, oxygen delivery to the heart and brain is limited by blood flow rather than by arterial oxygen content.[1,2] Therefore, rescue breaths are less important than chest compressions during the first few minutes of resuscitation from witnessed VF cardiac arrest and could reduce CPR efficacy due to interruption in chest compressions and the increase in intrathoracic pressure that accompanies positive-pressure ventilation. Thus, during the first few minutes of witnessed cardiac arrest a lone rescuer should not interrupt chest compressions for ventilation. Advanced airway placement in cardiac arrest should not delay initial CPR and defibrillation for VF cardiac arrest

Oxygen Administration during CPR

The optimal inspired oxygen concentration during adult CPR has not been established in human or animal studies. In addition, it is unknown whether 100% inspired oxygen (FIO_2=1.0) is beneficial or whether titrated oxygen is better. Although prolonged exposure to 100% inspired oxygen (FIO_2=1.0) has potential toxicity, there is insufficient evidence to indicate that this occurs during brief periods of adult CPR.[3–5] Empirical use of 100% inspired oxygen during CPR optimizes arterial oxyhemoglobin content and in turn oxygen delivery; therefore, use of 100% inspired oxygen (FIO_2=1.0) as soon as it becomes available is reasonable during resuscitation from cardiac arrest (Class IIa, LOE C).

Passive Oxygen Delivery during CPR

Positive-pressure ventilation has been a mainstay of CPR but recently has come under scrutiny because of the potential for increased intrathoracic pressure to interfere with circulation due to reduced venous return to the heart.

In the out-of-hospital setting, passive oxygen delivery via mask with an opened airway during the first 6 minutes of CPR provided by emergency medical services (EMS) personnel was part of a protocol of bundled care interventions (including continuous chest compressions) that resulted in improved survival.

Chest compressions cause air to be expelled from the chest and oxygen to be drawn into the chest passively due to the elastic recoil of the chest. In theory, because ventilation requirements are lower than normal during cardiac arrest, oxygen supplied by passive delivery is likely to be sufficient for several minutes after onset of cardiac arrest with a patent upper airway. **At this time there is insufficient evidence to support the removal of ventilations from CPR performed by ACLS providers.**

Bag-Mask Ventilation

Bag-mask ventilation is an acceptable method of providing ventilation and oxygenation during CPR but is a challenging skill that requires practice for continuing competency. When ventilations are performed by a lone provider, mouth-to-mouth or mouth-to-mask are more efficient. When a second provider is available, bag-mask ventilation may be used by a trained and experienced provider. Bag-mask ventilation is particularly helpful when placement of an advanced airway is delayed or unsuccessful."

During CPR give 2 breaths (each 1 second) during a brief (about 3 to 4 seconds) pause after every 30 chest compressions.

Bag-mask ventilation can produce gastric inflation with complications, including regurgitation, aspiration, and pneumonia. Gastric inflation can elevate the diaphragm, restrict lung movement, and decrease respiratory system compliance.

Airway Adjuncts

Cricoid Pressure

Cricoid pressure in nonarrest patients may offer some measure of protection to the airway from aspiration and gastric insufflation during bag-mask ventilation. The routine use of cricoid pressure in cardiac arrest is not recommended (Class III, LOE C).

Oropharyngeal Airways

Although studies have not specifically considered the use of oropharyngeal airways in patients with cardiac arrest, airways may aid in the delivery of adequate ventilation with a bag-mask device by preventing the tongue from occluding the airway.

To facilitate delivery of ventilations with a bag-mask device, oropharyngeal airways can be used in unconscious (unresponsive) patients with no cough or gag reflex and should be inserted only by persons trained in their use (Class IIa, LOE C).

Nasopharyngeal Airways

Nasopharyngeal airways are useful in patients with airway obstruction or those at risk for developing airway obstruction, particularly when conditions such as a clenched jaw prevent placement of an oral airway. Nasopharyngeal airways are better tolerated than oral airways in patients who are not deeply unconscious. Airway bleeding can occur in up to 30% of patients following insertion of a nasopharyngeal airway. In the presence of known or suspected basal skull fracture or severe coagulopathy, an oral airway is preferred (Class IIa, LOE C).

Advanced Airways

Ventilation with a bag and mask or with a bag through an advanced airway (eg, endotracheal tube or supraglottic airway) is acceptable during CPR.

Although insertion of an endotracheal tube can be accomplished during ongoing chest compressions, intubation frequently is associated with interruption of compressions for many seconds. Placement of a supraglottic airway is a reasonable alternative to endotracheal intubation and can be done successfully without interrupting chest compressions.

The provider should weigh the need for minimally interrupted compressions against the need for insertion of an endotracheal tube or supraglottic airway.

If advanced airway placement will interrupt chest compressions, providers may consider deferring insertion of the airway until the patient fails to respond to initial CPR and defibrillation attempts or demonstrates ROSC (Class IIb, LOE C).

Continuous waveform capnography is recommended in addition to clinical assessment as the most reliable method of confirming and monitoring correct placement of an endotracheal tube (Class I, LOE A). Providers should observe a persistent capnographic waveform with ventilation to confirm and monitor endotracheal tube placement in the field, in the transport vehicle, on arrival at the hospital, and after any patient transfer to reduce the risk of unrecognized tube misplacement or displacement.

Supraglottic Airways

Supraglottic airways are devices designed to maintain an open airway and facilitate ventilation. Unlike endotracheal intubation, intubation with a supraglottic airway does not require visualization of the glottis, so both initial training and maintenance of skills are easier. Also, because direct visualization is not necessary, a supraglottic airway is inserted without interrupting compressions. Supraglottic airways that have been studied in cardiac arrest are the laryngeal mask airway (LMA), the esophageal-tracheal tube (Combitube) and the laryngeal tube (Laryngeal Tube or King LT). During CPR performed by providers trained in its use, the supraglottic airway is a reasonable alternative to bag-mask ventilation (Class IIa, LOE B) and endotracheal intubation (Class IIa, LOE A).

Endotracheal Intubation

The endotracheal tube was once considered the optimal method of managing the airway during cardiac arrest.

No prospective randomized clinical trials have performed a direct comparison of bag-mask ventilation versus endotracheal intubation in adult victims of cardiac arrest.

The endotracheal tube keeps the airway patent, permits suctioning of airway secretions, enables delivery of a high concentration of oxygen, provides an alternative route for the administration of some drugs, facilitates delivery of a selected tidal volume, and, with use of a cuff, may protect the airway from aspiration.

Indications for emergency endotracheal intubation are (1) the inability of the provider to ventilate the unconscious patient adequately with a bag and mask and (2) the absence of airway protective reflexes (coma or cardiac arrest). The provider must have appropriate training and experience in endotracheal intubation.

Continuous waveform capnography is recommended in addition to clinical assessment as the most reliable method of confirming and monitoring correct placement of an endotracheal tube (Class I, LOE A).

If waveform capnography is not available, an EDD or nonwaveform exhaled CO_2 monitor in addition to clinical assessment is reasonable (Class IIa, LOE B).

Ventilation after Advanced Airway Placement

Except for respiratory rate, it is unknown whether monitoring ventilatory parameters (eg, minute ventilation, peak pressure) during CPR will influence outcome. However, positive-pressure ventilation increases intrathoracic pressure and may reduce venous return and cardiac output, especially in patients with hypovolemia or obstructive airway disease. Ventilation at high respiratory rates (>25 breaths per minute) is common during resuscitation from cardiac arrest.

Because cardiac output is lower than normal during cardiac arrest, the need for ventilation is reduced. Following placement of an advanced airway, the provider delivering ventilations should perform 1 breath every 6 to 8 seconds (8 to 10 breaths per minute) without pausing in applying chest compressions (unless ventilation is inadequate when compressions are not paused) (Class IIb, LOE C).

Automatic Transport Ventilators

In out-of-hospital and in-hospital settings, automatic transport ventilators (ATVs) can be useful for ventilation of adult patients in noncardiac arrest who have an advanced airway in place (Class IIb, LOE C). Providers should always have a bag-mask device available for backup.

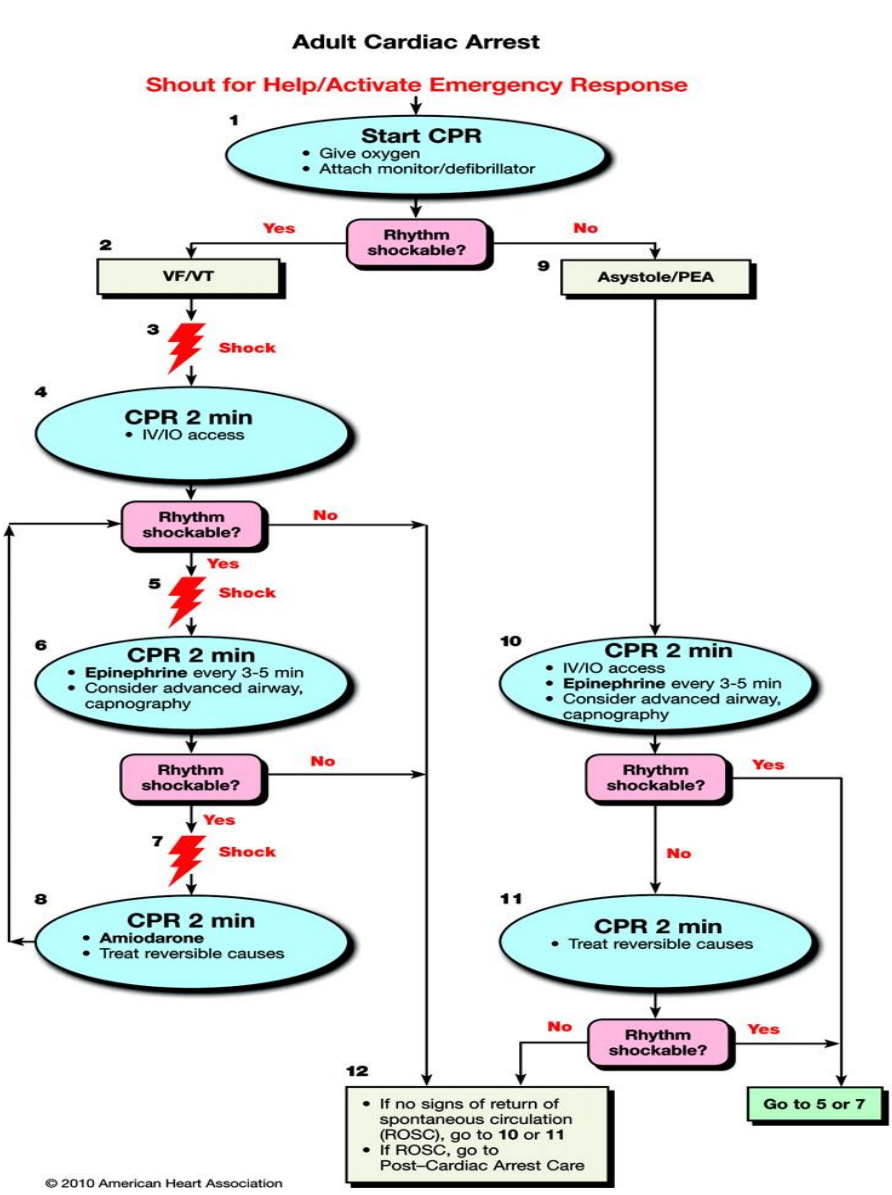
Suction Devices

Both portable and installed suction devices should be available for resuscitation emergencies. The installed suction unit should be powerful enough to provide an airflow of >40 L/min at the end of the delivery tube and a vacuum of >300 mm Hg when the tube is clamped.

Summary

All basic and advanced healthcare providers should be able to provide ventilation with a bag-mask device during CPR or when the patient demonstrates cardiorespiratory compromise. Airway control with an advanced airway, which may include an endotracheal tube or a supraglottic airway device, is a fundamental ACLS skill. Prolonged interruptions in chest compressions should be avoided during advanced airway placement. All providers should be able to confirm and monitor correct placement of advanced airways; this key skill is required to ensure the safe and effective use of these devices. Training, frequency of use, and monitoring of success and complications are more important than the choice of a specific advanced airway device for use during CPR.

Management of Cardiac Arrest



CPR Quality
- Push hard (≥2 inches [5 cm]) and fast (≥100/min) and allow complete chest recoil
- Minimize interruptions in compressions
- Avoid excessive ventilation
- Rotate compressor every 2 minutes
- If no advanced airway, 30:2 compression-ventilation ratio
- Quantitative waveform capnography
  - If P_{ETCO_2} <10 mm Hg, attempt to improve CPR quality
- Intra-arterial pressure
  - If relaxation phase (diastolic) pressure <20 mm Hg, attempt to improve CPR quality

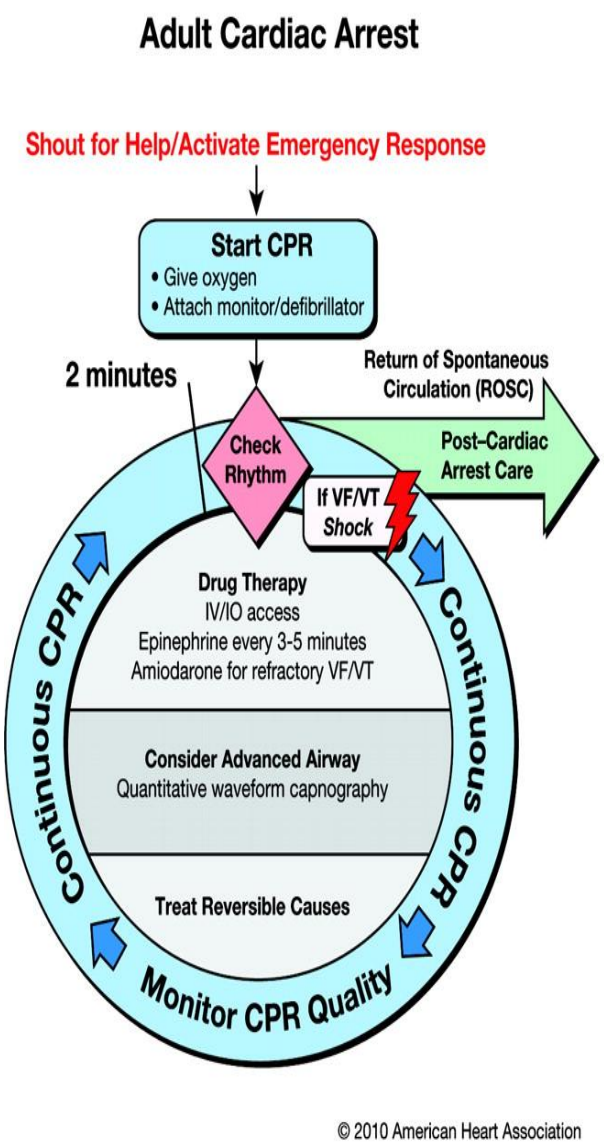
Return of Spontaneous Circulation (ROSC)
- Pulse and blood pressure
- Abrupt sustained increase in P_{ETCO_2} (typically ≥40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

Shock Energy
- **Biphasic:** Manufacturer recommendation (120-200 J); if unknown, use maximum available. Second and subsequent doses should be equivalent, and higher doses may be considered.
- **Monophasic:** 360 J

Drug Therapy
- **Epinephrine IV/IO Dose:** 1 mg every 3-5 minutes
- **Vasopressin IV/IO Dose:** 40 units can replace first or second dose of epinephrine
- **Amiodarone IV/IO Dose:** First dose: 300 mg bolus. Second dose: 150 mg.

Advanced Airway
- Supraglottic advanced airway or endotracheal intubation
- Waveform capnography to confirm and monitor ET tube placement
- 8-10 breaths per minute with continuous chest compressions

Reversible Causes
- **H**ypovolemia
- **H**ypoxia
- **H**ydrogen ion (acidosis)
- **H**ypo-/hyperkalemia
- **H**ypothermia
- **T**ension pneumothorax
- **T**amponade, cardiac
- **T**oxins
- **T**hrombosis, pulmonary
- **T**hrombosis, coronary



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Advanced Airway
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- Waveform capnography to confirm and monitor ET tube placement
- 8-10 breaths per minute with continuous chest compressions

Reversible Causes
- Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hypo-/hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary

Overview

Cardiac arrest can be caused by 4 rhythms: ventricular fibrillation (VF), pulseless ventricular tachycardia (VT), pulseless electric activity (PEA), and asystole.

VF represents disorganized electric activity, whereas pulseless VT represents organized electric activity of the ventricular myocardium. Neither of these rhythms generates significant forward blood flow.

PEA encompasses a heterogeneous group of organized electric rhythms that are associated with either absence of mechanical ventricular activity or mechanical ventricular activity that is insufficient to generate a clinically detectable pulse. Asystole (perhaps better described as ventricular asystole) represents absence of detectable ventricular electric activity with or without atrial electric activity.

The foundation of successful ACLS is high-quality CPR, and, for VF/pulseless VT, attempted defibrillation within minutes of collapse

The 2010 ACLS Adult Cardiac Arrest Algorithms (Figures 1 and 2) are presented in the traditional box-and-line format and a new circular format. The 2 formats are provided to facilitate learning and memorization of the treatment recommendations.

Overall these algorithms have been simplified and redesigned to emphasize the importance of high-quality CPR that is fundamental to the management of all cardiac arrest rhythms. Periodic pauses in CPR should be as brief as possible and only as necessary to assess rhythm, shock VF/VT, perform a pulse check when an organized rhythm is detected, or place an advanced airway.

Monitoring and optimizing quality of CPR on the basis of either mechanical parameters (chest compression rate and depth, adequacy of relaxation, and minimization of pauses) or, when feasible, physiologic parameters (partial pressure of end-tidal CO_2 [$PETCO_2$], arterial pressure during the relaxation phase of chest compressions, or central venous oxygen saturation [$ScvO_2$]) are encouraged .

