Chapter 1: Initial Assessment and Management

Objectives:

Upon completion of this topic, the physician will be able to demonstrate an ability to apply the principles of emergency medical care to the multiply injured patient. Specifically, the physician will be able to:

A. Identify the correct sequence of priorities to be followed in assessing the multiply injured patient.

B. Outline the primary and secondary evaluation surveys to be used in assessing the multiply injured patient.

C. Identify and discuss the key components of and rationale for obtaining the patient's history and the history of the trauma incident.

D. Explain guidelines and techniques to be used in the initial resuscitative and definitive-care phases of treatment of the multiply injured patient.

E. Conduct an initial assessment and management survey on a simulated multiply injured patient, using the correct sequence of priorities and explaining management techniques for primary treatment and stabilization.

I. Introduction

The treatment of the seriously injured patient requires rapid assessment of the injuries and institution of life-preserving therapy. Since time is of the essence, a systematic approach that can be reviewed and practiced is desirable. This process is termed "Initial Assessment" and includes:

1. Preparation.

2. Triage.

3. Primary Survey (ABCs).

4. Resuscitation.

5. Secondary survey (head-to-toe).

6. Continued postresuscitation monitoring and re-evaluation.

7. Definitive care.

The primary and secondary surveys should be repeated frequently to ascertain any deterioration in the patient's status, and necessary treatment instituted at the time an adverse change is identified.
This sequence is presented in this chapter as a longitudinal progression of events. In the actual clinical situation, many of these activities occur in parallel or simultaneously. The linear or longitudinal progression allows the physician an opportunity to mentally review the progress of an actual trauma resuscitation for completeness.

II. Preparation

Preparation for the trauma patient occurs in two different clinical settings. First, the prehospital phase, from which all events must be coordinated with the physicians at the receiving hospital. Second, the inhospital phase, during which preparations must be made to facilitate the rapid progression of resuscitating the trauma patient.

A. Prehospital Phase

Coordination with the prehospital agency can greatly expedite the treatment of the patient in the field. The prehospital system should be set up such that the receiving hospital is notified before the prehospital personnel transport the patient from the scene. Emphasis should be placed on airway maintenance, control of external bleeding and shock, immobilization of the patient, and immediate transport to the closest, appropriate facility, preferably a verified trauma center. Every effort should be made to minimize scene time. (See Resource Document 2, Prehospital Triage Criteria and Flow Chart 1, Triage Decision Scheme.) Emphasis also should be placed on obtaining and reporting pertinent information needed for triage at the hospital, time of injury, events related to the injury, and patient history. The mechanisms of injury can suggest the degree of injury as well as specific injuries for which the patient must be evaluated.

B. Inhospital Phase

Advanced planning for the trauma patient's arrival is essential. In the emergency department, preparation must be made for the patient's arrival. Ideally, a suitable area should be kept available for trauma patients. Proper airway equipment (laryngoscopes, tubes, etc) should be organized, tested, and set up in a place where they are immediately available. Warmed intravenous crystalloid solutions, eg, Ringer's lactate, should be available and hung in readiness. Appropriate monitoring capabilities should be immediately available. A method to summon extra medical assistance should be in place. A means to assure prompt response by laboratory and radiology personnel is necessary. Ideally, transfer agreements with a verified trauma center should be established and in place. (Reference: ACS Committee on Trauma, Resources for Optimal Care of the Injured Patient.) (See Resource Document 9, Transfer Agreement.)

All personnel who have contact with the patient must be protected from communicable diseases. Most prominent among these diseases are hepatitis and the Acquired Immune Deficiency Syndrome (AIDS). The Centers for Disease Control (CDC) and other health agencies strongly recommend the use of universal precautions (eg, face mask, eye protection, water-impervious apron, leggings, and gloves) when coming in contact with body fluids. The ACS Committee on Trauma considers these to be minimum precautions. (See Resource Document 4, Protection of Personnel from Communicable Diseases.)
III. Triage

Triage is the sorting of patients based on the need for treatment and the available resources to provide that treatment. Treatment is rendered based on the ABC priorities (Airway with cervical spine control, Breathing, and Circulation with hemorrhage control) as outlined later in this chapter.

