**Initial Assessment and Management of the Trauma Patient**

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**I. Introduction**

Rapid assessment of injuries and institution of life-preserving therapy is vital to the treatment of a trauma patient and requires a systemic approach. Components of the initial assessment includes:

 1. Preparation

 2. Triage

 3. Primary survey (ABCDEs)

 4. Resuscitation

 5. Adjuncts to primary survey and resuscitation

 6. Secondary survey (head to toe evaluation and history)

 7. Adjuncts to secondary survey

 8. Continued postresuscitation monitoring and reevaluation

 9. Definitive care

The primary and secondary surveys should be repeated frequently to ascertain changes in patient’s status and to institute any additional treatment necessary to stabilize the patient.

**II. Preparation**

1. **Prehospital phase**: All events must be coordinated with the doctors at the receiving hospital to allow for mobilization of appropriate personnel and resources. Airway maintenance, control of external bleeding and shock, immobilization of the patient, and immediate transport to the closest appropriate facility with minimal on-scene time is vital. Emphasis should be placed on obtaining and reporting information needed for triage, i.e. time of injury, events related to the injury, mechanism of injury, and patient history.
2. **Inhospital phase**: Advanced planning with proper airway equipment, warmed IV crystalloid solutions, monitoring capabilities, and appropriate personnel (trauma team, laboratory and radiology staff) are essential for the trauma patient’s arrival. All personnel with direct patient contact should use standard precautions, i.e. facemask, eye protection, gowns, and gloves.

**III. Triage**

Patients are sorted based on the need for treatment and the available resources. In multiple casualties, patients with life-threatening problems and those sustaining multiple-system injuries are treated first. In mass casualties (patients number and severity exceed the capability of the facility and staff), patients with the greatest chance of survival and with the least expenditure of time, equipment, supplies, and personnel, are managed first.

**IV. Primary Survey and Resuscitation**

In the initial assessment and management of a severely injured patient, logical sequential treatment priorities must be established based on overall patient assessment. A systematic process constitutes the ABCDEs of trauma care and identifies life-threatening conditions by adhering to this sequence:

 **A** Airway maintenance with cervical spine protection

 **B** Breathing and ventilation

 **C** Circulation with hemorrhage control

 **D** Disability: Neurologic status

 **E** Exposure/Environmental control: undress the patient, but prevent hypothermia

**A – Airway Maintenance with Cervical Spine Protection**

Airway management is the first priority. Its primary objective is to diagnose an obstructed or potentially obstructed airway, to clear the obstruction and keep the airway patent. Assess it by determining the ability of air to pass unobstructed into the lungs. Critical findings include obstruction of the airway due to direct injury, edema, or foreign bodies and the inability to protect the airway because of a depressed level of consciousness. Treatment may include:

* Secretion control with suctioning
* Chin lift, jaw thrust (simultaneously with in-line stabilization of the head and neck)
* Oral or nasal airway
* Bag valve mask
* Endotracheal intubation, RSI (Rapid Sequence Intubation)
* Difficult airway assessment
	+ LMA (laryngeal mask airway)
	+ LTA (laryngeal tube airway)
	+ Bougie
	+ Glidescope
* Surgical airway (cricothyroidotomy or tracheostomy)

Clearance of the cervical spine from serious injury involves careful clinical assessment, with or without radiologic imaging. If the patient is obtunded, assume there is a cervical spine injury until proven otherwise. Whenever possible, use of a two-person spinal stabilization technique is suggested in which one provider devotes undivided attention to maintaining in-line immobilization and preventing excessive movement of the cervical spine while the other manages the airway. In patients with blunt trauma and patients with an unknown mechanism of injury (eg. "found down"), observe full spine precautions until injury to the spinal column is excluded.

**B – Breathing and Ventilation**

Evaluate the breathing to determine patient’s ability to ventilate and oxygenate. Begin with 100% oxygen, and monitor oxygen saturation. Then auscultate for breath sounds and inspect thorax and neck for:

* absent or asymmetric breath sounds (consistent with either pneumothorax or endotracheal tube malposition)
* deviated trachea (suggesting tension pneumothorax)
* hyperresonance or dullness to chest percussion (suggesting tension pneumothorax or hemothorax)
* crepitus over chest or neck
* gross chest wall instability or defects that compromise ventilation (eg, flail chest, sucking chest wound)

Treat suspected tension pneumothorax with immediate needle decompression followed by tube thoracostomy. For hemothorax or a sucking chest wound, treat with tube thoracostomy. Initial treatment for a flail chest is mechanical ventilation.

**C – Circulation with Hemorrhage Control**

Evaluate the circulation by assessing for blood volume and cardiac output. Look at level of consciousness, skin color, radial/femoral/carotid pulses, and blood pressure. Initiate treatment of hypovolemia by rapidly infusing warm crystalloid solution via 2 large-bore, peripheral IV catheters. Place them preferentially in the upper extremities and consider central venous access, venous cutdowns, or intraosseous insertion if peripheral sites are unavailable. Aggressive and continued volume resuscitation is not a substitute for manual or operative control of hemorrhage.