Rhythm-Based Management of Cardiac Arrest

In most cases of witnessed and unwitnessed cardiac arrest the first provider should start CPR with chest compressions and the second provider should get or turn on the defibrillator, place the adhesive pads or paddles, and check the rhythm. Paddles and electrode pads should be placed on the exposed chest in an anterior-lateral position.. Rhythm checks should be brief, and if an organized rhythm is observed, a pulse check should be performed. If there is any doubt about the presence of a pulse, chest compressions should be resumed immediately. If a cardiac monitor is attached to the patient at the time of arrest, the rhythm can be diagnosed before CPR is initiated.

VF/Pulseless VT

When a rhythm check by an automated external defibrillator (AED) reveals VF/VT, the AED will typically prompt to charge, "clear" the victim for shock delivery, and then deliver a shock, all of which should be performed as quickly as possible. CPR should be resumed immediately after shock delivery (without a rhythm or pulse check and beginning with chest compressions) and continue for 2 minutes before the next rhythm check.

When a rhythm check by a manual defibrillator reveals VF/VT, the first provider should resume CPR while the second provider charges the defibrillator. Once the defibrillator is charged, CPR is paused to "clear" the patient for shock delivery. After the patient is "clear," the second provider gives a single shock as quickly as possible to minimize the interruption in chest compressions ("hands-off interval"). The first provider resumes CPR immediately after shock delivery (without a rhythm or pulse check and beginning with chest

compressions) and continues for 2 minutes. After 2 minutes of CPR the sequence is repeated, beginning with a rhythm check.

The provider giving chest compressions should switch at every 2-minute cycle to minimize fatigue. CPR quality should be monitored based on mechanical or physiologic parameters.

Defibrillation Strategies

Waveform and Energy

If a biphasic defibrillator is available, providers should use the manufacturer's recommended energy dose (eg, initial dose of 120 to 200 J) for terminating VF (Class I, LOE B). If the provider is unaware of the effective dose range, the provider may use the maximal dose (Class IIb, LOE C). Second and subsequent energy levels should be at least equivalent, and higher energy levels may be considered if available (Class IIb, LOE B). If a monophasic defibrillator is used, providers should deliver an initial shock of 360 J and use that dose for all subsequent shocks. If VF is terminated by a shock but then recurs later in the arrest, deliver subsequent shocks at the previously successful energy level.

CPR Before Defibrillation

During treatment of VF/pulseless VT healthcare providers must ensure that coordination between CPR and shock delivery is efficient. When VF is present for more than a few minutes, the myocardium is depleted of oxygen and metabolic substrates. A brief period of chest compressions can deliver oxygen and energy substrates and "unload" the volume-overloaded right ventricle, increasing the likelihood that a perfusing rhythm will return after shock delivery.

Drug Therapy in VF/Pulseless VT

When VF/pulseless VT persists after at least 1 shock and a 2-minute CPR period, a vasopressor can be given with the primary goal of increasing myocardial blood flow during CPR and achieving ROSC Amiodarone is the first-line antiarrhythmic agent given during cardiac arrest because it has been clinically demonstrated to improve the rate of ROSC and hospital admission in adults with refractory VF/pulseless VT. Amiodarone may be considered when VF/VT is unresponsive to CPR, defibrillation, and vasopressor therapy (Class IIb, LOE A). Magnesium sulfate should be considered only for torsades de pointes associated with a long QT interval (Class IIb, LOE B).

Treating Potentially Reversible Causes of VF/Pulseless VT

The importance of diagnosing and treating the underlying cause of VF/pulseless VT is fundamental to the management of all cardiac arrest rhythms. As always, the provider should recall the H's and T's to identify a factor that may have caused the arrest or may be complicating the resuscitative effort In the case of refractory VF/pulseless VT, acute coronary ischemia or myocardial infarction should be considered as a potential etiology. Reperfusion strategies such as coronary angiography and PCI during CPR or emergency cardiopulmonary bypass have been demonstrated to be feasible in a number of case studies and case series but have not been evaluated for their effectiveness in RCTs. Fibrinolytic therapy administered during CPR for acute coronary occlusion has not been shown to improve outcome.

ROSC after VF/Pulseless VT

If the patient has ROSC, post–cardiac arrest care should be started .Of particular importance are treatment of hypoxemia and hypotension, early diagnosis and treatment of ST-elevation myocardial infarction (STEMI) (Class I, LOE B) and therapeutic hypothermia in comatose patients (Class I, LOE B).

PEA/Asystole

When a rhythm check by an AED reveals a nonshockable rhythm, CPR should be resumed immediately, beginning with chest compressions, and should continue for 2 minutes before the rhythm check is repeated. When a rhythm check using a manual defibrillator or cardiac monitor reveals **an organized rhythm**, a pulse check is performed. If a pulse is detected, post–cardiac arrest care should be initiated immediately . If the rhythm is asystole or the pulse is absent (eg, PEA), CPR should be resumed immediately, beginning with chest compressions, and should continue for 2 minutes before the rhythm check is repeated.

Drug Therapy for PEA/Asystole

A vasopressor can be given as soon as feasible with the primary goal of increasing myocardial and cerebral blood flow during CPR and achieving ROSC (see "Vasopressors" below for dosing) (Class IIb, LOE A). Available evidence suggests that the routine use of atropine during PEA or asystole is unlikely to have a therapeutic benefit (Class IIb, LOE B). For this reason atropine has been removed from the cardiac arrest algorithm.

Treating Potentially Reversible Causes of PEA/Asystole

PEA is often caused by reversible conditions and can be treated successfully if those conditions are identified and corrected. During each 2-minute period of CPR the provider should recall the H's and T's to identify factors that may have caused the arrest or may be complicating the resuscitative effort . Given the potential association of PEA with hypoxemia, placement of an advanced airway is theoretically more important than during VF/pulseless VT and might be necessary to achieve adequate oxygenation or ventilation. PEA caused by severe volume loss or sepsis will potentially benefit from administration of empirical IV/IO crystalloid. A patient with PEA caused by severe blood loss will potentially benefit from a blood transfusion. When pulmonary embolism is presumed or known to be the cause of cardiac arrest, empirical fibrinolytic therapy can be considered (Class IIa, LOE B; see Part 12). Finally, if tension pneumothorax is clinically suspected as the cause of PEA, initial management includes needle decompression. If available, echocardiography can be used to guide management of PEA because it provides useful information about intravascular volume status (assessing ventricular volume), cardiac tamponade, mass lesions (tumor, clot), left ventricular contractility, and regional wall motion. Asystole is commonly the end-stage rhythm that follows prolonged VF or PEA, and for this reason the prognosis is generally much worse.

ROSC after PEA/Asystole

If the patient has ROSC, post–cardiac arrest care should be initiated .Of particular importance is treatment of hypoxemia and hypotension and early diagnosis and treatment of the underlying cause of cardiac arrest. Therapeutic hypothermia may be considered when the patient is comatose (Class IIb, LOE C).

Monitoring During CPR

Mechanical Parameters

CPR quality can be improved by using a number of nonphysiologic techniques that help the provider adhere to recommended CPR parameters such as rate and depth of compression and rate of ventilation. The most simple are auditory or visual metronomes to guide providers in performing the recommended rate of chest compressions or ventilations.

Physiologic Parameters

In humans cardiac arrest is the most critically ill condition, yet it is typically monitored by rhythm assessment using selected electocardiographic (ECG) leads and pulse checks as the only physiologic parameters to guide therapy. Animal and human studies indicate that monitoring of $PETCO_2$, coronary perfusion pressure (CPP), and central venous oxygen

saturation ($ScvO_2$) provides valuable information on both the patient's condition and response to therapy. Most importantly, $PETCO_2$, CPP, and $ScvO_2$ correlate with cardiac output and myocardial blood flow during CPR, and threshold values below which ROSC is rarely achieved have been reported.

Pulse

Clinicians frequently try to palpate arterial pulses during chest compressions to assess the effectiveness of compressions. No studies have shown the validity or clinical utility of checking pulses during ongoing CPR. Carotid pulsations during CPR do not indicate the efficacy of myocardial or cerebral perfusion during CPR. Palpation of a pulse when chest compressions are paused is a reliable indicator of ROSC but is potentially less sensitive than other physiologic measures discussed below.

End-Tidal CO_2

End-tidal CO_2 is the concentration of carbon dioxide in exhaled air at the end of expiration. It is typically expressed as a partial pressure in mm Hg ($PETCO_2$). Because CO_2 is a trace gas in atmospheric air, CO_2 detected by capnography in exhaled air is produced in the body and delivered to the lungs by circulating blood. Under normal conditions $PETCO_2$ is in the range of 35 to 40 mm Hg. During untreated cardiac arrest CO_2 continues to be produced in the body, but there is no CO_2 delivery to the lungs. Under these conditions $PETCO_2$ will approach zero with continued ventilation. With initiation of CPR, cardiac output is the major determinant of CO_2 delivery to the lungs. If ventilation is relatively constant, $PETCO_2$ correlates well with cardiac output during CPR.

Persistently low $PETCO_2$ values (<10 mm Hg) during CPR in intubated patients suggest that ROSC is unlikely.

Coronary Perfusion Pressure and Arterial Relaxation Pressure

CPP (coronary perfusion pressure=aortic relaxation ["diastolic"] pressure minus right atrial relaxation ["diastolic"] pressure) during CPR correlates with both myocardial blood flow and ROSC.

Central Venous Oxygen Saturation

When oxygen consumption, arterial oxygen saturation (SaO_2), and hemoglobin are constant, changes in $ScvO_2$ reflect changes in oxygen delivery by means of changes in cardiac output. $ScvO_2$ can be measured continuously using oximetric tipped central venous catheters placed in the superior vena cava. $ScvO_2$ values normally range from 60% to 80%. During cardiac arrest and CPR these values range from 25% to 35%, indicating the inadequacy of blood flow produced during CPR. If $ScvO_2$ is <30%, it is reasonable to consider trying to improve the quality of CPR by optimizing chest compression parameters (Class IIb, LOE C).

Pulse Oximetry

During cardiac arrest, pulse oximetry typically does not provide a reliable signal because pulsatile blood flow is inadequate in peripheral tissue beds. But the presence of a plethysmograph waveform on pulse oximetry is potentially valuable in detecting ROSC, and pulse oximetry is useful to ensure appropriate oxygenation after ROSC.

Arterial Blood Gases

Arterial blood gas monitoring during CPR is not a reliable indicator of the severity of tissue hypoxemia, hypercarbia (and therefore adequacy of ventilation during CPR), or tissue acidosis. Routine measurement of arterial blood gases during CPR has uncertain value (Class IIb, LOE C).

Echocardiography

No studies specifically examine the impact of echocardiography on patient outcomes in cardiac arrest. However, a number of studies suggest that transthoracic and transesophageal echocardiography have potential utility in diagnosing treatable causes of cardiac arrest such as cardiac tamponade, pulmonary embolism, ischemia, and aortic dissection. (Class IIb, LOE C).

Access for Parenteral Medications During Cardiac Arrest

Timing of IV/IO Access

During cardiac arrest, provision of high-quality CPR and rapid defibrillation are of primary importance and drug administration is of secondary importance. After beginning CPR and attempting defibrillation for identified VF or pulseless VT, providers can establish IV or IO access. This should be performed without interrupting chest compressions. The primary purpose of IV/IO access during cardiac arrest is to provide drug therapy.

Peripheral IV Drug Delivery

If a resuscitation drug is administered by a peripheral venous route, it should be administered by bolus injection and followed with a 20-mL bolus of IV fluid to facilitate the drug flow from the extremity into the central circulation.

IO Drug Delivery

IO cannulation provides access to a noncollapsible venous plexus, enabling drug delivery similar to that achieved by peripheral venous access at comparable doses.. Although virtually all ACLS drugs have been given intraosseously in the clinical setting without known

ill effects, there is little information on the efficacy and effectiveness of such administration in clinical cardiac arrest during ongoing CPR. It is reasonable for providers to establish IO access if IV access is not readily available (Class IIa, LOE C). Commercially available kits can facilitate IO access in adults.

Central IV Drug Delivery

The appropriately trained provider may consider placement of a central line (internal jugular or subclavian) during cardiac arrest, unless there are contraindications (Class IIb, LOE C). The primary advantage of a central line is that peak drug concentrations are higher and drug circulation times shorter compared with drugs administered through a peripheral IV catheter. Central venous catheterization is a relative (but not absolute) contraindication for fibrinolytic therapy in patients with acute coronary syndromes.

Endotracheal Drug Delivery

One study in children, 5 studies in adults, and multiple animal studies have shown that lidocaine, epinephrine atropine, naloxone, and vasopressin are absorbed via the trachea. There are no data regarding endotracheal administration of amiodarone.

Administration of resuscitation drugs into the trachea results in lower blood concentrations than when the same dose is given intravascularly.

When Should Resuscitative Efforts Stop?

The final decision to stop can never rest on a single parameter, such as duration of resuscitative efforts. Rather, clinical judgment and respect for human dignity must enter into decision making. In the out-of-hospital setting, cessation of resuscitative efforts in adults should follow system-specific criteria under direct medical control. There are limited clinical data to guide this decision in neonatal and pediatric out-of-hospital or in-hospital cardiac arrest

Pacing

Electric pacing is generally not effective in cardiac arrest, and no studies have observed a survival benefit from pacing in cardiac arrest. Existing evidence suggests that pacing by transcutaneous, transvenous, or transmyocardial means in cardiac arrest does not improve the likelihood of ROSC or survival outcome regardless of the timing of pacing administration (early or delayed in established asystole), location of arrest (in-hospital or out-of-hospital), or primary cardiac rhythm (asystole, PEA) targeted for treatment. Electric pacing is not recommended for routine use in cardiac arrest (Class III, LOE B).

Precordial Thump

The potential utility of precordial thump in cardiac arrest has not been well studied. When hemodynamically unstable ventricular tachyarrhythmias were induced during electrophysiological testing, initial administration of a precordial thump appeared to be safe but rarely effective in terminating ventricular arrhythmias.

The precordial thump may be considered for termination of witnessed monitored unstable ventricular tachyarrhythmias when a defibrillator is not immediately ready for use (Class IIb, LOE B), but should not delay CPR and shock delivery. There is insufficient evidence to recommend for or against the use of the precordial thump for witnessed onset of asystole, and there is insufficient evidence to recommend percussion pacing during typical attempted resuscitation from cardiac arrest.

Summary

Intervention to prevent cardiac arrest in critically ill patients is ideal. When cardiac arrest occurs, high-quality CPR is fundamental to the success of any subsequent ACLS intervention. During resuscitation healthcare providers must perform chest compressions of adequate rate and depth, allow complete recoil of the chest after each compression, minimize interruptions in chest compressions, and avoid excessive ventilation, especially with an advanced airway. Quality of CPR should be continuously monitored. Physiologic monitoring may prove useful to optimize resuscitative efforts. For patients in VF/pulseless VT, shocks should be delivered promptly with minimal interruptions in chest compressions. The increased rates of ROSC associated with ACLS drug therapy have yet to be translated into long-term survival benefits.

However, improved quality of CPR, advances in post–cardiac arrest care, and improved overall implementation through comprehensive systems of care may provide a pathway to optimize the outcomes of cardiac arrest patients treated with ACLS interventions.

References

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Chest Injury

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About 25% of deaths due to trauma are result of thoracic trauma. Chest injuries may damage – 1) the rib cage, 2) the lungs, 3) the heart, or 4) the great vessels. Clinical assessment must establish which (if any) of the following is present-

1. A simple fracture of one or two ribs
2. Multiple fracture ribs or closed
3. Pneumothorax – open or closed
4. Hemothorax
5. Cardiac tamponade

IMPORTANT TO NOTE

1. Unconscious patient often have serious chest injuries.
2. Restlessness or confusion are initial signs of hypoxemia and must not be attributed to head injury until thoracic trauma is ruled out.
3. Small wounds may hide serious complications.
4. Pneumothorax can take many hours to develop, so repeated examination is necessary.

SUSPECT CHEST INJURY when there is

1. Direct/Indirect compression of the rib cage.
2. Acceleration/Deceleration injuries.
3. High velocity injuries.
4. Poly trauma victims.
5. Victims of mass disasters.
6. Stab injury / Suffocation.
7. Elderly patient
8. Intracranial injuries
9. Cervical spine injuries – Diaphragmatic breathing

SIGNS OF INADEQUATE VENTILATION

- Chest asymmetry – flail chest, Splinting and Rib cage
- Laboured breathing
- Tachypnoea
- Engorged neck veins
- Involvement of accessory muscles
- Decrease and absence of breath sounds
- ↓ SPO_2 ↑ $ETCO_2$

MANAGEMENT

- Management based on Initial assessment of the patient during the primary survey, assessment during the secondary survey and definitive care.
- Because hypoxia is the most serious feature of the chest injury, early interventions are designed to ensure that an adequate amount of oxygen is delivered from the Lung to the tissues.
- Immediately life threatening injuries are treated as quickly and as simply as possible.
- Most life threatening thoracic injuries are treated with an appropriately placed chest tube or needle.
- The secondary survey is guided by a high index of suspicion for specific injuries.

EXAMINATION:

- Look specially for airway obstruction, pneumo or hemothorax, lung contusion and flail chest.
- Inspect chest wall for any open wounds/bruises (which suggest a crushing injury).
- Note shape of the chest; a stove-in chest may show obvious asymmetry.
- Observe the respiration – whether in distress, restriction of movement in one side of the chest or paradoxical respiration as in flail chest.
- Palpate the trachea if it is deviated from the midline.
- Percussion and auscultation may reveal signs of pulmonary collapse, fluid in the chest and mediastinal shift.