Triage also pertains to the sorting of patients in the field and the medical facility to which they are to be transported. It is the responsibility of the prehospital personnel and their medical director to see that the appropriate patients arrive at the appropriate hospital. It is inappropriate for prehospital personnel to deliver a severely traumatized patient to a nontrauma center hospital if a trauma center is available. (See Resource Document 2, Prehospital Triage Criteria and Flow chart 1, Triage Decision Scheme.) The Pediatric Trauma Score is helpful in identifying those severely injured patients who should be transported to a trauma center. (See Resource Document 7, Pediatric Trauma Score.)

To prevent inappropriate patient transfer, an attempt to triage or sort trauma patients in the field is desirable. The American College of Surgeons Committee on Trauma has published criteria based on physiologic indices and mechanism of injury. Many trauma systems have used these criteria or a modification thereof to triage patients to trauma and nontrauma hospitals.

Two types of triage situations usually exist:

1. The number of patients and the severity of their injuries do not exceed the ability of the facility to render care. In this situation, patients with life-threatening problems and those sustaining multiple-system injuries are treated first.

2. The number of patients and the severity of their injuries exceed the capability of the facility and staff. In this situation, those patients with the greatest chance of survival, with the least expenditure of time, equipment, supplies, and personnel, are managed first.

IV. Primary Survey

Patients are assessed and treatment priorities are established based on their injuries, the stability of their vital signs, and the injury mechanism. In the severely injured patient, logical sequential treatment priorities must be established based on overall patient assessment. The patient's vital functions must be assessed quickly and efficiently. Patient management must consist of a rapid primary evaluation, resuscitation of vital functions, a more detailed secondary assessment, and finally, the initiation of definitive care. This process constitutes the ABCs of trauma care and identifies life-threatening conditions.

A Airway maintenance with cervical spine control.
B Breathing and ventilation.
C Circulation with hemorrhage control.
D Disability: Neurologic status.
E Exposure/Environmental Control: Completely undress the patient, but prevent hypothermia.
During the primary survey, life-threatening conditions are identified and management is begun simultaneously. The prioritized assessment and management procedures reviewed in this chapter are identified as sequential steps in order of importance and for the purpose of clarity. However, these steps are frequently accomplished simultaneously.

Priorities for the care of the pediatric patient are basically the same as for adults. Although the quantities of blood, fluids, and medications, the size of the child, degree of heat loss, and injury patterns may differ, assessment and priorities are the same. Specific problems of the pediatric trauma patient are addressed in Chapter 10.

A. Airway with Cervical Spine Control

Upon initial evaluation of the trauma patient, the airway should be assessed first to ascertain patency. This rapid assessment for signs of airway obstruction should include inspection for foreign bodies and facial, mandibular, or tracheal/laryngeal fractures that may result in airway obstruction. Measures to establish a patent airway should protect the cervical spine. The chin lift or jaw thrust maneuvers are recommended to achieve this task.

While assessing and managing the patient's airway, great care should be taken to prevent excessive movement of the cervical spine. The patient's head and neck should not be hyperextended, hyperflexed, or rotated to establish and maintain the airway. Based on the history of the trauma incident, the loss of integrity of the cervical spine should be suspected. Neurologic examination alone does not rule out a cervical spine injury. The integrity of the bony components of the cervical spine can be assessed initially by visualizing all seven cervical vertebrae, including the C-7 to T-1 interspace on a crosstable lateral cervical spine roentgenogram. The lateral cervical spine film does not exclude all cervical spine injuries. Immobilization of the patient's head and neck with appropriate cervical immobilization devices should be accomplished and maintained. If immobilizing devices must be removed temporarily, the head and neck should be stabilized with manual, in-line immobilization by one member of the trauma team. These devices should be left in place until cervical spine injury is excluded. Remember: Assume a cervical spine injury in any patient with multisystem trauma, especially with an altered level of consciousness or a blunt injury above the clavicle.

Pitfalls:

1. Foreign body in the airway.
2. Mandibular or maxillofacial fracture.
3. Tracheal or laryngeal disruption.

B. Breathing

Airway patency alone does not assure adequate ventilation. Adequate exchange of gases is mandatory to maximize oxygen transfer and carbon dioxide elimination. Ventilation involves adequate function of the lungs, chest wall, and diaphragm. Each component must be examined and evaluated rapidly.
The patient's chest should be exposed to assess ventilatory exchange adequately. Auscultation should be performed to assure air exchange in the lungs. Percussion may reveal the presence of air or blood in the chest. Visual inspection and palpation may reveal injuries to the chest wall that may compromise ventilation.

Injuries that may acutely impair ventilation are tension pneumothorax, flail chest with pulmonary contusion, and open pneumothorax. Hemothorax, simple pneumothorax, fractured ribs, and pulmonary contusion compromise ventilation to a lesser degree.