Identify external hemorrhage and control by direct manual pressure on the wound. Pneumatic splinting devices may help control hemorrhage.

Inspect neck veins for distension or collapse, determine whether heart tones are audible by auscultation, and use ultrasound examination to identify severe injuries. The extended focused assessment with sonography for trauma (EFAST) examination is rapid and effective for the identification of major intrathoracic and intraperitoneal bleeding as the source of hypotension or shock. The EFAST examination is a screening tool used simultaneously during the primary survey and should be performed as an extension of the physical exam. Refer to the EFAST section for details in performing the assessment.

**D – Disability (Neurologic Evaluation)**

Perform screening neurologic and mental status examination to determine whether a serious head or spinal cord injury exists. Assess:

* Orientation, level of consciousness
* Pupil size and reactivity
* Lateralizing signs and spinal cord injury level

**Glasgow Coma Scale**: is a quick, simple method for determining the level of consciousness.

|  |  |  |  |
| --- | --- | --- | --- |
| ***Points*** | ***Eye Opening***  | ***Best Verbal*** | ***Best Motor***  |
| 6 | ------------- | ----------------- | Obeys commands  |
| 5 | ------------ | Oriented | Localizes pain |
| 4 | Spontaneous | Confused conversation | Withdraws to pain |
| 3 | To speech  | Inappropriate words | Flexion (decorticate) |
| 2 | To pain | Incomprehensible sounds | Extension (decerebrate) |
| 1 | None | None | None (flaccid) |

Lowest score 3/15, Highest score 15/15. Normal GCS does not exclude the presence of a traumatic brain injury. In intubated patients, best verbal is 1T.

Exam abnormalities may suggest impending herniation of the cerebrum through the tentorial incisura due to an expanding intracranial mass or diffuse cerebral edema. Treatments for elevated ICP include administration of IV mannitol, hypertonic saline, sedatives, and paralytics, after the establishment of a definitive airway. Consider measurement of capillary blood glucose level in patients with altered mental status.

**E – Exposure/Environmental Control**

The final step in the primary survey includes patient exposure and control of the immediate environment. Completely remove patient clothes for a thorough physical examination. Look for:

* Lacerations, abrasions, contusions
* Burns
* Toxic exposures
* Open fractures, deformities

Inspect patient’s front and back by performing a log roll. Palpate the spinous processes of the thoracic and lumbar spine for tenderness or deformity, and then carefully log-roll the patient back to a neutral position. Initiate treatment to prevent hypothermia with the administration of warmed IV fluids and blankets.

**V. Adjuncts to Primary Survey and Resuscitation**

1. **Electrocardiographic Monitoring**: Blunt cardiac injury may present with dysrhythmias, including tachycardia, atrial fibrillation, premature ventricular contractions, and ST segment changes. Pulseless electrical activity (PEA) may indicate cardiac tamponade, tension pneumothorax, and/or profound hypovolemia. Hypoxia and hypoperfusion may also produce bradycardia, aberrant conduction, and premature beats.
2. **Urinary and Gastric Catheters**: Urinary output is a sensitive indicator of the patient’s volume status and reflects renal perfusion. Transurethral bladder catheterization is contraindicated in urethral injury, which should be suspected if there is blood at the meatus, perineal ecchymosis, high-riding or nonpalpable prostate or pelvic fracture. Gastric tube is indicated to reduce stomach distention and decrease the risk of aspiration.
3. **Monitoring**: Adequate resuscitation is best assessed by improvement in physiologic parameters, ie, pulse rate, blood pressure, pulse pressure, ventilatory rate, arterial blood gas analysis, body temperature and urinary output.
4. **X-rays and Diagnostic Studies**: Portable chest and pelvic x-rays may detect potentially life-threatening injuries that require immediate treatment. Diagnostic peritoneal lavage (DPL) and EFAST are useful tools for quick detection of occult intrathoracic and intraabdominal bleeding and may indicate need for operative control of hemorrhage.

**VI. Secondary Survey**

The secondary survey is a rapid but thorough head-to-toe examination for other injuries. Do not start the secondary survey until the primary survey (ABCDEs) is completed, resuscitative efforts are well established, and the patient is demonstrating normalization of vital functions. After reviewing vital signs, then review the patient's history, including reports from prehospital personnel and from family members or other victims. The **AMPLE** history is useful for this purpose: **A**llergies, **M**edications, **P**ast illness/**P**regnancy, **L**ast meal, **E**vents/**E**nvironment related to the injury.