INITIAL MEASURES:

- Ensure a reliable AIRWAY, restore mechanics of BREATHING and resuscitate the CIRCULATORY SYSTEM.
- Connect to a monitor – monitor respiration, SaO_2, BP.
- If SaO_2 is not maintained above 90%, start O_2 therapy and do an ABG (artery blood gases) analysis.
- Analgesics – Adequate analgesia by NSAIDS, TRAMADOL, but avoid respiratory depressants.
- Urgent chest x-ray – confirm the clinical diagnosis.

BREATHING WITH VENTILATION

When to ventilate

Hypoventilation

Flail chest

Diaphragmatic Injury

Spinal cord Injury

- GCS < 9

Metabolic

Hypoxia

Hypercapnoea

Hypothermia

SPECIFIC TREATMENT:

Open or Sucking Pneumothorax:

- Open wounds that communicate with the pleural cavity cause a sucking pneumothorax and lung collapse. The patient may soon die.
- The open wound must be sealed at once by an occlusive surface dressing endotracheal intubation and positive pressure ventilation may sometimes be necessary to save the patient.
- Once the patient survives the emergency, the wound should be properly stitched and ICWD (Intercostal water seal drainage) inserted that allows the lung to expand.

Tension Pneumothorax:

- A tension pneumothorax occurs when there is no open wound but there is a valvular leak of air into the pleural cavity from the injured lung. The condition is lethal and urgent treatment is required.
- Clinical sign and symptoms are increasing respiratory distress, reduced chest movement, absent breath sound and increased resonance on percussion.
- Even when suspected, do not wait for chest x-ray. A large bore needle (14 /16 Gauge) should be inserted into the second inter space anteriorly as emergency that immediately relieves the tension.
- The needle can be later replaced by ICWD in 4^{th} intercostals space that is retained until the lung re-expands.

Hemothorax:

- An accumulation of blood in the pleural effusion with reduced respiratory movement, absent breath sound, dull percussion note at lung base and chest X-ray reveals pleural opacity above that level of diaphragm.
- Put an ICWD through a lower interspace and measure the evacuated blood.
- Thoracotomy in indicated if from the intercostals tube.
    - Initial drainage is 1500 ml or more
    - 200ml or more blood/hr is drained for 4 hours or more
    - Continuous loss of 1000 ml/day for two consecutive days
    - Continuous brisk bleeding > 100ml/15minutes.

Flail Chest (Stove- In Chest):

- A flail chest develops when the chest has lost its mechanical rigidity due to multiple rib fractures both in front and behind. One segment of the rib cage becomes isolated and flails and can move paradoxically (i.e. Inwards on respiration, onwards on expiration). This results in inadequate ventilation of the lung and hypoxemia.
- The diagnosis is made from signs of fracture ribs, increasing dyspnea, paradoxical respiration and chest X-ray.
- O_2 should be administered and as a temporary measure the flail segment should be strapped.
- Serial ABG analysis to monitor progress.
- Severe cases with persistent hypoxemia need endotracheal intubation and intermittent positive pressure ventilation (IPPV).
- If ventilation is to be continued for several days, a tracheostomy is needed that also facilitates tracheobrochial toilet.
- The flail segment can be stabilized by rib traction or internal fixation.

Lung Contusion/Laceration:

- This is bruising and edema of the lung beneath chest wall trauma. The patient is breathless, apprehensive and cyanosed and coughing produces sputum tinged with blood.
- Chest X-ray shows progression of diffuse patchy opacities to a complete" white out". Blood gases show hypoxia & hypercapnia.
- Oxygen, adequate analgesic & physiotherapy help, but eventually need artificial ventilation.
- IV fluid must be carefully regulated to avoid aggravating the pulmonary edema. It is better to keep the patient relatively dehydrated with the help of diuretics.

Cardiac Tamponade:

- Clinical diagnosis: Hypotension, Venous distensions (↑JVP) & muffled heart sounds (Beck's triad.
- Chest X-ray may show classical globular heart.
- This is a life threatening condition. In hemodynamically unstable patient Pericardiocentesis by inserting a needle just under seventh costal cartilage and Paricardiostomy to the left of the xiphoid process should be done immediately under LA.
- Thoracotomy may be required - anterolateral or sternotomy.

Rib Fracture:

- Rule out underlying internal chest injury.
- Adequate analgesic to allow effective respiration – NSAIDS commonly.
- Breathing exercise and physiotherapy.
- Strapping is not recommended as it restricts normal chest expansion.

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Shock

Dr Biraj Saikia DA (RCA), MD,DNB,FFA(Ireland)

Definition: Shock is a physiologic state characterized by inadequate tissue perfusion and clinically manifested by hemodynamic disturbances and organ dysfunction.

Hemorrhage is the most common cause of shock after injury, and virtually all multiple injured patients have an element of hypovolumia. It is also "transition between life and death" because of failure to oxygenate & nourish the body adequately. Pathophysiologically there is an imbalance in oxygen supply and demand leading to activation of conversion from aerobic to anaerobic metabolism leading to appropriate and inappropriate metabolic and physiologic responses. At the cellular level, there is cell membrane ion pump dysfunction resulting in leakage of intracellular contents into the extracellular space and intracellular pH dysregulation. Ultimately it leads to cell death and end organ dysfunction, MSOF and death.

Physiology:

There are three stages of shock:

(1) Preshock (warm shock, compensated shock)
(2) Shock
(3) End organ dysfunction

(1) Compensated shock- there may be two phases-

   (a) Low preload shock – tachycardia, vasoconstriction, mildly decreased BP
   (b) Low after load (distributive) shock – peripheral vasodilatation, hyperdynamic state

(2) Shock will show initial signs of end organ dysfunction, Tachycardia, Tachypnea, Metabolic acidosis, Oliguria , cool and clammy skin

(3) End Organ Dysfunction-Progressive irreversible dysfunction, Oliguria or anuria, Progressive acidosis and decreased CO, Agitation, obtundation, and coma death.

Haemorrhagic Shock:

In trauma cases hypovolumic is the cause of shock unless proved otherwise. Mostly it is the result from decreased preload. To identify blood loss due to accidents or injuries, the dictum is "four in the body and one on the floor." The four major site of external or occult bleeding in the body are chest, abdomen, pelvis and limbs. Small bleeding from multiple lacerated injuries may result in significant blood loss visible on the trolley or floor. In the evaluation of shock it is to be remembered that heart rate and blood pressure responses can be variable and, therefore, no firm conclusion can be made by simply HR and BP readings.

Shock is classified into four stages depending upon the amount of blood loss, clinical signs.

Parameter	I	II	III	IV
Blood loss (ml)	<750	750–1500	1500-2000	>2000
Blood loss (%)	<15%	15–30%	30–40%	>40%
Pulse rate (beats/min)	<100	>100	>120	>140
Blood pressure	Normal	Decreased	Decreased	Decreased
Respiratory rate (bpm)	14–20	20–30	30–40	>35
Urine output (ml/hour)	>30	20–30	5–15	Negligible
CNS symptoms	Normal	Anxious	Confused	Lethargic

Evaluation of Shock:

(1) Done in parallel with treatment.

(2) H&P – helpful to distinguish type of shock

(3) Full laboratory evaluation (including H&H, cardiac enzymes, ABG)

(4) Basic studies – CXR, EKG, UA

(5) Basic monitoring – VS, UOP, CVP, A-line

(6) Imaging if appropriate – FAST, CT

(7) Echo vs. PA catheterization

(8) CO, PAS/PAD/PAW, SVR, SvO2

Management (1) Manage the emergency

(2) Determine the underlying cause

(3) Definitive management or support

(1) Management of Emergency:

(a) Control airway and breathing

(b) Maximize oxygen delivery

© Place lines, tubes, and monitors

(d) Get and run IVF on a pressure bag

(e) Get and run blood (if appropriate)

(f) Get and hang pressors

What Fluid:
(i) Several liters of crystalloids in adults

(ii) Three 20 cc/kg boluses in children

(iii) If still in shock after bolus start PRBC's at 5-10 cc/kg

(iv) Blood substitutes possibly in future but not currently advantageous

How to give the fluid:
(I) Fluid should be given in the cubital veins with one or two Large bore needles (size 16 or size 18).

(ii) In children if it is difficult to find a line, one should use intra Osseous route.

(2) Determination of site of bleeding: To identify blood loss due to accidents or injuries, the dictum is "four in the body and one on the floor." The four major site of external or occult bleeding in the body are chest, abdomen, Pelvis and limbs. Small bleeding from multiple lacerated injuries may result in significant blood loss visible on the trolley or floor.

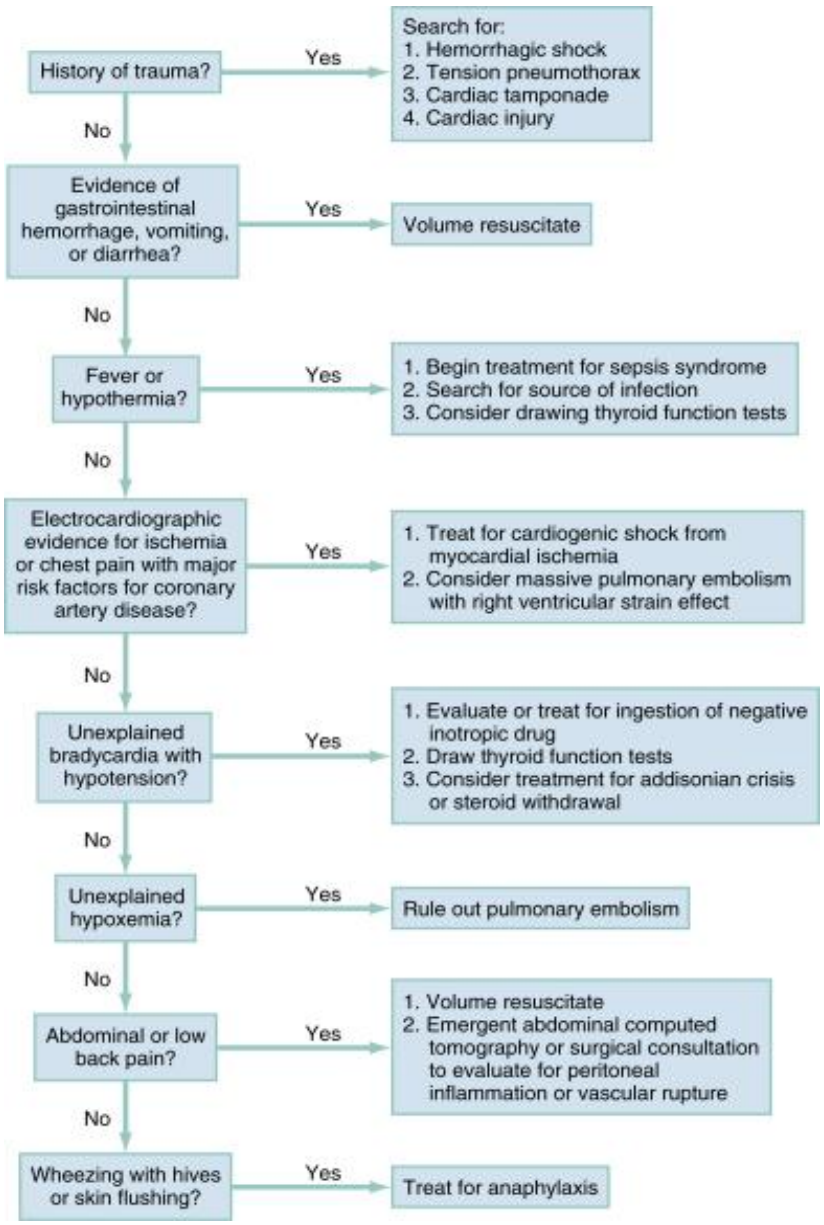
(3) Definitive Management:

(a) Hypovolumic – Fluid resuscitate (blood or crystalloid) and control ongoing loss

(b) Carcinogenic - Restore blood pressure (chemical and mechanical) and prevent ongoing cardiac death

(c) Distributive – Fluid resuscitate, pressors for maintenance, immediate abx/surgical control for infection, steroids for adrenocortical insufficiency.

Rosen's Flow diagram for management of Shock



Head Injury

Dr Shabbir Khan

Introduction:

Head injury is the leading cause of death in injured patients and most are due to Motor Vehicle Crash. Because every 15 seconds, a head injury occurs and patient dies of head injury every 12 minutes. By definition head injury defines an injury to the head and brain. The scalp, skull, meninges and the brain are the main constituents injury of which leads to alteration in the mechanism of cerebro spinal fluid, intra cranial pressure and tentorial compartments.

Classification of head injury:

(1) Based on mechanism of injury
(2) Based on morphology
(3) Based on severity of injury

Based on mechanism of injury:
Blunt head trauma,
Penetrating injury,
Gun shot.

Based on Morphology:
(A) Skull fractures
Vault
Linear or stellate
Depressed/Non depressed
Open/Closed
(B) Basilar
With/without CSF leak
With/without 7th Nerve Palsy.

© Intracranial lesions

Epidural hematoma
Subdural hematoma
Subarachnoid hemorrhage
Contusions
Intra cerebral hematoma
Diffuse brain injuries
Intraventricular haemorhage

Based on severity of Injury:
(A) Minor head injury (GCS 13-15)
(B) Moderate head injury (GCS 9-12)
© Severe head injury (GCS 3-8)

Assessment of head injury patient:

Brief history, initial assessment of ABC, assessment of vital signs, and neulogical examination are mandatory for head injury patients. Neurological examination must include level of consciousness, assessment of papillary function, and lateralized extremity weakness. It is very important to note that initial findings are only the reference with which to compare results of repeated neurological examination to determine whether a patient's condition is improving or detoriating.

Glasgow coma Scale: To be remembered or pasted at A&E for assessment of severity of head injury.

EYE RESPONSE (E)	Open Spontaneously	4
	Open to verbal command	3
	Open in response to pain	2
	No response	1
VERBAL RESPONSE (V)	Talking / Orientated	5
	Confused speech / Disorientated	4
	Inappropriate Words	3
	Incomprehensible sounds	2
	No response	1
MOTOR RESPONSE (M)	Obeys commands	6
	Localizes to pain	5
	Flexion / withdrawal	4
	Abnormal flexion	3
	Extension	2
	No response	1
	TOTAL	3-15

Special assessments:

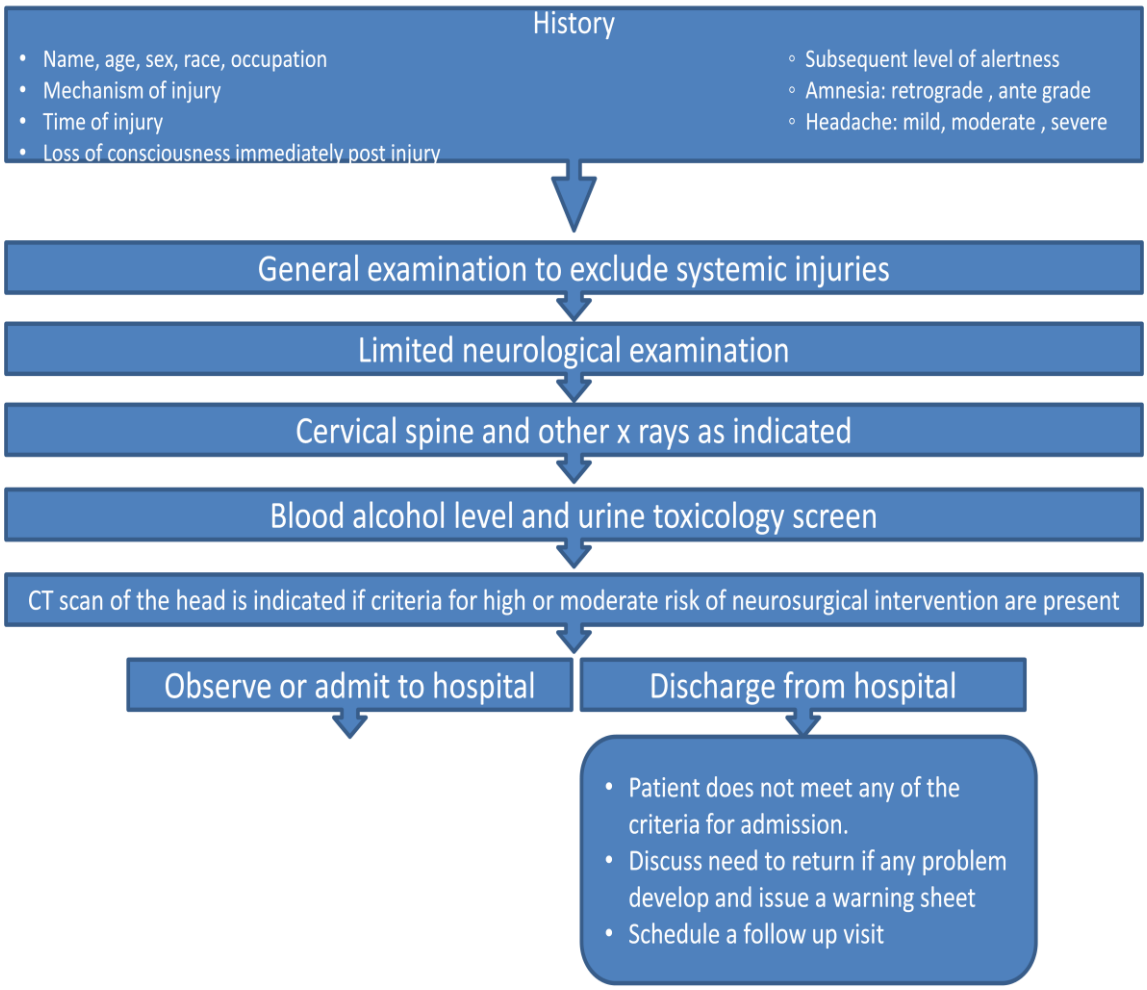
X ray skull and CT scan of brain are two vital radiological examinations. An unconscious patient should have skull x ray only if precise care of the cardio respiratory system and continuous assessment can be assured. In minor head injuries, skull x ray are now a day's rarely done because of limited information.