**Pitfalls:**

1. Tension pneumothorax.
2. Flail chest with pulmonary contusion.
3. Open pneumothorax.

**C. Circulation with Hemorrhage Control**

1. **Blood volume and cardiac output**

   Hemorrhage is the predominant cause of postinjury deaths that are amenable to effective and rapid treatment in the hospital setting. Hypotension following injury must be considered to be hypovolemic in origin until proved otherwise. Rapid and accurate assessment of the injured patient's hemodynamic status is therefore essential. Two elements of observation yield key information within seconds - level of consciousness and pulse.

   **a. Level of consciousness**

   When circulating blood volume is reduced, cerebral perfusion may be critically impaired, resulting in altered levels of consciousness. However, a conscious patient also may have lost a significant amount of blood.

   **b. Skin color**

   Skin color can be helpful in evaluating the hypovolemic injured patient. A patient with pink skin, especially in the face and extremities, is rarely critically hypovolemic after injury. Conversely, the ashen, gray skin of the face and the white skin of the exsanguinated extremities are ominous signs of hypovolemia. These latter signs usually indicate a blood volume loss of at least 30%, if hypovolemia is the cause.

   **c. Pulse**

   Pulses, usually an easily accessible central pulse (femoral or carotid), should be assessed bilaterally for quality, rate, and regularity. Full, slow, and regular peripheral pulses are **usually** signs of a relatively normovolemic patient. Rapid, thready pulses are early signs of hypovolemia, but may have other causes as well. An irregular pulse is usually a warning of cardiac impairment. Absent central pulses, not attributable to local factors, signify the need for immediate resuscitative action to restore depleted blood volume and effective cardiac
output if death is to be avoided.

2. Bleeding

External, severe hemorrhage is identified and controlled in the primary survey.

Rapid, external blood loss is managed by direct manual pressure on the wound. Pneumatic splinting devices also may help control hemorrhage. These devices should be transparent to allow monitoring of underlying bleeding. Tourniquets should not be used because they crush tissues and cause distal ischemia. The use of hemostats is time-consuming, and surrounding structures, such as nerves and veins, can be injured. Hemorrhage into the thoracic or abdominal cavities, into muscles surrounding a fracture, or as a result of a penetrating injury can account for major, occult blood loss.

Pitfalls: Hypovolemia resulting from

1. Intra-abdominal or intrathoracic injury.
2. Fractures of the femur and/or pelvis.
3. Penetrating injuries with arterial or venous involvement.
4. External hemorrhage from any source.

D. Disability (Neurologic Evaluation)

A rapid neurologic evaluation is performed at the end of the primary survey. This neurologic evaluation establishes the patient's level of consciousness, and pupillary size and reaction. A simple mnemonic to describe the level of consciousness is the AVPU method.

- A Alert
- V Responds to Vocal stimuli
- P Responds to Painful stimuli
- U Unresponsive.

The Glasgow Coma Scale (GCS) is a more detailed neurologic evaluation that is quick, simple, and predictive of patient outcome. This evaluation can be done in lieu of the AVPU. If not done in the primary survey, the GCS should be performed as part of the more detailed, quantitative neurologic examination in the secondary survey. (See Chapter 6, Head Trauma and Chapter 12, Stabilization and Transport, Chart 2, Revised Trauma Score with Glasgow Coma Scale Score.)

A decrease in the level of consciousness may indicate decreased cerebral oxygenation and/or perfusion or may be due to direct cerebral injury. An altered level of consciousness indicates the need for immediate re-evaluation of the patient's oxygenation, ventilation, and perfusion status. Alcohol and/or other drugs also may alter the patient's level of consciousness. However, having excluded hypoxia and hypovolemia, changes in the level of consciousness should be considered to be of traumatic central nervous system origin until proven otherwise.
Pitfalls:

1. Head injury.
2. Decreased oxygenation.
3. Shock.
4. Altered level of consciousness secondary to alcohol and/or other drugs. (This is a diagnosis of exclusion. Head injury, decreased oxygenation, and shock must be excluded first.)

E. Exposure/Environmental Control

The patient should be completely undressed, usually by cutting off the garments to facilitate thorough examination and assessment of the patient. After the patient's clothing is removed, it is imperative to cover and protect the patient from becoming hypothermic in the emergency department. Warm blankets are useful, intravenous fluids should be warmed before administering to the patient, and a warm environment should be maintained.