The dictum "fingers or tubes in every orifice" guides this examination. Examine each region of the body for signs of injury, bony instability, and tenderness to palpation.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Physical Exam*** | ***Identifies*** | ***Assess*** | ***Finding*** | ***Confirm By*** |
| Level of consciousness | Severity of head injury | GCS score | ≤ 8, Severe 9-12, Moderate13-15, Minor | CT scan |
| Head | Scalp injurySkull injury | Inspect for lacerations and skull fracturePalpable defects | Scalp lacerationDepressed skull Basilar skull fracture | CT scan |
| Pupils | Type of head injuryPresence of eye injury | SizeShape Reactivity | Mass effectDiffuse brain injuryOphthalmic injury | CT scan |
| Maxillofacial | Soft-tissue injuryBone injuryNerve injuryTeeth/mouth injury | Visual deformityMalocclusionPalpation for crepitus | Facial fracturesSoft-tissue injury | Facial bone x-rayCT scan of facial bones |
| Neck | Laryngeal injuryC-spine injuryVascular injuryEsophageal injuryNeurologic deficit | Visual inspectionPalpationAuscultation | Laryngeal deformitySubcutaneous emphysemaHematoma BruitPlatysmal penetrationTender c-spine | C-spine x-rayCT scan c-spineAngiography/ Duplex examEsophagoscopyLaryngoscopy |
| Thorax | Thoracic wall injurySubcutaneous emphysemaPneumo/hemo-thoraxBronchial injuryPulmonary contusionThoracic aortic disruption | Visual inspectionPalpationAuscultation | Bruising, deformity or paradoxical motionChest wall & mediastinal tenderness & crepitusDiminished breath soundsMuffled heart tonesSevere back pain | Chest x-rayCT scanAngiographyBronchoscopyTube thoracostomyPericardiocentesisThoracotomyTransesosphageal ultrasound |
| Abdomen/ Flank | Abdominal wall injuryIntraperitoneal injuryRetroperitoneal injury | Visual inspectionPalpationAuscultationDetermine path of penetration | Abdominal wall pain/tendernessPeritoneal irritationVisceral injuryRetroperitoneal organ injury | DPL/UltrasoundCT scanContrast GI x-ray studiesAngiography |
| Pelvis | CU tract injuriesPelvic fractures | Palpate pubis symphysis for wideningPalpate pelvis Check pelvic stability only onceExam perineumRectal/vaginal exam | GU tract injury(Hematuria)Pelvic fracturesRectal, vaginal and/or perineal injury | Pelvic x-rayGU contrast studiesUrethrogramCystogramIVPCT scan |
| Spinal Cord | Cranial injuryCord injuryPeripheral nerve injury | Motor responsePain response | Unilateral cranial mass effectQuadriplegiaParaplegiaNerve root injury | Plain spine x-raysMRI |
| Vertebral Column | Column injuryVertebral instabilityNerve injury | Verbal response to pain, lateralizing signsPalpate for tendernessDeformity | Fracture vs. dislocation | Plain x-raysCT scan |
| Extremities | Soft tissue injuryBony deformitiesJoint abnormalitiesNeurovascular defects | Visual inspectionPalpation | Swelling, bruising, pallorMalalignmentPain, tenderness, crepitusDiminished pulsesTense muscular compartmentsNeurologic deficits | Specific x-raysDoppler examCompartment pressuresABI (Ankle-Brachial Index)Angiography |

**VII. Adjuncts to the Secondary Survey**

Specialized diagnostic tests to identify specific injuries, including: additional x-rays of spine and extremities; CT scans of head, chest, abdomen, and spine; contrast urography and angiography; and other diagnostic procedures. These tests should not be performed until the patient is hemodynamically stable and has been carefully examined.

**VIII. Continued Postresuscitation Monitoring and Reevaluation**

Reevaluate the trauma patient constantly to avoid overlooked injuries and prevent deterioration in hemodynamic status. Continuous monitoring of vital signs and urinary output is essential. Arterial blood gas analyses, cardiac and pulse oximetry monitoring should be used. Relieve severe pain with IV analgesics.

**IX. Definitive Care and Disposition**

The level, pace, and intensity of initial management of the multiple-injured patient should be dictated by the trauma team and the capacity of the treating facility. The patient’s physiologic status, obvious and anatomic injury, mechanisms of injury, concurrent diseases, and factors that may alter the patient’s prognosis should be taken into account. If necessary, the patient should be transferred to a trauma center or closest appropriate hospital capable of providing more specialized care.

**Pearls and Classic Exam Findings**

Periorbital ecchymosis or "raccoon eyes", hemotympanum, CSF oto/rhinorrhea, Battle’s sign 24 hours later: basilar skull fracture.

Blood at the urethral meatus, high riding prostate: urethral injuries.

Beck’s Triad: hypotension, JVD, muffled heart sounds: cardiac tamponade

Deviated trachea: tension pneumothorax

Paradoxical chest wall motion: flail chest

Baby with retinal hemorrhages and discrepant history: shaken baby syndrome

Seatbelt sign (high risk of hollow viscus injury, admit for serial exam and observation)

Singed nares, closed space fire: inhalation Injury (early intubation for respiratory distress, consider coexistent CO poisoning)

Pain out of proportion, pallor, paresthesia, paralysis & pulselessness: compartment syndrome requiring fasciotomy