Head CT is required for patients with minor head injuries (i.e. witnessed loss of consciousness, definite amnesia, or witnessed disorientation in a patient with a GCS score of 13 to 15) and any of the following.

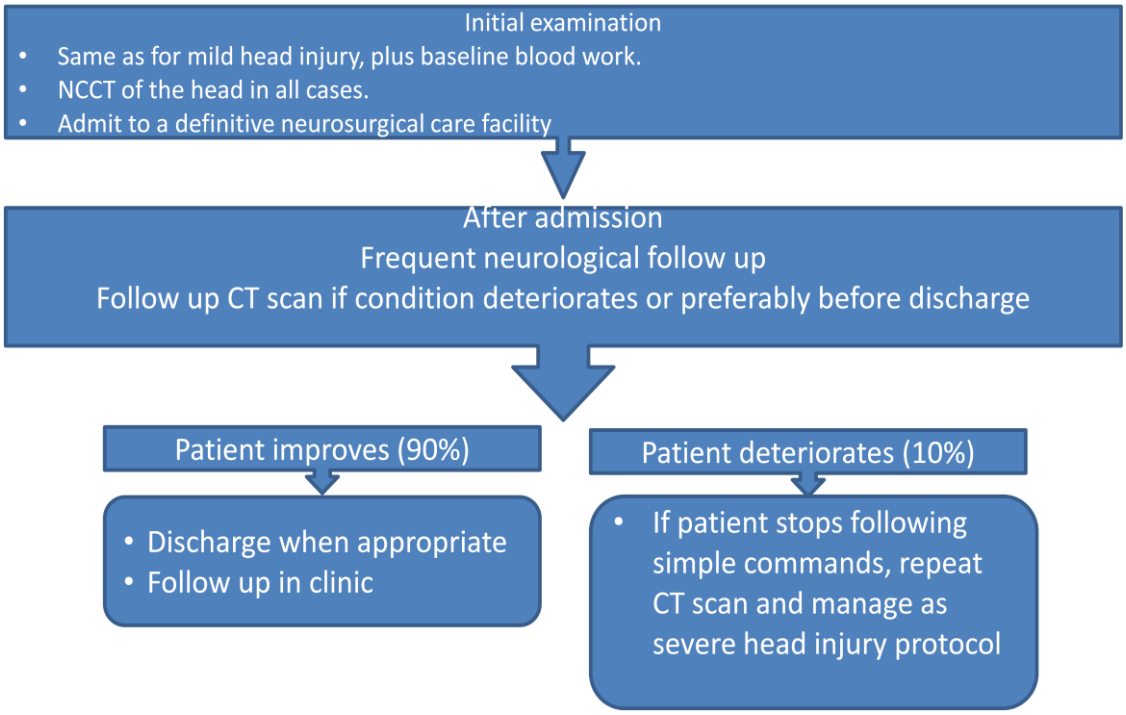
(A) GCS score less than 15 at 2 hrs after injury.
(B) Suspected open or depressed skull fracture.
© Any sign of basal skull fracture
(D) Vomiting (more than 2 episodes).
(E) Age greater than 65 years.
(F) Amnesia before impact (more than 30 minutes)
(G) Dangerous mechanism- fall from height, Motor vehicle accident.

Management of Head Injury:

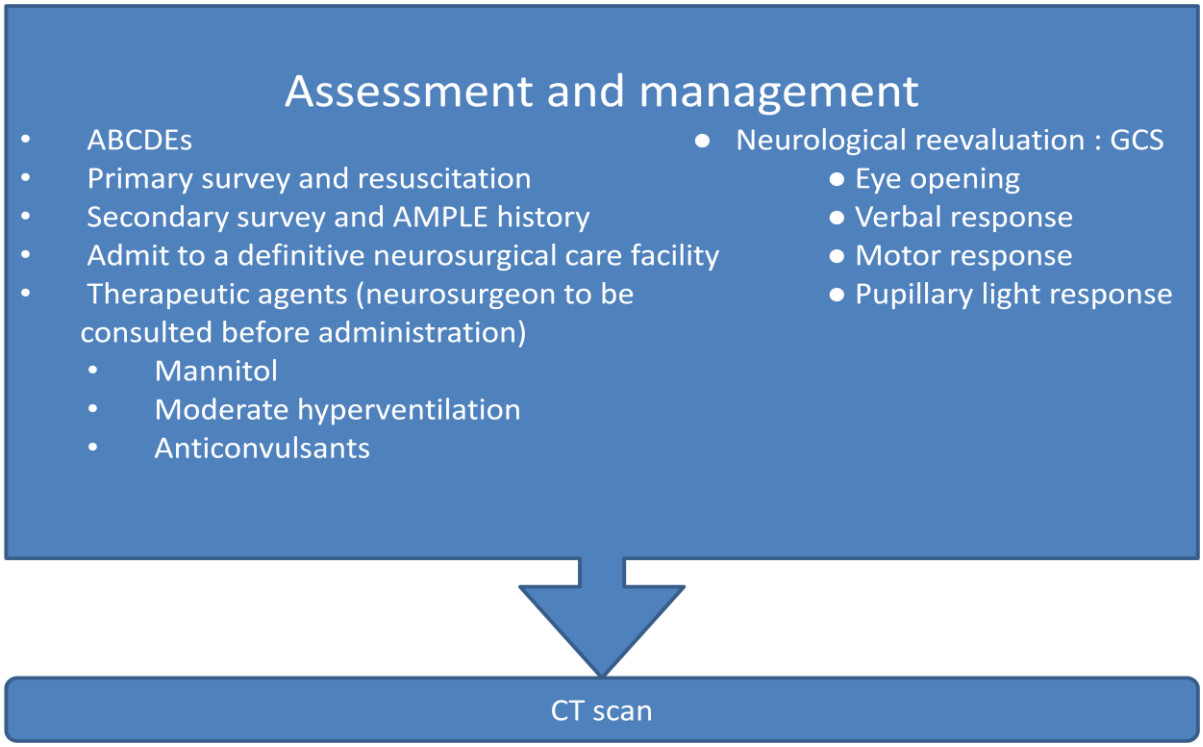
Minor head injury management



Moderate head injury management



Management of severe head injury



Surgical Management:

Scalp wound.
Depressed skull fractures.
Intracranial mass lesions.
Penetrating brain injuries.

Admission Criteria for Head Injury:

No CT scanner available
Abnormal CT scan
All penetrating head injuries
History of prolonged loss of consciousness
Deteriorating level of consciousness
Moderate or severe headache
Significant alcohol/drug intoxication
Skull fracture
CSF leak
Significant associated injuries
No reliable companion at home
Abnormal GCS (< 15)
Focal neurological deficits

Brain Dead:

Glasgow Coma Scale score = 3
Nonreactive pupils
Absent brainstem reflexes (e.g. oculocephalic, corneal, doll's eye)
No spontaneous ventilatory effort on formal apnea testing
EEG: No activity at high gain
CBF studies: No CBF
ICP: Exceeds MAP for 1 hour or longer
Cerebral angiography

References:

1. A Textbook of HEAD INJURY by A.K. Mahapatra & Raj Kamal
2. Advanced Trauma Life Support for Doctors by American College of Surgeons 8E.

Spinal Injury

Dr Shabbir Ahmed

Introduction:

Spinal injury is one of the most debilitating injuries that a person sustains. It should be always considered in any patients sustaining multiple injuries. Spinal injury can occur with or without neurological deficit. A vertebral column injury should be presumed and immobilization of the entire patient should be maintained until x rays are obtained and fractures and fracture dislocations are excluded. As long as patient is immobilized, clearance of the spine may be deferred safely especially in the presence of systemic instability like hypotension, respiratory inadequacy etc

Incidence

10 - 15 per million

18 - 35 years

Male - 3:1

RTA 51% - cars

Domestic 16%

Distribution:

55%- Cervical region,

15%- Thoracic,

15%- Thoracolumbar junction

15%- Lumbosacral area

Assessment of Spinal injury

General

Vertebral assessment

Neurologic assessment

Neurogenic and spine shock

Effect on other organ system

Radiological assessment

(a) General Assessment

Patient examination in supine position without any movement of the spine

The neck, trunk must not be flexed, extended and rotated.

The neck should be kept immobilized in semi rigid cervical collar in spine board with bolster splinting.

Total spinal examination is the goal- including the chest, pelvis and lower extremity.

(b) Vertebral Assessment

Palpate from occiput to sacrum in supine.

Log roll and visualize entire spine

Palpate for- Pain, tenderness and posterior step off deformity, ecchymosis, visible deformity, muscle spasm

(c) Neurologic Assessment

Motor strength and weakness

Sensory disturbances

Reflex changes

Bladder and Bowel control

Level of spinal injury may be difficult to determine. Neurological level is at the most lowest segment with normal motor & sensory function as most muscle efferents receive fibres from more than one level. Moreover, closed cord lesions may extend over several cms and dermatomes have imprecise boundaries. The spinal cord may have anterior cord syndrome, posterior cord syndrome or Brown Sequards syndrome depending upon the site of injury of the cord.

(d) Spinal Shock

Transient physiological reflex depression of cord function – 'concussion of spinal cord'

Loss anal tone, reflexes, autonomic control within 24-72hr

Flaccid paralysis bladder & bowel and sustained Priapism

Last even days till reflex neural arcs below the level recovers

(e) Effect on other organs

Lesions above C5 – damage to diaphragm leads to 20% reduction in vital capacity.

Lesions at D4-6 – reduces vital capacity if < 500ml patient is ventilated

Intercostal nerve paralysis

Atelectasis – poor cough

Reduced compliance of lung – muscle fatigue.

(f) Radiological assessment

X –RAY– cervical spine x ray should include from atlanto-occipital joint to T1 body.

CT of spine – preferred method to assess bony injury

MRI of spine – gives information about spinal cord status

Classification of Spinal Injuries:

Based on level of injury	Based on severity Of neurological deficit	Based on spinal cord syndromes	Based on morphology
Motor level	Incomplete paraplegia	Central cord syndrome	Fractures
Sensory level	Complete paraplegia	Central cord syndrome	Fracture/dislocation
Bony level of injury	Incomplete quadriplegia	Brown Sequard syndrome	SCIWORA
Neurological level of injury	Complete quadriplegia		Penetrating injuries
	Para/ Quadriparesis		

Management:

Assume cervical spine injury in all injured patient unless proven otherwise.

Assess after stabilization.

Immobilization to prevent injury aggravation.

Intravenous fluids.

Treat spinal shock – Vasopressors may be required.

Medications – Use of steroids is controversial.

Transfer to proper facility.

Definitive surgery.

Rehabilitation.

References:

1. Advanced Trauma Life Support for Doctors by American College of Surgeons 8E.

Management of Musculo skeletal Injury

Dr Utpal Kumar Tamuli MS (Ortho)

Introduction:

Though extremity injuries are not life threatening as such, but associated injuries can sometimes cause death of trauma victims. Sometimes extremity injuries may be part of poly trauma situations. Obvious and external bleeding, occult internal haemorrhage, severe pelvic fractures, bilateral femur fractures, multiple closed fractures, severe crush injury, open contaminated fractures traumatic proximal amputations, are some of the conditions that may be life threatening. Limb injuries produces not only fractures and dislocations, but it may also injure skin, muscle, ligaments, nerves and vessels Sometimes clostridial infections due to severe contaminated compound fractures may result deaths. It is, therefore, important to identify life or limb threatening extremity injuries and outline priorities and principles of initial management of these injuries.

Management protocol:

In the management of extremity injury, we must follow the ABCDE Protocol. In the primary survey the limbs are assessed only briskly for obvious bleeding that requires immediate control and to assess perfusion.

During the secondary survey, detailed evaluation of the extremities is performed. The priorities are:

(a) To assess perfusion
(b) Identify open wounds
(c) Identify closed wound, fractures, and joint injuries.
(d) Assessment of neuromuscular functions
(e) Identify abnormal joint movement.

Once the open fracture is inspected, it should be covered with sterile dressings and splinting is done. Radiographs are deferred to a later period when the patient is stable.

Systematic approach for extremity injury management:

(I) History
(II) Physical examination- Look, feel, move, stability.
(III) Assessment of vascular injury
(IV) Assessment of nerve injury
(V) Assessment of Open/Compound fracture
(VI) Assessment of compartment syndrome
(VII) Occult skeletal injury.
(VIII) Management.

History:

Any information obtained from the attendant, bystanders at the site of accident should be documented and included in medical record. Apart from AMPLE history (A- Allergy, M-Medication currently taken, P-Past illness, L-last meal, E-events related to injury), following information are important from management perspective.

(a) Time of injury
(b) Mode and nature of injury (RTA, Fall from height, sports injury)
(c) Magnitude of injury (High velocity, trivial injury)
(d) Site and severity of the pain arising out of injury.
(e) Any loss of functional activity (Inability to stand, move a joint)

Physical Examination:

Properly exposing the patient, the injured and uninjured extremity is to be examined physically to identify any life threatening, limb threatening or occult trauma.

(a) Look for colour/perfusion, wound, deformity or swelling.
(b) Feel for tenderness, warmth, distal pulsation, sensation, crepitation
(c) Move- Active, passive movement, abnormal movement.
(d) Pelvic stability- pelvic compression test to identify abnormal movement.

Assessment of Vascular Injury:

Vascular injuries may cause bleeding (may be life threatening) or ischemia (may be limb threatening). Amount of bleeding (Obvious or occult) may be difficult to assess. Blood loss from femoral shaft fracture may be 1-1.5 litre; from pelvic fracture may be 1.5-2 litres. Haemorrhage will lead to hypovolumic shock and should be treated as per guidelines given in Shock management. Vascular injuries should be suspected if there is

(a) Significant blunt/penetrating trauma close to a major vessel (Brachial artery near the neck, popliteal artery near the knee, Iliac artery near the pelvis)
(b) Brisk, external bleeding from a wound.
(c) Rapid and progressive swelling (haematoma) at the site of injury.

We should suspect acute arterial insufficiency in the presence of 5 P's:

(i) Pain- cramp like pain in the limb
(ii) Pallor- Pale or cold extremity.
(iii) Pulselessness- Loss of distal pulses.
(iv) Paraesthesia- Numbness/ tingling in the extremity
(v) Paralysis- Motor and sensory deficit.

Arteriography is valuable to identify arterial injury, its site, or any occult injury (incomplete intimal tear).

Assessment of Nerve Injury:

Assessment of nerve function is performed in cooperative patients by evaluating distal voluntary motor function and sensation. It is to be remembered that a significant nerve injury may be present with only partial loss of function; again, impaired sensation and muscle function may be due to arterial occlusion or compartment syndrome.

Table I- Peripheral nerve assessment of lower extremity

Nerve	Motor	Sensation
Femoral	Knee Extension	Anterior knee
Ole of foot	Hip adduction	Medial Thigh
Tibial	Toe flexion	Sole of foot
Superficial Peroneal	Ankle eversion	Lateral dorsum of foot
Deep Peroneal	Ankle dorsiflexion	Dorsal first to second toe web
Superior gluteal	Hip abduction	
Inferior gluteal	Hip extension	

Table II- Peripheral nerve assessment of upper extremity

Nerve	Motor	Sensation
Ulnar	Index finger abduction	Little finger
Median- distal	Thenar contraction with opposition	Index finger
Median- interosseous	Index tip flexion	
Musculocutaneous	Elbow flexion	Lateral forearm
Radial	Thumb extension/abduction	Dorsal web of thumb & index
Axillary	Shoulder abduction	Lateral shoulder

Assessment of Open/Compound fracture

A fracture is called an open fracture or compound fracture when there is a wound in continuity with the fracture. The skin over the fracture is breached and the fracture communicates with the exterior. The compound fracture may be within out when a sharp edge of a bone breaches the skin. In without in open fracture the direct injury (e.g. penetrating wound) breaks the skin and fractures the underlying bone. Open fractures have greater risk of development of infection (staphylococcal, anaerobic, or clostridial), wound and fracture healing, delayed vascular compromise, and compartment syndrome. There is another variety of open fracture called technically open fracture. Here the skin damage is minimal limited to a tiny puncture wound from which bead of blood oozes out. The bead of blood reappears as soon as it is swabbed. The risk of infection is comparatively less in within out open fractures compared to without in open fractures; however, sometimes tetanus and gas gangrene is seen in even technically open fractures.

Gustilo et al has classified open wounds as follows depending upon the severity:

Type	Injury characteristics
I	Clean wound less than 1 cm
II	Laceration more than 1 cm long, but without extensive soft tissue damage, skin flap or avulsion
III A	High velocity trauma; Extensive soft tissue laceration or flap but maintain adequate soft tissue coverage of bone; segmental or severely comminuted fractures even those with 1 cm laceration
IIIB	Open fractures with extensive soft tissue loss with periosteal stripping and bony exposure. Usually massively contaminated.
IIIC	Open fractures with arterial injury that require repair regardless of the size of the wound

More serious is the injury worst is the prognosis.

Assessment of compartment syndrome

Whenever the interstitial tissue pressure rises above that of capillary bed in a closed fascial compartment, local ischemia of nerve and muscle occurs and if untreated in time, permanent paralysis and/or necrosis may result. Usually one or two compartments of forearm or leg are involved but other spaces like thigh, foot or hand may also be affected.

Compartment syndrome may result over a period of few hours as a result of

(a) Crush injuries
(b) Closed or open fracture with soft tissue injuries
(c) Compression of extremity injury in comatose patient
(d) After restoration of blood flow to a previously ischemic limb.
(e) Prolonged period of inflated pneumatic anti shock garment (PASG)

One must suspect compartment syndrome when there is

(a) Pain typically increased by passively stressing involved muscle
(b) Decreased sensation of nerves traversing the involved compartment.
(c) Tensed swelling of the involved region
(d) Weakness/ paralysis of the involved muscle.
(e) Doubt about presence or absence of distal pulsation or capillary refilling.