V. Resuscitation

A. Airway

The airway should be protected in all patients and secured in those patients whose ventilation is not adequate. The jaw thrust or chin lift maneuver may suffice in some cases. The use of a nasopharyngeal airway may initially establish and maintain airway patency in the conscious patient. If the patient is unconscious and has no gag reflex, an oropharyngeal airway may be helpful.

B. Breathing/Ventilation/Oxygenation

Definitive control of the airway in patients who have compromised airways due to mechanical factors, who have ventilatory problems, or who are unconscious is achieved by endotracheal intubation, either nasally or orally. This procedure should be accomplished with control of the cervical spine. A surgical airway can be performed if oral or nasal intubation is contraindicated or cannot be accomplished due to technical reasons. (See Chapter 2, Airway and Ventilatory Management.)

A tension pneumothorax compromises ventilation, and if suspected, chest decompression should be accomplished immediately.

Every injured patient should receive supplemental oxygen therapy. If not intubated, the patient ideally should have oxygen delivered by a mask/reservoir device to achieve optimal oxygenation. (See Chapter 2, Airway and Ventilatory Management.)

C. Circulation

A minimum of two large-caliber intravenous catheters (IVs) should be established. The maximum rate of fluid administration is determined by the internal diameter of the catheter and inversely by its length, not by the size of the vein in which the catheter is placed.
Initiation of upper extremity peripheral intravenous lines is preferred in most cases. Other peripheral lines, cutdowns, and central venous lines should be utilized and performed as necessary in accordance with the skill level of the physician caring for the patient. (See Skill Station IV, Vascular Access and Monitoring and Skill Station V, Venous Cutdown in Chapter 3, Shock.)

When initiating the intravenous lines, blood should be drawn for type and crossmatch and for baseline hematologic studies, including a pregnancy test for all females of childbearing age.

Vigorous intravenous fluid therapy with a balanced salt solution should be initiated. Ringer's lactate solution is preferred as the initial crystalloid solution and should be administered rapidly in the adult patient. Such bolus intravenous therapy may require the administration of two to three liters of solution to achieve an appropriate patient response.

The shock state associated with trauma is most often hypovolemic in origin. If the patient remains unresponsive to bolus intravenous therapy, type-specific blood may be administered as necessary. If type-specific blood is not available, low titer type O or O-negative blood must be considered as a substitute. For life-threatening blood loss, the use of unmatched, type-specific blood is preferred over type O blood unless multiple, unidentified casualties are being treated simultaneously. Hypovolemic shock should not be treated by vasopressors, steroids, or sodium bicarbonate.

Hypothermia can be produced quickly in the emergency department by leaving the patient uncovered and by rapid administration of room temperature fluids or four-degree centigrade blood. The use of a high-flow fluid warmer or microwave oven to heat crystalloid fluids to 39 degrees centigrade is recommended. Blood, plasma, and glucose-containing solutions should not be warmed in a microwave oven. (See Chapter 3, Shock.)

Careful electrocardiographic (ECG) monitoring of all trauma patients is required. Dysrhythmias, including unexplained tachycardia, atrial fibrillation, premature ventricular contractions, and ST segment changes, may indicate cardiac contusion. Electromechanical dissociation (EMD) may indicate cardiac tamponade, tension pneumothorax, and/or profound hypovolemia. When bradycardia, aberrant conduction, and premature beats are present, hypoxia and hypoperfusion should be suspected immediately. Hypothermia also produces these dysrhythmias.

D. Urinary and Gastric Catheters

The placement of urinary and gastric catheters should be considered as part of the resuscitation phase. Urine should be submitted for routine laboratory analysis.

1. Urinary catheters

Urinary output is a sensitive indicator of the volume status of the patient. Urinary catheterization is contraindicated in patients in whom urethral transection is suspected. Urethral injury should be suspected if there is (1) blood at the penile meatus, (2) blood in the scrotum, and (3) the prostate is high-riding or cannot be palpated. Accordingly, urinary
catheter insertion should not be attempted before an examination of the rectum and genitalia has been performed, and associated injuries have been excluded.

2. **Gastric catheters**

   A gastric tube is indicated to reduce stomach distention and decrease the risk of aspiration. However, thick or semisolid gastric contents will not return through the tube, and actual passage of the tube may induce vomiting. For the tube to be effective, it must be positioned properly, attached to appropriate suction, and be functioning. Blood in the gastric aspirate may represent oropharyngeal (swallowed) blood, traumatic insertion, or actual injury to the stomach. If the cribriform plate is fractured or a fracture is suspected, the gastric tube should be inserted orally or through a properly positioned nasopharyngeal airway to prevent intracranial passage of the tube.