Tissue pressure in the compartments can be measured with special instruments. Tissue pressure above 35-40 mm of mercury suggests impaired capillary blood flow. However, clinical evaluations of the above signs are more important than tissue pressure measurement. Whenever there is doubt, it is always safe to perform a fasciotomy to release the gradually increasing intra compartmental tissue pressure.

Associated and occult skeletal injury

Certain skeletal injuries may be missed in initial primary or secondary survey in poly trauma patients in an impaired conscious patient. Repeated examination of such patients may show some associated injuries which were missed earlier. Some examples are:

(i) Hip and pelvic injuries with femoral shaft fractures.
(ii) Vertebral fracture with calcaneal fracture in patients falling from height.
(iii) Femur or Tibia injuries associated with knee injuries (floating knee)
(iv) Fracture of radius or ulna shaft fracture with dislocation of superior or inferior radio ulnar joint.
(v) Cervical spine injuries in association with head trauma.
(vi) Fracture and dislocation of clavicle, scapula or proximal humerus are overlooked.

Radiology

Radiographs confirm presence of fractures and provide sound basis of planning for management and also for medico legal purposes. Some of the guidelines are

(i) Not to shift an unstable fracture to radiology department unattended. It is said that stable patient should go to radiology, and radiology should go to unstable patients (portable x ray)
(ii) In cases of poly trauma patients X ray Chest and Pelvis are mandatory.
(iii) Always ask for two views- AP and lateral. Oblique views in special circumstances.
(iv) Always include joint above and below in fractures of long bones.
(v) In elderly patients trivial injury may cause undisplaced fracture neck of femur. Ask for an X ray of pelvis.

Management of Musculo skeletal Injuries:

Basic aims of management of musculo skeletal injuries are

(a) to prevent further damage,
(b) to reduce pain,
(c) to make the patient feel comfortable
(d) to get medical aid as soon as possible.

Before definite care is instituted, following measures are to be taken

(i) Treatment of ABC (Airway, breathing and circulation)
(ii) Fractures often occur along with other injuries. Heavy bleeding is more urgent and requires higher priority care over a fracture.
(iii) If there is no danger to life then temporary attention to the fracture is often sufficient.
(iv) Handle the patient very gently. Avoid all unnecessary movement.

(v) If the broken ends of the bones show out, do not wash the wound or apply antiseptics to the end of the bone.
(vi) Do not handle the fracture unnecessarily
(vii) May attempt to reduce the fracture or to bring the bones to the normal position by simple pull; if painful, avoid pulling.
(viii) Stabilise and support the injured part so that no movement is possible. This stops further injury and helps to control the bleeding.
(ix) Immobilise the fracture area and the joints on both sides of the fracture site (above and below) by using bandages or by using splints wherever available.
(x) Applying direct pressure is one of the most effective ways of stopping severe bleeding in almost any part of the body.
(xi) Place the palm or fingers over the bleeding point and apply direct pressure.
(xii) The bleeding will usually stop after a while.
(xiii) With this method, there is also a slight risk of introducing germs into the wound. To prevent this, place a clean piece of material like lint or gauze over the wound before applying pressure.
(xiv) In case the bleeding continues, do not remove the original dressing, but apply some more bandages or dressing over the original one.
(xv) If ribbon or rope (tourniquet) is used, it should not be applied very tightly. Time must be noted. Tourniquet must be kept exposed.
(xvi) An injured body part should usually be splinted in the position in which it was found.
(xvii) Find something rigid to use as supports to make the splint such as sticks, boards, or even rolled up newspapers.
(xviii) If none can be found, use a rolled blanket or clothing. An injured body part can also be taped to an uninjured body part in order to prevent it from moving.
(xix) Extend the splint beyond the injured area in order to keep it from moving. In general, try to include the joint above and below the injury in the splint.
(xx) Do not try to remove the glass pieces, weapons or instruments. Doing such activities may produce profuse bleeding.

One should never attempt to do the following

(i) Give massage to affected area
(ii) Try to straighten the broken limb
(iii) Move the patient without support
(iv) Ask the patient to move on his own
(v) Move the joints above and below the fracture

Emergency management of open fractures:

The principles of management are to early wound debridement and cover, prevent infection and to stabilise the fractures. One should treat all open fractures as emergency. Proper clinical evaluation, radiographs are required. Other emergency measures include :

(i) Tetanus prophylaxis
(ii) Antibiotics- to cover gram positive, gram negative and anaerobes.
(iii) Local examination – type, size of the wound, neuro vascular status.
(iv) Photographic documentation- to avoid repeated examinations and legal purpose.
(v) Primary wound treatment with adequate normal saline and hydrogen peroxide.
(vi) Temporary stabilisation with POP slab or Splints.

Conclusions:

The extremity can sustain a variety of injuries from sprain to open fractures. Assessment and management of limb injuries, therefore, are part of secondary survey in poly trauma patients. However, it is essential to consider the blood loss and shock in these cases. Early recognition and management of arterial injuries, crush injuries, pelvic fractures, open fractures and compartment syndrome are keys to successful extremity injury management.

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Paediatric Trauma: an overview

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Pediatric trauma refers to a traumatic injury that happens to an infant, child or adolescent. Trauma is the most common cause of mortality and morbidity in pediatric population in many developed countries. In the USA, injury is the leading cause of death among children older than 1 year. For every child who dies from an injury, 40 others are hospitalized and 1120 are treated in emergency departments. In India, like many other developing countries, various infectious diseases still remain the number one killer in children. However, with improving health care and successful implementation of several national programs, death from such illnesses is gradually decreasing. The day is not far when trauma becomes the leading cause of death among children in our country as well.

Several factors influence childhood injuries, including age, sex, behavior, and environment. Of these, age and sex are the most important factors affecting the patterns of injury. Male children younger than 18 years have higher injury and mortality rates, perhaps in part because of their more aggressive behavior and exposure to contact sports. In the infant and toddler group, falls are a common cause of severe injury, whereas bicycle-related mishaps,along with motor bikes and vehicles are the main culprits for injury of older children and adolescents. Use of helmets results in fewer head injuries and decreases the severity of them as well.

Most pediatric trauma occurs as a result of blunt trauma, with penetrating injury accounting for 10-20% of all pediatric trauma admissions at most centers. Gunshot wounds are responsible for most penetrating injuries and carry a significantly higher mortality compared with blunt mechanism injuries.

A child's trauma differs from an adult's because of various factors:

- A child has smaller stature causing increased energy dissipation, which, coupled with closeness of organs to the body surface in a child results in multisystem injury[1].

- Children have shallow pelvis and hepatic recess, so abdominal organs are relatively unprotected by these bony structures[2].
- Increased pliability of child's bones causes decreased protection to underlying organs[3].
- Children have more surface area to body weight ratio and more likely to suffer from hypothermia[4].
- There is significant long term post traumatic psychological effects in children[5].

CNS Injuries

Among children, the CNS is the most commonly injured isolated system. Because CNS injury is the leading cause of death among injured children, it is the principal determinant of outcome.

In children aged 2 years or younger, physical abuse is the most common cause of serious head injury, whereas, falls and motor vehicle, bicycle, and pedestrian accidents are more common among children older than 3 years.

Diffuse injury of the brain is more common in children rather than focal space occupying lesions. An early CT scan may miss diffuse parenchymal injury.

The Glasgow Coma Scale (GCS) score is the universal tool for the rapid assessment of the consciousness level of injured children. The GCS score and its modified version (with scores of 3-15) are based on children's best response in 3 areas:

(1) motor activity,

(2) verbal response, and

(3) eye opening.

Assessment of traumatic brain injury:

i) Mild (GCS 13-15),

ii) Moderate (GCS 9-12), or

iii) Severe (GCS 3-8).

Regardless of the GCS score, a head CT scan should be performed on any child with a history of trauma and loss of consciousness longer than 5 minutes or an altered level of consciousness.

Prognosis of CNS injury:

Predictors of outcome after traumatic brain injury in the pediatric population have been noted to include initial GCS, pupillary reaction, and severity of findings on initial head CT scan.

Poor prognostic signs (Mortality 70-98%):

GCS score < 8,

Unilateral dilated pupil, and

Transcranial gunshot wound

Spinal cord injury:

The most common cause of spinal cord injury (SCI) in the pediatric population is motor vehicle collision, accounting for about 40%. The common cervical fracture usually involves the first 2 vertebrae. If it remains undetected, cervical fracture can result in devastating injuries.

Spinal cord injury without radiologic abnormality (SCIWORA) syndrome is a problem unique to the pediatric population. SCIWORA has been reported in 10-20% of children with SCI. The incompletely calcified vertebral column of the child may transiently deform and allow stretching of the cord or nerve roots with no residual anatomic evidence of injury.

Management of CNS trauma:

Injured children respond exceedingly well to preservation of cerebral oxygenation and perfusion. Therefore, management must focus on preservation of cerebral perfusion and elimination of potential detrimental effects of extracranial lesion. Judicious fluid resuscitation, precise ventilatory care, and careful titration of cerebral perfusion pressure are the keys to success.

Children with a mild head injury (GCS 14-15) with a history of transient loss of consciousness or amnesia of the events and normal findings on a head CT scan can be discharged and observed at home after at least 6 hours of uneventful observation in the pediatric emergency department.

In severe head injury, the goal of initial resuscitation must be to limit or prevent secondary brain injury by maximizing cerebral perfusion and oxygen delivery while minimizing increased intracranial pressure (ICP). Hypoxia and hypotension should be aggressively treated. ICP monitoring is recommended in infants and children with a GCS score of 8 or less. Current treatment of elevated ICP includes CSF drainage, sedation, neuromuscular blockade, mannitol, and hypertonic saline. Elevated ICP that is refractory to medical treatment may ultimately require decompressive craniectomy.

Thoracic Injuries

Thoracic injury is the second leading cause of death in pediatric trauma. Thoracic injury occurs in about 5% of children hospitalized for trauma. Blunt trauma, particularly from MVAs, is responsible for most thoracic injuries. The pediatric thorax has a greater cartilage content and incomplete ossification of the ribs. Due to the pliability of the pediatric rib cage and mediastinal mobility, significant intrathoracic injury may exist in the absence of external signs of trauma. Pulmonary contusion and pneumothorax are frequently present without rib fractures. Hemothorax and pneumothorax are the most common thoracic injuries from penetrating trauma.

Approximately 90% of blunt pediatric thoracic injuries can be managed conservatively or with tube thoracostomy. Severe pulmonary injury may require mechanical ventilation. Great vessel injury is rare. The diagnosis is suggested by a finding of widened mediastinum on plain film. Blunt cardiac injury is rare in children. Traumatic cardiac rupture is uniformly fatal. Traumatic cardiac contusion may result in arrhythmia, myocardial hypokinesis, and abnormal cardiac serum enzymes.

Traumatic diaphragmatic rupture occurs in about 1% of children with blunt chest trauma, with left-sided rupture being more common. Diagnosis is suggested with passage of a nasogastric tube noted to be in the chest on plain film.

Management:

- Immobilise fractured part
- Tube thoracostomy for pneumo, haemo or pyothorax
- Occluding dressing for penetrating wound
- Mechanical ventilation when child's respiratory effort is poor or in presence of contusion and flail chest.

Chest exploration is indicated for an immediate return of 20% of the patient's estimated blood volume or a continued output of 2 mL/kg/h.

Traumatic Asphyxia

Traumatic asphyxia is a unique injury in pediatric trauma because of the compliance of the chest wall. This injury is commonly the result of blunt compressing thoracic trauma, with sudden airway obstruction and abrupt retrograde high pressure in the superior vena cava. Patients with traumatic asphyxia have a dramatic physical presentation characterized by cervical and facial petechial hemorrhages or cyanosis associated with vascular engorgement and subconjunctival hemorrhage. Despite its dramatic presentation, this injury has a good prognosis.

Abdominal Injuries

Anatomical differences in children make them more vulnerable to major abdominal injuries with very minor forces. In children, the abdomen begins at the level of the nipple. Children's small, pliable rib cages and undeveloped abdominal muscles provide little protection of major organs. Solid organs (eg, spleen, liver, kidneys) are vulnerable to injury.

Blunt trauma is responsible for most intra-abdominal injuries. Injuries of solid organs predominate, particularly injuries of the spleen, followed by the liver and kidney. Fortunately, nonoperative management has a 90% success rate and has become the standard of care.

Suspect abdominal or thoracic injuries if:

- vital signs are unstable after adequate resuscitation
- Abdominal tenderness & distension is present ,presence of haematuria

Management:

- USG/ CT abdomen
- Peritoneal lavage with R/L @ 10ml/kg
- Plan surgery when bleeding continues or there is evidence of bowel perforation

Ocular Trauma

Half of pediatric eye injuries occur during sporting events. Significant morbidity may result from pediatric eye trauma because of the continued development of the visual system up to age 9 years. If a rupture of the globe is suspected, the examination should cease; the eye should be covered with a protective device, and urgent ophthalmologic consultation is indicated.

Prehospital Care

The survival of children who sustain major or life-threatening trauma depends upon good prehospital care, appropriate triage, resuscitation by an experienced trauma team in an emergency centre, and effective emergent surgery.

Caring for the injured child requires special knowledge, precise management, and scrupulous attention to details. All clinicians who are responsible for the care of a pediatric trauma patient, including paediatricians, emergency room doctors, paramedics, nurses and trauma surgeons, must be familiar with every tenet of modern trauma care. The special considerations, characteristics, and unique needs of injured children must also be recognized.

Doctors and Paramedics attending injured children at the site of trauma must be trained in rapid pediatric cardio-respiratory assessment, prompt establishment of airway and ventilation, oxygenation (breathing), and perfusion (circulation), as well as in stabilization and transport of injured or ill children to a tertiary care facility. Resuscitation should be tailored to each child and should begin in the field. Dedicate time in the field to securing the airway. Do not extend the time with multiple attempts to establish intravenous access. If direct transport to a designated pediatric trauma facility is not possible because of great

distance or a child's instability, take the child to the nearest emergency department for stabilization.

Initial Assessment and Resuscitation

The primary survey or initial phase of resuscitation should address life-threatening injuries that compromise oxygenation and circulation.

Priorities:

- Evaluation and maintenance of the child's ABCs,
- Disability – Take utmost care to prevent and minimize disability.
- Adequate exposure of the child for a quick assessment of injury.

Airway control is the first priority. Unlike in adults, the cause of childhood cardiac arrest is an initial respiratory arrest. A child's airway is anatomically different from an adult's. A child has a shorter neck, smaller and anterior larynx, floppy epiglottis, short trachea, and large tongue. If oral intubation is indicated, use the jaw-thrust maneuver to improve airway patency. All pediatric trauma patients must be assumed to have cervical spine injury until proven otherwise. If oral intubation is contraindicated in patients with severe maxillofacial or laryngotracheal trauma, then perform needle cricothyrotomy.

Once a patent airway is established, carefully assess the child's breathing. If respiration is inadequate, provide ventilatory assistance. Infants and small children are primarily diaphragmatic breathers; their ribs lack the rigidity and configuration present in adults.

Recognizing hypovolemic shock in pediatric trauma patients is essential to ensure a positive outcome. Tachycardia is usually the earliest measurable response to hypovolemia. Obvious signs of shock, such as hypotension or a decrease in urinary output, may not occur until more than 30% of blood volume has been lost. Make vascular access the next priority once adequate ABCs are established.

Initial fluid resuscitation should consist of warm isotonic crystalloid solution (Ringer lactate or isotonic sodium chloride solution) at a bolus of 20 mL/kg. The goals of the initial resuscitation should be to achieve hemodynamic normality and to restore adequate tissue perfusion as soon as possible. Children with evidence of hemorrhagic shock who fail to

response to fluid resuscitation should also receive blood (10 mL/kg) and be evaluated by a pediatric surgeon for possible operative intervention.

Once the primary survey has been completed, address the issue of pain control. Manage pain on a case-by-case basis. Pain relief can be provided with morphine (0.1 mg/kg) or a combination of fentanyl (1 mcg/kg) and midazolam (0.5-0.1 mg/kg).

The secondary survey involves a more detailed systemic evaluation and initiation of diagnostic studies.

Management

The management of pediatric trauma depends on a knowledge of the physiological, anatomical, and developmental differences in comparison to an adult patient[6]. The first ever pediatric trauma unit in the world was established at the King's Country Hospital Centre in Brooklyn, USA in 1962. Currently, 81 accredited pediatric trauma programs are going on in the USA alone.

Because of anatomical and physiological differences between children and adults the care and management of this population differs. For example, the internal organs are closer in proximity to each other in children than in adults; this places children at higher risk of traumatic injury[1].

A child's weight to surface area ratio is lower than an adult's, children more readily lose their body heat through radiation and have a higher risk of becoming hypothermic[2,3]. Smaller body size in children often makes them more prone to multiorgan injury[4].

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INITIAL ASSESSMENT & MANAGEMENT OF BURNS

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Introduction

Burns constitute a major cause of morbidity and morality . Attention to basic principles of initial trauma resuscitation and timely application of simple emergency measures should minimize the morbidity and mortality of these injuries.

These principles include a high index of suspicion for the presence of airway compromise in smoke inhalation of hemodynamic stability, and fluid and electrolyte balance. The Physician also must have an awareness of measures to be instituted for prevention and treatment of the potential complications of thermal injuries , eg, rhabdomyolysis and cardiac dysrhythmias, as seen in electrical burns. Removal from the injuries-provoking environment, cautious temperature control, and observation for definite demarcation of nonviable tissue before major debridement also constitute major principles of thermal injuries management

I. Immediate Life –saving Measures for Burn Injuries

A. Airway

Although the larynx protects the subglottic airway from direct thermal injuries , the supraglottic airway is extremely susceptible to obstruction as a result of exposure to heat. Signs of airway obstruction may not be obvious immediately , although if present , they may warn the examiner of potential airway injuries . The physician should be alert to the possibility of airway involvement, identify signs of distress, and initiate supportive measures. Clinical indications of inhalation injuries include:

1. Facial burns
2. Singeing of the eyebrows and nasal vibrissae
3. Carbon deposits and acute inflammatory change in the or pharynx
4. Carbonaceous sputum
5. History of impaired mentation and /or confinement in a burning environment
6. History of explosion

The presence of any of these findings suggests acute inhalation injuries. Such injuries requires immediate and definitive care including airway support, which may involve endotracheal intubation and early transfer to a burn center.

B . Stop the burning process

All clothing should be removed to stop the burning process. Synthetic fabrics ignite, burn rapidly at high temperatures, and melt into hot residue that continues to burn the patient. Any clothing with chemical involvement should be removed carefully. Chemical powders (dry) should be brushed from the wound, with the individual caring for the patient avoiding direct with the chemical. The involved body surface areas are then rinsed with copious amounts of water.

B. Intravenous lines

After establishing airway patency and indentify and treating immediately life threatening injuries, intravenous access must be established. Any patient with burns over more than 20% of the body surface area needs circulatory volume support. Large-caliber (at least # 16 gauge catheters) intravenous lines must be established immediately in a peripheral vein. If the extent of burn precludes placement of the catheter through unburned skin, overlying burned skin should not deter placement of the catheter in an accessible vein. The upper extremities are preferable to the lower extremities for venous access because of the high incidence of phlebitis and septic phlebitis in the saphenous veins. Begin infusion with Ringer's lactate solution. Guidelines for establishing the flow rate of Ringer's lactate solution are outlined later in this chapter.

Assessing the burn patient

A. A brief history of the nature of the injury may prove extremely valuable in the management of the burn patient. Associated injuries may be sustained while the victim attempts to escape the fire. Water heater explosions, propane gas may result in internal injuries or fractures, i.e. CNS, myocardial, pulmonary and abdominal injuries. It is essential that the time of the burn injury be established. The history, from the patient of relative, should include a brief survey of preexisting illness : (1) diabetes, (2) hypertension ,(3) cardiac, pulmonary and /or renal disease, and (4) drug therapy. Allergies and sensitivities also are important. The patient's tetanus immunization status also should be ascertained.

B. Body Surface Area

The "Rule of Nines" is a useful and practical guide to determine the extent of the burn. The adult body configuration is divided into anatomic regions the represent 9%, or multiple of 9%, of the total body surface. Body surface area differs considerably for children. The infant's of young child's head represents a larger proportion of the surface area, and the lower extremities a lesser proportion, than an aduld's. The percentage of total body surface of the infant's head is twice that of the normal adult. (See figure 1."Rule of Nines") Remember, the palm (not including the fingers) of the patient's hand represents approximately 1% of the patient's body surface. The guideline helps estimate the extent of burns or irregular outline or distribution.

C. Depth of burn

The depth of burn is important in evaluating the severity of the burn, planning for wound care, and predicting functional and cosmetic results. First- degree burns (eg, sunburn) are characterized by erythema, pain and the absence of blisters. The are not life threatening, and generally do not require intravenous fluid replacement. This type of burn will not be discussed further in this chapter.
Second-degree burns of partial-thickness burns are characterized by a red of mottled appearance with associated swelling and blister formation. The surface may have a weeping, wet appearance and is painfully hypersensitive, even to air current.
Full-thickness or third-degree burns appear dark and leathery. The skin also may appear translucent, mottled, or waxy white. The surface is painless and generally dry. (See Figure 2, Depth of burn)

II. Stabilizing the burn patient

A. Airway

Objective signs of airway injury or history of confinement in a burning environment dictates evaluation of the airway and definitive management. Pharyngeal thermal injuries may produce marked upper airway edema, and early maintenance of the airway is important. The clinical manifestation of inhalation injury may be subtle and frequently do not appear in the first 24 hours. If the physician waits for roentgeographic evidence of pulmonary injuries or change in blood gas determinations, airway edema may preclude intubation, and surgical airway may be required.

B. Breathing

Initial treatment of injuries is a graded response based on the patient's signs and symptoms. Major concerns regarding the respiratory status in the patient exposed to smoke and heat are:

1. Direct thermal injury, producing upper airway edema and /or obstruction
2. Inhalation of products of incomplete combustion(carbon particles) and toxic fumes, leading to chemical tracheobronchitis, edema, and pneumonia

Always assume carbon monoxide (CO) exposure in patients burned enclosed areas. Diagnosis of carbon monoxide poisoning is made primarily from a history of exposure. Cherry-red skin color is rare. Headache, nausea, vomiting, and mental disturbances occur at higher carbon monoxide levels. Because of the increased affinity of carbon monoxide for hemoglobin molecule and shifts the oxyhemoglobin dissociation curve monoxide to the left.

Carbon monoxide dissociates very slowly, and its half –life is 250 minutes while the patient is breathing room air, compared with 40 minutes while breathing 100% oxygen. Therefore, patients suspected of exposure to carbon monoxide should receive initially, high –flow oxygen via a nonrebreathing mask.

Early management of inhalation injury may require endotracheal intubation and mechanical ventilation. Arterial blood gas determinations should be obtained immediately as baseline for the evaluation of the pulmonary status. However, measurements of arterial PO2 do not reliably predict carbon monoxide poisoning, because a carbon monoxide partial pressure of only 1 mm Hg results in carboxyhemoglobin levels of 40% or greater. Therefore, baseline carboxyhemoglobin levels should be obtained, and 100% oxygen should be administered.

"Rule of Nine"

The "Rule of Nine" is used in the hospital management of severe burns to determine fluid replacement. It also useful as a practical guide for the evaluation of severe burns. The adult body is generally divided onto surface area of 9% each and/or fractions or multiples of 9%

Figure 1

Depth of Burn	Sign and Symptoms
Second –degree or Partial –thickness Burn Injury Second –degree burns are Deeper than first –degree Burns. They commonly result Contact with not Liquids or flash burns From Gasoline flames.	Red or mottled appearance Blistered and broken epidermis Considerable swelling Weeping, wet surface Painful Sensitive to air
Third –degree of **Full- thickness Burn Injury**	
Third –degree burns because damage to all skin layers, never endings and even subcutaneous tissues. They can be caused by fire prolonged exposure to hot liquids, contact with hot objects, or electricity. Initially, they may resemble second-degree burn injuries.	Pale, while, charred, or leathery appearance Broken skin with fat exposed Dry surface Painless and insensate Edema

C. Circulating Blood Volume

Evaluation of the circulating blood volume is often difficult in the severely burned patient. Blood pressure may be difficult to obtain and may unreliable. Monitoring hourly urinary outputs reliably assesses blood volume in the absence of osmotic dieresis (eg. Glycosuria). Therefore, an indwelling urethral catheter should be inserted. A good rule thumb is to infuse fluid at a rate sufficient to produce 1.0 ml of urine per kilogram body weight per hour for children, who weight 30 kilograms or less, and 30 to 50ml or urine per hour in the adult.

The burn patient required 20 to 4 ml of ringer's lactate solution per kilogram body weight per percent body surface burn in the first 24 hours to maintain an adequate circulating blood volume and provide adequate renal output. The estimated fluid volume is then proportioned in the following manner: one half of the total estimated fluid is provided in the first eight hours post burn, and the remaining one half is administered in the next 16 hours. To maintain an average urinary output of 1 ml per kilogram per hours in small children who weight 30 kilogram or less, it may be necessary to calculate and add glucose – containing fluids to the burn formula.

Any resuscitation formula provides only an estimate of fluid need.

Fluid requirement calculations for infusion rates based on the time from injuries, not from the time fluid resuscitation is initiated. The amount of fluid given should be adjusted according to the individual patients, i.e. urinary output, vital signs, and general condition.

D. **Physical Examination**

The following must be done In order to plan and direct patient management :

1. Estimate extent and depth of burn
2. Assess for associated injuries
3. Weight the patient

E. **Flow Sheet**

A flow sheet, outlining the patient's management, should be initiated when the patient is admitted to the emergency department. His flow sheet should accompany the patient when he transferred to the burn unit.

F. **Baseline Department Determinations for the Major Burn Patient**

1. **Blood**

Obtain samples for CBO, type and crosshatch, carboxyhemoglobin, serum glucose, electrolytes, and pregnancy test in all females of child-bearing age. Arterial blood samples also should be obtained for blood gas determinations.

2. **Roentgenograms**

A chest film should be obtained. An additional film may be required if end tracheal intubation and / or subclavian or internal jugular vein catheterization are accomplished. Other roentgenograms may be indicated for appraisal of associated injuries.

G. **Circumferential Extremity Burn- Maintenance of Peripheral Circulation.**

1. Remove all jewelry.

2. Assess the status of distal circulation, checking for cyanosis, impaired capillary refilling, or progressive neurologic sign(ie, parenthesis and deep tissue pain.)Assessment of peripheral pulses in burn patients is best performed with a Doppler Ultrasonic Flow Meter.

3. Circulatory embarrassment in circumferentially burned limb is best relieved by escharotomy, preferably with surgical consultation. Incision of the Escher to relieve edema pressure can be performed as an emergency procedure without anesthesia, because the incision is limited to insensate full-thickness burn. The incision must extend across the entire length of the Escher in the lateral and/or medial line of the limb including the joints. The incision is limited to nonviable tissue, and to limit blood loss, viable subeschar tissue should not be incised. Escharotomy of the fingers is rarely indicated and should be done only in consultation with an experienced burn surgeon.

4. Circumferential burns if the thorax may impair respiratory excursion. Bilateral, escharotomy incisions in the anterior auxiliary line should be considered if respiratory excursions are limited.

5. Fasciotomy is seldom required. However, it may be necessary to restore circulation for patients with associated skeletal trauma, crush injuries, high voltage electrical injuries, or burns involving tissue beneath the investing fascia.

H. **Nasogastric Tube Insertion**

Insert a nasogastric tube and attach it to suction if the patient experiences nausea, vomiting, and abdominal distention or if burns involve more than 20% of the total body surface area. Prior to transfer it is essential that a nasogastric tube be inserted and functioning in such patients.

I. Narcotics, Analgesic, and sedatives

The severely burned patient may be restless and anxious from hypoxemia of hypovolemia fluid administration, rather than to narcotic analgesics or sedatives that may mask the signs of hypoxemia or hypovolemia. Narcotics, analgesics, and sedatives should be used sparingly. If narcotics are necessary, the should be administered in small, frequent doses by the intravenous route only.

J. Wound Care

Partial-thickness (second- degree) burn are painful when air currents pass over the burned surface. Gently covering he burn with clean linen relieves the pain and deflects air currents. Do not break blisters or apply an antiseptic agent. Any applied medication must be removed before appropriate antibacterial topical agents can be applied. Application of cold compresses may cause hypothermia. Do not apply cold water to a patient with extensive burns.

K. Antibiotics

Prophylactic antibiotics are not indicated in the early post burn period. Antibiotics should be reserved for the treatment of infection.

III. Special Burn Requirements

A. Chemical Burns

Chemical injury can result from exposure to acids, or petroleum products. Alkali burn is generally more serious than acid burn, because the alkalis penetrate more deeply. Removal of the chemical and immediate attention to wound care is essential.

Chemical burn are influenced by the duration of contact, concentration of the chemical, ad amounts of water, using a shower of hose if available, for at least 20 to 30 minutes. Alkali Burn required longer irrigation. If dry power is still present on the skin, brush it away before irrigation with water. Neutralizing agents have no advantage over water ravage, because reaction with the neutralizing agent may itself produce heat and cause further tissue damage. Alkali burs to the eye require continuous irrigation during the first eight hours after the burn. A small caliber cannula can be fixed in the palpebral sulcus for such irrigation.

B. Electrical

Electrical burns results from of electrical power making contact with the patient's body Electrical burn frequently are more serious the they appear on the surface. The body may serve as volume conductor of electrical energy and the heat generated results in thermal injury of issue. Different rates of heat loss from superficial and deep tissues account for relatively normal overlying skin coexisting with deep muscle necrosis. Rhabdomyolysis result in myoglobin release, which can cause acute renal.

The immediate management of a patient with a significant electrical burn includes attention to the airway and breathing, establishment of an intravenous line, electrocardiographic monitoring, and placement of an indwelling urethral catheter. If the urine is dark, assume that hemochromogens are in the urine. Do not wait for laboratory confirmation before instituting therapy for myglobinuria. Fluid administration should be increased to ensure a urinary output of at least 100 ml per hour in the adult. If the pigment does not clear with increased fluid administration, 25 grams of mannitol should be administered immediately and 12.5 grams of mannitol should be added to subsequent liters of fluid in order t maintain the dieresis. Metabolic acidosis should be corrected by maintaining adequate perfusion and adding sodium bicarbonate to alkanize the increase the solubility of myoglobin in the urine.

IV .Criteria for Transfer

A. Types of Burn Injuries

The American Burn Association has identified the following types of burn injures that usually require referral to a burn center :

1. Partial –thickness and full thickness burns greater than 10% of the total body surface area (BSA) in patients under 10 years o over 50 years of age.
2. Partial –thickness and full-thickness burn than 20% BSA in other age group.
3. Partial –thickness and full thickness burns involving the vace, eye, ears, hands, feet, genitalia, or perineum or those that involve skin overly major joints.
4. Full- thickness burns greater than 5% BSA in any age group
5. Electrical burn, including lightening injury: (significant volumes of tissue beneath the surface may be injured and result in acute renal failure and other complications)
6. Significant chemical burns
7. Inhalation injury
8. Burn injury in patients with pre-existing illness that could complicate management, prolong recovery or affect mortality
9. Any burn patient in whom concomitant trauma poses an increased risk of morbidity may be treated initially in a trauma center until stable before transfer to a burn center.
10. Children with burns seen in hospital without qualified personnel or equipment for their car should be transferred to a burn center with these capabilities.
11. Burn injury in patients who will require special social and emotional of long term rehabilitative support, including cases involving suspected child abuse and neglect.

B. Transfer Procedure

1. Transfer of any patient must be coordinated with the burn-center physician.
2. All pertinent information regarding tests, temperature, pulse, fluids administered, and urinary output should be recorded on the burn/trauma flow sheet and sent with the patient. Any other information deemed important by the referring of receiving physician also is sent with the patient.

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Trauma in Pregnancy

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INTRODUCTION

Trauma in pregnancy is the leading non-obstetric cause of maternal death. Studies have shown that female drivers are likely to be involved in a RTA than male drivers. The incidence of assaults, domestic violence and homicide are also increased during pregnancy.

Trauma in pregnancy is unique as

- it involves two patients-a mother and the fetus
- it causes major anatomic and physiologic changes in nearly all organ systems

ANATOMIC AND PHYSIOLOGIC ALTERATIONS OF PREGNANCY

- After 12weeks of pregnancy, uterus rises out of the pelvis and becomes vulnerable to injury. However, the fetus is protected to a large extent by strong uterine musculature and cushioned by the amniotic fluid.
- At term, the uterus consists of a lot of elastic tissue whereas the placenta is devoid of it. this predisposes to sheer forces between the placenta and the uterine wall leading to abruption placentae.
- Direct trauma to the placenta or the uterus may reverse the normal protective hemostasis of pregnancy by releasing high concentration of placental thromboplastin or plasminogen activator from the myometrium
- After the 10^{th} week of pregnancy, cardiac output is increased by 1-1.5L/min. Vena caval compression in supine position may decrease cardiac output by 30-40% and hence the importance of left lateral position.
- Heart rate increases by15-20/min during the third trimester.
- Electrocardiographic changes – the axis may shift leftward by 15degrees. Flattened or inverted T waves in lead III, AVF and precordial leads may be normal. Ectopic beats are increased.
- At 34weeks of gestation, plasma volume increases by 40-50%. Therefore, a healthy pregnant woman may lose 30-35% of blood volume before exhibiting symptoms.
- WBC count may normally be as high as 20,000-25,000/cu.mm, especially in the third trimester.
- Serum fibrinogen and other clotting factors might be increased.

- Prothrombin and activated partial thromboplastin time may be shortened.
- Oxygen consumption is usually increased during pregnancy. Maintainence of adequate arterial oxygen saturation is therefore, particularly important in the resuscitation of the injured pregnant patient.
- Diaphragm is pushed up. Auscultation of breath sounds must be done in the axilla and the apices.
- Gastric emptying is prolonged.
- Glomerular filteration rate and renal plasma flow increases during pregnancy. Therefore, the levels of creatinine and BUN falls to half.
- Shock may cause necrosis of the anterior pituitary, resulting in pituitary insufficiency.
- Pelvic joint spaces is increased.

MECHANISM OF INJURY

Penetrating injury – The dense uterine musculature and the amniotic fluid protects the fetus to a considerable extent

Blunt injury – Seat belts decrease maternal injury and death by preventing ejection. However, the lap belt must be placed below the pregnancy bulge. Placement on the bulge causes the force to be directly transmitted to the fetus. Shoulder harness should be positioned in between both the breasts.

DIAGNOSIS AND MANAGEMENT

- The guiding principle is to treat the mother first. The best way to help the baby is to help the mother.
- Unless a spinal injury is suspected, the pregnant patient should be transported and evaluated on her left side. A 15degrees left lateral tilt is enough.

Primary survey

- Follow ABC.
- Administer supplemental oxygen and maintain oxygen saturation at 100%.
- Crystalloid fluid replacement and type specific blood should be administered as required. Vasopressors must be avoided as these might decrease uterine blood flow. The pregnant women may lose upto 35% of her blood volume before tachycardia, hypotension and other signs of hypovolumia occur. Thus the fetus may be in shock and deprived of perfusion even when the mother appears stable.
- Nasogastric decompression should be considered to avoid aspiration.

Secondary assessment

Secondary survey should follow the same pattern as in the non pregnant. First system physical examination is performed on the patient. This is also the first time that the fetus is assessed. Investigations are ordered during this time

Assessment should include a thorough abdominal examination including a obstetrical examination. A search for uterine irritability, tenderness and contraction, fetal heart sounds must be made. Fetal distress can occur without warning. In minor injuries 4hrs CTG(cardiotocography) must be considered. If any abnormality is detected, 24 hrs CTG is necessary.

A per vaginal examination to exclude the presence of amniotic fluid or blood in the vagina and for assessment of the cervix is an integral part of secondary survey.

RADIOLOGICAL PROCEDURES

All necessary x-rays should be obtained. The greatest risk of fetal radiation exposure is during the first trimester. A missed maternal injury is more likely to have a negative effect on the fetus than the judicious use of diagnostic x-ray. Care should be taken not to exceed five rads of radiation exposure at anytime. This is more important than the x-ray of lumbar spine, pelvis and hips are being performed. Abdominal trauma should be initially evaluated by ultrasound. If CT scan is required the spacing of cuts passing through the uterus should be increased to 1 cm.

MEDICATIONS

Safety of medications is a concern in pregnancy. The most common medications administered to a trauma patients are analgesics, antibiotics and tetanus toxoid. Analgesic like morphine and meperidine have been used for many years and posses a good safety profile. If necessary they can be reversed with naloxone. Second and third generation cephalosporines are safe and effective against the most common organisms encountered in a trauma situation. Tetanus toxoid and tetanus immune globulin are safe and should also be administered when required.

DEFINITIVE TREATMENT

In addition to the spectrum of injury in the non pregnant patient, trauma during pregnancy may cause apruptio placentae or fetal distress necessicitating emergency caesarean section. Trauma may also lead to uterine rupture or injury to other organs like liver and spleen requiring urgent laparotomy.

CONCLUSION

- Important and predictable anatomic and physiologic changes occur during pregnancy that may influence the evaluation and treatment of the injured pregnant patient.
- Vigorous fluid and blood replacement is given to correct the maternal as well as the fetal hypovolumic shock.
- A search of conditions unique to pregnancy like abruption, issoimmunization, PROM, amniotic fluid embolism must be made.
- Respect the golden hour.

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Modified Early Warning Score (MEWS)

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Trauma and Critical care specialist.

The Modified early warning score (MEWS) is a simple guide used by hospital nursing & medical staff as well as emergency medical services to quickly determine the degree of illness of a patient.

It is based on data derived from four physiological readings (systolic blood pressure, heart rate, respiratory rate, body temperature) and one observation (level of consciousness, AVPU). The resulting observations are compared to a normal range to generate a single composite score as follows---

MEWS:

	3	2	1	0	1	2	3
Pulse		< 40	41-50	51-100	101-110	111-130	> 130
Systolic BP mmHg	< 70	71-80	81-100	101-199		> 200	
Respiratory Rate		< 8		9 -14	15-20	21-29	> 30
Temp °C		< 35	35.1-36.5	36.6-37.4	> 37.5		
CNS				A	V	P	U

A score of five or more is statistically linked to increased likelihood of death or admission to an intensive care unit. A score of 5 or more is taken as a criterion for calling a Doctor to see the patient and warrants more close observation.

It is very useful particularly in situations where few staffs have to see a large number of patients so that the staffs can give more time and efforts to the neediest ones. Also it is of utmost importance in Emergency departments to quickly recognise the most seriously ill patients irrespective of the type of disease he is suffering from.

This score has been validated many times and presently being used by many advanced countries all over the world after some modifications.

Blast Injuries: Essential Facts

Dr Utpal Kumar Tamuli MS (Ortho), PGDDM

Explosive devices are a rather inexpensive and easy method for terrorists to trigger major disruptions to our everyday lives. Terrorists have used everything from a small backpack to large trucks and even commercial jet airliners to deliver the explosive agent. Injuries can vary from various forms of trauma and burns to amputations or even immediate death.

Blast devices

Car and truck bombs are very powerful weapons in the terrorist's arsenal, especially for suicide attacks. Terrorists also employ letter and parcel bombs, explosive and incendiary bombs, and a few groups are known to possess either rocket-propelled grenades (RPGs) or surface-to-air shoulder-fired missiles that can bring down civilian or military aircraft

Improvised explosive devices

Improvised explosive devices (IEDs) are handmade or improvised bombs used by terrorists. They can be made from stolen explosives, commercial blasting supplies or fertilizer, fuel oil, and other household ingredients. Often IEDs are packed with metal objects such as nails or ball bearings and could contain toxic chemicals or radiological materials (dirty bomb). Examples of IEDs are Pipe bombs, Molotov cocktail, Fertilizer bombs and barometric bombs.

Blast Physics

Blast injuries are the result of the rapid chemical conversion of a solid or liquid into highly pressurized gasses that expand rapidly and compress the surrounding air. This generates a pressure pulse, which spreads as a blast wave in all directions. The effects of the blast wave are more intense in a confined space like a building or bus. The shock wave is amplified as it is reflected off walls, floors, and the ceiling. If the blast occurs outside, the blast wave will dissipate rapidly. It is also affected by the medium through which it travels, i.e., air vs. water.

Classification

Explosives are categorized as high-order explosives (HE) or low-order explosives (LE).
HE produces a defining supersonic over-pressurization shock wave. Examples of HE include TNT, C-4, Semtex, nitroglycerin, dynamite, ammonium nitrate fuel oil (ANFO) and Triacetone triperoxide (TAPT).
LE creates a subsonic explosion and lack HE's over-pressurization wave. Examples of LE include pipe bombs, gunpowder, and most pure petroleum-based bombs such as Molotov cocktails or aircraft improvised as guided missiles.
HE and LE cause different injury patterns due to the presence or absence of the over-pressurization wave

Factors affecting severity of the blast
Distance is the most important factor. Intensity varies by the third power of the distance. Double the distance from the explosion and reduce the injury by a factor of eight. The most effective way to minimize injury from primary blast injury is to increase the distance from the center of the explosion (stand-off distance)

Other factors are magnitude of the blast, composition of the explosive e.g., presence of shrapnel or other material that can be propelled, radiological or biological contamination, environment of the blast— open space vs. closed space, underwater, urban, existence of protective barriers, structural collapse, available medical resources, triage efficiency

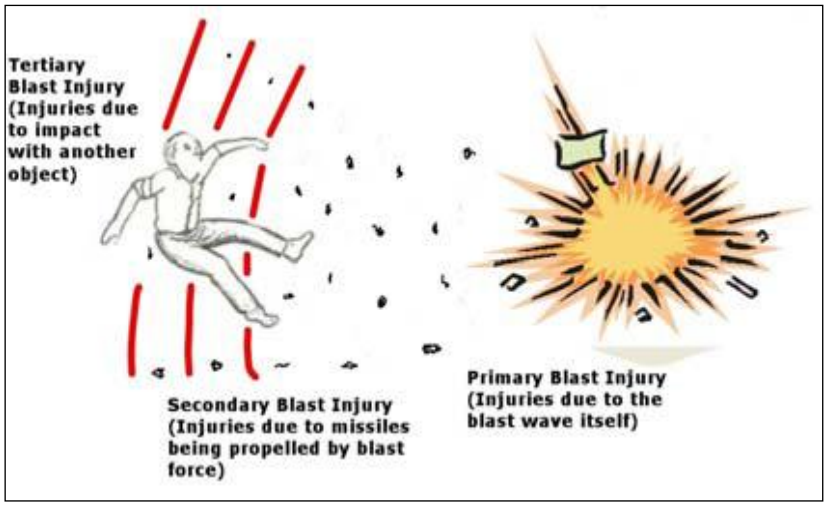
Classification of Blast Injury

1. Primary blast—unique to high-order explosives; results from the direct impact of the over-pressurization wave with body surfaces by the blast wave.

2. Secondary blast—results from flying debris and bomb fragments causing shrapnel wounds.

3. Tertiary blast—results from individuals being thrown by the blast wind.

4. Quaternary blast—all explosion-related injuries, illnesses, or diseases not due to primary, secondary, or tertiary mechanisms—includes exacerbation or complications of existing conditions



Common Primary Blast Injuries

Blunt trauma from over pressure wave is unique to high-order explosives and results in the impact of the over-pressurization wave with body surfaces, causing blunt force injuries and produces barotraumas.

Common Secondary Blast Injuries

The most common cause of death in a blast event is secondary blast injuries. These injuries are caused by flying debris generated by the explosion. Terrorists often add screws, nails, and other sharp objects to bombs to increase injuries.

Common tertiary blast injuries

Tertiary injuries result from individuals being thrown by the blast wind. The most common types of tertiary blast injuries are head injuries, skull fractures, and bone fractures.

Common Quaternary Blast Injuries

All explosion-related injuries, burn, illnesses, or diseases not due to primary, secondary, or tertiary mechanisms are considered quaternary blast injuries. This includes exacerbation or complications of existing conditions

Mechanisms of Blast Injury			
Category	**Characteristics**	**Body Part Affected**	**Types of Injuries**
Primary	Unique to HE, results from the impact of the over-pressurization wave with body surfaces.	Gas filled structures are most susceptible - lungs, GI tract, and middle ear.	Blast lung (pulmonary barotrauma) TM rupture and middle ear damage Abdominal hemorrhage and perforation - Globe (eye) rupture- Concussion (TBI without physical signs of head injury) Traumatic amputations
Secondary	Results from flying debris and bomb fragments.	Any body part may be affected.	Penetrating ballistic (fragmentation) or blunt injuries Eye penetration (can be occult)
Tertiary	Results from individuals being thrown by the blast wind.	Any body part may be affected.	Fracture and traumatic amputation Closed and open brain injury
Quaternary	All explosion-related injuries, illnesses, or diseases not due to primary, secondary, or tertiary mechanisms. Includes exacerbation or complications of existing conditions.	Any body part may be affected.	Burns (flash, partial, and full thickness) Crush injuries Closed and open brain injury Asthma, COPD, or other breathing problems from dust, smoke, or toxic fumes Angina, hypertension

Overview of Explosive-Related Injuries	
System	**Injury or Condition**
Auditory	TM rupture, ossicular disruption, cochlear damage, foreign body
Eye, Orbit, Face	Perforated globe, foreign body, air embolism, fractures
Respiratory	Blast lung, hemothorax, pneumothorax, pulmonary contusion and hemorrhage, A-V fistulas (source of air embolism), airway epithelial damage, aspiration pneumonitis, sepsis
Digestive	Bowel perforation, hemorrhage, ruptured liver or spleen, sepsis, mesenteric ischemia from air embolism
Circulatory	Cardiac contusion, myocardial infarction from air embolism, shock, vasovagal hypotension, peripheral vascular injury, air embolism-induced injury
CNS Injury	Concussion, closed and open brain injury, stroke, spinal cord injury, air embolism-induced injury

Common hazards

Common hazards that could be encountered in an explosive event may be secondary devices, shrapnel, building collapse/structural damage, air-borne contaminants, contaminated patients and scene/environment, perpetrators, terrorists as patients, victims with no soft tissue injuries, vehicles coming or leaving scene (out of place), people acting oddly, packages or containers at scene (out of place), vehicles not damaged or out of place, structural damage, weather

Health and Safety Information for the General Public

Immediately after the event

BE WARY OF SECONDARY DEVICES Device command detonated or timed to occur 30-100 minutes after the first device. The evacuation procedure in blast scene is “Scoop and go”. Help the victim to be moved as soon as possible and leave the site.

 If you or others have life-threatening injuries, such as severe bleeding, difficulty breathing, chest pain, or burns, provide or seek first aid and get help from officials or others at the scene.

 If you or someone else has minor injuries seek first aid as a first step until those more severely injured can be cared for first. If possible, go to a hospital that is not in the immediate area of the blast. Hospitals closest to the blast(s) will quickly become crowded.

 Listen to emergency officials at the scene. If no one is near you to give instructions and you are in the immediate area of the blast(s), leave as soon as you can.

 To keep safe, move away from the area. Avoid crowds, unattended cars and trucks, public transportation, and damaged buildings.

 Hospitals and roads will become crowded quickly, which can make it difficult for emergency workers to care for severely injured patients. If you have loved ones who are not with you, and who are not in the area of the blast(s), call and tell them to avoid driving to the area.

 Follow the instructions of local officials who are responding to this situation. Listen to the television news, radio, or Internet to stay informed.

 Inform individuals in the area not to rush to the site of the blast, as secondary attacks can occur. Instruct bystanders to move away from the area and to avoid crowds, unattended cars and trucks, public transportation, and damaged buildings.

 Bombs and explosions can cause unique patterns of injury seldom seen outside combat.

 Most injuries in a bombing are not life-threatening and are due to blunt and penetrating trauma from flying debris or bomb fragments.

 Primary blast injury to the lung may require complex ventilators, fluid, and support management.

 Wounds can be grossly contaminated. Consider tetanus status.

 Communication with bombing victims may be difficult, as they often experience ringing in the ears and/or sudden temporary (about 60-80%) or permanent hearing loss.

 Explosions in closed spaces, such as in subways or buses, or combined with a building or structural collapse, result in a greater number of severe injuries and deaths.

 Expect half of all initial casualties to seek medical care over a one-hour period.

 Those less injured go directly to the closest hospitals and arrive before the more severely injured.

 All bombing events have the potential for chemical and/or radiological contamination. Triage and life saving treatment should never be delayed because of the possibility of radioactive contamination of the victim. In general, the risk of exposure to caregivers is small.

 For those with injuries resulting in non intact skin or mucous membrane exposure, administer hepatitis B immunization (within 7 days) and age-appropriate tetanus toxoid vaccine (if not current).

Hours or days after the event

 Until authorities learn more about the situation, stay away from the area of the blast(s).

 Stay informed by turning to the radio, television, or Internet news for updated health and safety announcements during the immediate hours after the event.

 Even if the bomb or explosion doesn't cause physical injuries, it can cause fear, confusion, and uncertainty. It is normal to have strong feelings after such an event. You may feel sad, helpless, anxious, dazed, or even numb. These are all normal reactions to stress.

 There is no simple fix to make things better right away. But there are actions that can help you, your family, and your community heals. Try to:

Follow a normal routine as much as possible.
Eat healthy meals. Stay active.
Help other people in your community as a volunteer. Stay busy.
Accept help from family, friends, co-workers. Talk about your feelings with them.
Limit your time around the sights and sounds of what happened. Don't dwell on TV, radio, or newspaper reports on the tragedy.

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IMAGING IN TRAUMA

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There is always some confusion during imaging of a trauma patient. Many a times it has been observed that some unnecessary imaging modalities are asked for or unnecessary parts of the body are imaged.

In fact in a trauma patient of any kind we have to get the earliest diagnosis and treatment required not only to save the patient's life but also to save him from future disabilities.

Some of the main imaging procedures and its importance according to their priorities-

(1) CONVENTIONAL X-RAY

After more than one century of the invention of the X' Rays by Prof. Conrad Rontgen the use of conventional X-ray is still at large all over the globe.

Technical development has taken place in the recent years. Therefore time factor is minimized to get a diagnosis.

In conventional X-Ray First priority is the –

X-RAY CHEST PA/AP/SUPINE VIEWS.

Now what to see in a X-ray Chest.-

A- Airway- for F.B/extrinsic or intrinsic pressure effect etc.
B- Bone – for fracture/dislocation/displacement etc.
C- Cardiac size- cardiomegaly /pericardial effusion etc.
D- Diaphragm – for position/flattening etc.
E- Environment – e.g. soft tissue emphysema/ F.B soft tissue etc.

The X-ray chest evaluation is important because the Anesthesiologist will try his procedures in the ICU and OT wherever necessary.

X RAY PELVIS : AP VIEW

Things to be noted in a X-ray pelvis are any fractures/ dislocations soft tissue swellings and F.B. etc.

One can approximately estimate the amount of blood loss in fractures e.g.- fracture femur.

X RAY SKULL: AP AND LATERAL VIEWS.

There may be fractures/ F.B or scalp swelling in the X-ray skull. Both the basic views are taken.

However extent of brain trauma cannot be rule out in X-ray skull. We have to go for CT scan brain.

X-RAY CERVICAL SPINE : AP/LAT. VIEWS

Things to be noted in a X-ray cervical spine. –

A – Adequate visualization of the vertebrae (C1 –C7)/ alignment/ Airway visualization.

B - Bone e.g. – Fracture

C – Cartilage e.g. Disc spaces.

D – Dense (Atlanto- Odontoid distance)

E – Environment e.g. – Soft tissue/F.B/ NGT etc.

X RAY CV JUNCTION : (OPEN MOUTH/ LATERAL VIEWS)

This x-ray shows the position of the dense. Fracture and dislocation of the dense can be seen here. However MRI is the proper modality to see the cord compression by a fractured dense.

PLEASE REMEMBER CERVICAL SPINE X' RAY ARE NOT LIVE SAVING .SO DO NOT DELAY VITAL PROCEDURES OR SURGERIES.

Keep a cervical collar and investigate the cervical spine when patient is stabilized.

X RAY L.S. SPINE (AP/ LAT. VIEWS)/ X' RAY DORSAL SPINE (AP/LAT. VIEWS)

These X Rays are important to locate any fracture/ dislocation/ paravertebral soft tissue swelling by which severity of the trauma can be assess.

X RAY OF EXTREMITIES : AP/LAT VIEWS

Mainly fractures/ dislocations/ soft tissue swelling / soft tissue discontinuations / F.B are noted in these X' Rays to assess the severity of trauma and for future treatment.

(2) ULTRASONOGRAPHY :

In short it is known as FAST-

F – Focused

A – Abdominal.

S – Sonography

T – Trauma

Fast consists of focused views of the abdomen including the pericardium. It is a bed side quick USG screening.

ONLY OBJECTIVE IS TO DETECT FREE INTRAPERITONEAL FLUID.

The goal is not to determine the source of bleeding (e.g. rupture liver, spleen etc.) As it is difficult and unreliable in times.

If intraperitoneal fluid is detected mostly it is haemoperitoneum in a trauma patient. However needle aspiration is necessary at times to look for -

A – ascites
B – Intestinal fluid
C – urine

In FAST multiple views are taken. Standard areas are examined like -
Morison's pouch
Perisplenic space
Para colic spaces
Supra pubic view
Pericardium.

THERE ARE PITFALLS IN TRAUMA USG

The sensitivity for detection of free fluid varies between 80 – 98 %
It is operator dependent
Extremely obese patients and with extensive subcutaneous Emphysema are difficult to examine. May miss bowel injuries

COMMON MISTAKES WHEN PERFORMING FAST

Failure to do multiple view examinations.
Failure to consider other intraperitoneal fluid e.g. Ascites, intestinal fluid, urine.
Failure to do serial exams when the initial exam is negative.
Do serial exams when vital signs are changing.
Over dependent on USG
Please do clinical examination and other investigations e.g. vital signs, haematocrits, X rays.

(3) CT SCAN :

Well in case of head injuries non contrast CT scan of the brain is a must. Now a day most of the places are equipped with CT scan machines. We can evaluate the scan for – EDH/SDH/SAH/IVH/ICH/Fractures /scalp swelling etc. Severity of the trauma can be judged.
Accordingly we can get the CT scan of other body parts like, Thorax, Extremities, abdomen, CV Junction etc. which gives better diagnostic tools then conventional X' Rays.

In fact higher modalities of imaging like MRI, Angiography are done for different part of the body according to the need and availability.

CONCLUSION :

1. Priority of modalities is the most important key for imaging investigation in a trauma patient.
2. Send the stable patients to the imaging department.
3. Call the imaging department for the unstable patient e.g. (Portable X' Rays/Portable USG etc)
4. Please do not send unstable patients for X' Rays/ USG/CT scan or MRI without first securing the bleeding points/IV lines/Oxygen inhalation etc.

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DROWNING

Dr Brajendra Lahkar MD (Med)

Drowning is the process of experiencing respiratory impairment from submersion or immersion in liquid. Death occurs within 24 hours.

Near drowning is the survival of a drowning event, victim surviving beyond 24 hours. Victim may become unconscious or water inhalation can lead to serious secondary complications, including death, after the event.

According to the World Health Organization**,** drowning is the 3rd leading cause of injury death worldwide, accounting for 7% of all injury related deaths (est. 388,000 deaths by drowning in 2004, excluding those due to natural disasters.

Types of Drowning-

Dry Drowning: 10-20% of submersions are dry drowning. Laryngospasm usually occurs preventing air entry to lung. Victim dies of Hypoxia and they become unconsciousness early in the course.

Wet Drowning: Aspiration of water inside lung causes dilution of surfactant. It leads to atelectasis and diminished gas transfer.

Treatment- Prehospital Care:

1. Resuscitation of the victim as early as possible.

2. Removal from water with C-spine protection.

3. CPR to be started as soon as possible and should be continued for longer time.

Emergency Department:

Continue Resuscitative care

- Airway
- Oxygen
- Ventilation
- Warmed fluids
- Warming adjunts
- Treat associated injuries

If GCS >12 — Oxygen supplementation to be given to keep sat > 95%

Observe for 4-6 hours

If Pulmonary exam normal and Saturation is normal victim can be discharged.

If GCS >12 — Oxygen supplementation to be given to keep saturation > 95% and observe for 4-6 hours. If Pulmonary examinations are abnormal they usually requires hospitalization. They should be admitted to Monitored bed.

If GCS < 12 — Oxygen therapy to be started to keep saturation > 95%. Many patients may require mechanical ventilation to maintain oxygen saturation. Continuous monitoring is very important. Pulmonary examinations are usually abnormal. They are usually admitted to Monitored bed in ICU.

Management in Hospital

Supportive

Avoid ARDS

Pneumonia Care

Dopamine, epinephrine infusions are considered if victim is in shock

No Benefit of the following modalities of treatment in Drowning and near drowning –

1) Mannitol
2) Loop diuretics

2) Hypertonic saline
3) Fluid restriction
4) Hyperventilation
5) Controlled hypothermia
6) Barbiturate coma

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POST TRAUMATIC STRESS DISORDER

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Stress can be defined as a nonspecific response of the body to any demand. Many Physical stressors cause specific responses – heat causes sweating; cold produces shivering; they all make a demand on the body's adaptive functions to restore a state of normalcy. Similarly mental stressors [e.g. life events] also make a demand on our system to adapt. Because no two people are alike, the same stressor may affect different people differently, and they develop different types of reaction. For example, some people will withdraw, some will lash out, some will respond with humors, some feel dismay, some develop sleep problem, and some feel anxious. A stressor may be beyond a person's ability to cope and adapt, resulting in a stress related disorder.

Post Traumatic Disorder [PTSD] is a severe form of disorder where the stressor is so profound or unusual [e.g., bomb blast, earthquake, flood] in that stress is outside the range of human experiences, and is markedly distressing to anyone. The term PTSD is used when the reaction is characterized by recurrent intrusive dreams or recollections of the original stressful event, avoidance of reminders of the event, and symptoms indicating increased arousal like irritability, insomnia [not being able to sleep] or poor concentration lasting for more than a month.

PTSD is more frequent in young people because of the nature of precipitating situations. But among those exposed to such stressors very young and very old are more at risk. People with previous psychiatric disorder, single, divorced, widowed, socially isolated or those with low socioeconomic status are more at risk.

The reaction generally begins soon after the onset [acute onset], and most cases recover within 6 months. However the onset could be delayed in few cases and may persist for years. Associated symptoms can include aggression, violence, poor impulse control, depression and substance related disorders.

PREVALENCE: 1 to 3 % in general population

60 to 70% of people who have survived a major disaster

Signs and symptoms:

The disorder arises after an unusual and pervasive stress. The onset of symptoms could be soon after event or may be delayed up to six months or more. The typical symptoms are:

- Recurrent or intrusive re- experiencing of the traumatic event either in memory flash –back or dreams.
- Intense distress at exposure to events that resemble the original event.
- Efforts are made to avoid thoughts, feelings associated with the trauma.
- Partial or complete amnesia [memory loss] of the event.
- Feeling of numbness and detachment from other people and unresponsiveness to other people.
- Inability to feel pleasure.
- Increased arousal and hyper vigilance startle reaction
- Sleep problem.
- There may be depression or anxiety.

The occurrence and the severity of PSTD depend on:

- Severity of the stressor.
- Stressor's subjective meaning to the person

Individual vulnerability factors include:

- Abnormal personality traits such as borderline, paranoid, dependent or antisocial.
- Inadequate support system
- Genetic / constitutional vulnerability to psychiatric illness.
- Recent stressful life changes.
- Perception of an external controlling power.
- Recent excessive use of alcohol intake.
- People of younger and older age groups.
- More common in females.

This disorder is more likely to be associated with the following;

- People who had suffered from a mental illness or had behavioural problems in childhood.
- People with poor coping skills.
- Severity of the disaster and intensity of experience.
- Lack of timely support.
- Poor social support system.

The following factors tend to reduce the risk of this disorder:

- Male sex
- Previous experience with similar situations
- Good psychosocial adjustment
- Low anxiety
- Disaster training

Major situations which have resulted in PTSD are:

- Bomb blast
- Combat experience
- Concentration camps of Nazis
- Volcanic eruptions
- Train disaster
- Earthquakes
- Tsunami, cyclone, typhoon etc.
- Coal mine collapse

Management

Psychotherapy, which aims:

- To provide emotional support
- To encourage recall of traumatic event and express associated emotions to an understanding person
- To support and advise on coping strategies
- To encourage resumption of normal activities as soon as possible

Debriefing is carried out soon after the event, and this allows the individual to speak about the experiences and emotions associated with the event. The autonomic arousal symptoms [reaction to traumatic event] are reframed as normal reactions to an abnormal event, and thus attempt to prevent the development of the initial response pattern of the individual to “symptoms” and then into “disorder”.

Behavior Therapy: These are useful in preventing avoidance behaviour.

- Exposure desensitizes patients to intrusive memories by encouraging them to recall them either while they are relaxing or when they are anxious.
- Stress management including relaxation and cognitive approaches to coping with stress.

Other psychological methods:

- Cognitive therapy
- Hypnosis
- Group therapy [sharing and support from other group members]
- Family therapy [including marriage counselling]

Medication

- Anxiolytic drugs and few antidepressant drugs are helpful and well proven.

Course and prognosis

The less severe cases recover, especially when there is opportunity to talk about the traumatic events and to express emotion soon after the events have been experienced. 30% recover completely, 40% continue to have mild symptoms, while 10% remain unchanged or worsen.

Factors helping in good recovery:

- Rapid onset
- Short duration of symptoms[< 6 months]
- Good premorbid [prior to traumatic experience] functioning
- Strong social supports.

Although the patients may recover from the symptoms, an emotional scar might remain, which may have an ongoing impact or on the person‘s future functioning an adjustment to life.

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Car Crash Management

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Introduction

India suffers from the highest number of deaths - around 1, 10,000 in absolute terms annually- due to road accidents. According to the World Health Organisation this is due to poor infrastructure and dangerous driving habits. Poor road infrastructure, failure to comply with speed limits, growing drinking and driving habits, refusal to use proper motorcycle helmets, seat belts, child car restrain seats are some of the main factors contributing to deaths from road crashes, WHO said in its report on 'Decade of Action for Road Safety 2010-2011 “With growing middle class which is encouraged to buy new and latest vehicles, the youth- people aged between 15-29 years - have become the main victims of injuries.”As per Government reports in Assam a total of 2,342 persons lost their lives in road accidents in Assam during 2011 and another 6,505 persons were injured in road accidents last year. The highest number of deaths was reported from the Guwahati city metropolitan area where 296 people were killed in road accidents in 2011, followed by 236 in Nagaon district in central Assam. Similarly, 896 persons were injured in Guwahati last year, followed by 602 in Barpeta district of lower Assam and 573 in Nagaon.

Golden hour of trauma management

In the past there was little concept of awareness programme amongst public in the management of road side accidents.The golden hour refers to a time period lasting from a few minutes to several hours following traumatic injury being sustained by a casualty, during which there is the highest likelihood that prompt medical treatment will prevent death. It is well established that the patient's chances of survival are greatest if they receive care immediately after a severe injury.

The type of help needed by road traffic victims varies with the severity of their injuries. In cases of minor injury, patients will often not be hospitalized but will wish to seek the help of a traditional practitioner or at most a general practitioner.

Role of Bystanders

There is no doubt that lay bystanders can play a crucial role: They can take immediate action by protecting the site of accident and thus the victim, by using a fire extinguisher if the vehicle is on fire. When the victim is in a dangerous situation, bystanders could take any necessary action to prevent further collisions or damage. Lay bystanders need to be able to

recognize the most seriously injured victim that will need an urgent help; lay bystanders should be able to recognize unconsciousness and the signs of failing vital functions.

It is recommended that a description of the important steps to be taken by lay bystanders in the event of a road collision should be included in national Highway Codes and in car manufacturers' maintenance manuals.

The emergency telephone number of emergency services such as fire fighters, road safety commission and emergency medical service should be widely publicized and accessible.

Who and how should deliver the care

It is not possible that paramedics, a nurse or a mobile intensive care unit (MICU) be available to every road collision even in developed countries where emergency medical service system is well established. Here comes the role of general public who witness the accident. Here are some steps to be taken by bystanders.

(1) Safety experts. It is generally recommended to park the car safely out of the traffic lanes, and turn on the emergency flashers. Then warn on-coming traffic that there is an accident ahead by sending other bystanders to flag down traffic approaching the accident scene.
(2) An accident victim lying on the road is especially vulnerable. Nevertheless, it's usually best not to move him. Such victims can be protected from traffic by positioning vehicles on both sides, creating protective "barriers." Barrier vehicles should have their four-way flashers turned on.
(3) Emergency 108 ambulance services help—police 100, fire 101, should be called promptly. Ask several passing motorists, going in opposite directions, and bystanders, too, to call for help.
(4) Turn off the ignition switches of the vehicle involved in the accident to reduce the risk of fire.
(5) If the person inside is not moving or responding to the calls, and the car is closed by all windows, one window may be break open taking care not to injure the victim.
(6) If the accident victim is conscious, ask if he wants assistance. If he rejects an offer of help, for any reason, do not aid him." As difficult as it might be, wait for professional help to arrive.
(7) A large number of people hurt in traffic accidents have head injuries. If a person has a head injury, one should assume he also has neck and back injuries. The neck should always be protected.
(8) If an injury is obviously life threatening, and waiting for help would endanger a life, then necessary action probably should be taken. For instance, if a victim has stopped breathing, mouth-to-mouth resuscitation or CPR becomes vital. The CPR should be given by a person who has knowledge about that. It is, therefore, recommended that even the non medical personals also take trainings of basic first aid measures.

(9) You can do several "safe" things.
   (a) Cover a victim with a coat or blanket to keep him warm and to prevent shock.
   (b) Shade him from the sun or protect the victim from falling rain to make the victim more comfortable while waiting for the ambulance.
   (c) Talk to victims; reassure them help is on the way. Be encouraging.
   (d) Hold his hand while waiting for the ambulance. While this might not seem like much, it can do a lot for an injured person's sense of survival.
   (e) Use a clean cloth as a compress to stop the flow of blood from any bleeding wound.

(10) When it comes to saving a life, most people wouldn't even worry about legal liabilities.

(11) Traffic accidents are terrible things. They can be traumatic for victims and bystanders alike. Still, if you ever have to "take charge" at the scene of an accident, keep in mind that your primary job is to help protect the victims until professional help arrives--not treat their injuries.

(12) A customised emergency stretcher can be made by attaching a blanket, tarpaulin, or heavy coat to two sturdy poles or tree branches of trees. And at three people should be available to place the victim onto a litter. Follow these steps:

   (a) Each rescuer kneels on the knee closer to the victim's feet, gently sliding his arms under the victim's body.
   (b) When the rescuer in charge of the lift says, "Prepare to lift!" followed by the command, "Lift!" - The victim's body is supported on the rescuers' knees so that they can secure two locked grips.
   (c) The victim can then be lowered onto the improvised litter that has been placed by another rescuer below his supported body.
   (d) He or she must be transported to a place of safety until an ambulance arrives

An unconscious patient should never be carried by holding his hands and feet.

Conclusion

Our experience has proved that there are many courageous and noble people who want to help the trauma victims; but lack of proper knowledge of shifting from injured vehicles and transporting them to hospitals improperly may do rather harm to the victim. We shall appreciate if general population make an effort to learn the basic first aid procedures to handle trauma victims and be an able citizen of our country.

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INFECTION CONTROL IN EMERGENCY DEPARTMENT

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Nosocomial infections are defined as infections acquired during or as a result of hospitalization. Generally, a patient who develops an infection after 48 hours of hospitalization is considered to have a nosocomial infection. An ideal emergency ward should have an isolation room. All patients entering ED should be secondarily decontaminated in decontamination area.

Universal Precautions / Standard Principles:

Safe Handling and disposal of sharps

There is always a potential for injury when using needles, scalpels and other sharp

Instruments

Many blood-borne pathogens can be transmitted through sharps injury

- handle sharps with extreme care and without hurrying
- never remove, re-sheath, bend or break off used needles
- Dispose of used sharps promptly
- place used sharps in a sealed puncture-proof container

Handling Sharps-Do's

- Pass sharps in a tray
- Use needle cutters
- If needle cutter is not available, use 2% hypochlorite
- Remove cap of needle near the site of use
- Pick open needles from tray with forceps
- Discard your used sharps yourself.

Handling sharps-Don'ts

- Never pass sharps directly to next person
- Do not bend or break needles with hands
- Never test the fineness of needles tip before use-with bare/gloved hands
- Never pick open needle with hands

Universal precautions for sharp injuries

In case of a sharps injury:

- if possible, put the injured area low to the ground to promote bleeding
- Do not rub or squeeze.
- Wash the area well with soap and water
- Report and record the incident
- Follow the Hospital policy on the management of sharps injuries.

Management of blood spills (Splashes and drips):

- Wear gloves
- Cover spillage area with tissue paper or gauze piece.
- Soak the area with 0.1% sodium hypochlorite solution 2.5ml of sod.hypochlorite+97.5ml water=100ml solution.
- Allow contact period of 30mts.
- Discard tissue paper in yellow bin.
- Wipe the area with hypochlorite solution (same dilution).
- Routine mop.
- Wash hands.

Large spills:

- If <30ml, sprinkle the bleaching powder granules until the fluid is absorbed.
- If >30ml, cover the spillage with paper towel, pour hypochlorite solution 1:10 dilution.
- Leave the spill for 30mts.
- Follow same procedure as above.

Standard management protocol to be followed in occupational exposure to HIV, Hep B, and Hep C:

PROCEDURES:

1. Provide immediate care to the exposure site.

2. Determine risk associated with exposure

    a) Type of fluid(blood, visible body fluid or others)
    b) Type of exposure(i.e., percutaneous injury, mucous membrane)

3. Evaluate exposure source

    a) Test known sources for HBsAg, anti HCV and HIV antibody (by rapid testing)

4. Evaluate exposed person by assessing immune status for HBV infection (history of Hep B vaccination and vaccine response)

5. Give post exposure prophylaxis for exposures posing risk of infection:

    a) HBV: PEP with Hep.B immunoglobulin (HBIG) and/or Hep.B vaccine series.

    b) HCV: PEP not recommended.

    c) HIV: Initiate PEP as soon as possible (within an hour of exposure).

        Administer PEP for 4 weeks if tolerated.

    d) Perform follow up testing.

        Hep B vaccine policy:

        Dosage: 1ml for an adult.

        Method of administration: intramuscularly in the deltoid region.

        Schedule: at 0, 1 and 6mths.

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