**E. Monitoring**

Adequate resuscitation is best assessed by quantitative improvement of physiologic parameters, ie, ventilatory rate, pulse, blood pressure, pulse pressure, arterial blood gases (ABGs), body temperature, and urinary output, rather than the qualitative assessment done in the primary survey. **Actual values should be obtained as soon as practical after completing the primary survey.**

1. **Ventilatory rate and arterial blood gases** should be used to monitor the patient's airway and breathing. Endotracheal tubes can be dislodged whenever the patient is moved. End-tidal carbon dioxide monitoring is a reliable means of confirming the position of the endotracheal tube in intubated patients. A variety of quantitative devices are available for this purpose. (See Chapter 2, Airway and Ventilatory Management.)

2. **Pulse oximetry** is a valuable adjunct for monitoring injured patients. The pulse oximeter measures the oxygen saturation of hemoglobin colorimetrically, but does **not** measure the PaO₂. A small sensor is placed on the finger, toe, earlobe, or other convenient place. Most devices display pulse rate and oxygen concentration continuously. Appropriate oxygenation is a reflection of proper airway, breathing, and circulatory status.

3. The **blood pressure** should be measured, realizing that it may be a poor measure of actual tissue perfusion.

4. Careful **electrocardiographic (ECG) monitoring** of all trauma patients is recommended.

**F. Consider Need for Patient Transfer**

**Remember:** Life-saving measures are initiated when the problem is identified, rather than after the primary survey. During the primary survey and resuscitation phase, the evaluating physician frequently has enough information to indicate the need for transfer of the patient to another facility. This transfer process may be initiated immediately by administrative personnel at the direction of the examining physician, while additional patient care and evaluation are being performed. Once the decision to transfer the patient has been
made, referring physician to receiving physician communication is essential.

VI. Roentgenograms

Roentgenograms should be used judiciously and should not delay patient resuscitation. In the patient with blunt trauma, three roentgenograms should be obtained - cervical spine, anteroposterior (AP) chest, and AP pelvis. These films can be taken in the resuscitation area, usually with a portable x-ray unit, but should not interrupt the resuscitation process. During the secondary survey, open-mouth odontoid and anteroposterior thoracolumbar films may be obtained with a portable x-ray unit if the patient's care is not compromised, and if the mechanism of injury suggests the possibility of spinal injury. After all life-threatening injuries are identified and treated, complete cervical spine, thoracic, and lumbar spine films should be obtained. In the patient with penetrating injuries, an AP chest film and films pertinent to the site(s) of wounding should be obtained. (See Resource Document 5, Roentgenographic Studies.)

VII. Secondary Survey

The secondary survey does not begin until the primary survey (ABCs) is completed, resuscitation is initiated, and the patient’s ABCs are reassessed.

The secondary survey is a head-to-toe evaluation of the trauma patient, including vital sign assessment - blood pressure, pulse, respirations, and temperature. Each region of the body is completely examined. The potential for missing an injury or to not appreciate the significance of an injury is great, especially in the unresponsive or unstable patient. Examples of these injuries are cited as pitfalls after each anatomic region examined is discussed in this chapter.

In this survey a complete neurologic examination is performed, including a GCS score, if not done during the primary survey. During this evaluation indicated roentgenograms are obtained. Such examinations can be interspersed into the secondary survey at opportune times.

Special procedures, eg, peritoneal lavage, radiologic evaluation, and laboratory studies, also are obtained during this time. Complete evaluation of the patient requires repeated examination of the patient. The secondary assessment might well be summarized as "tubes and fingers in every orifice."

A. History

Every complete medical assessment should include a good history of the injury-producing mechanism. Many times such a history cannot be obtained from the patient. Prehospital personnel and family must be consulted to obtain present and past information that may shed light on the patient's present physiologic state. The "AMPLE" history is a useful mnemonic to obtain the patient's pertinent history.
A Allergies
M Medications currently taken
P Past illnesses
L Last meal
E Events/environment related to the injury.

The patient's present state is greatly influenced by the mechanism of injury. Prehospital personnel can provide valuable insight into such mechanisms and should report pertinent data to the examining physician. Types of injuries can be predicted based on the direction and amount of energy force. Injury usually is classified into two broad categories - blunt and penetrating. (See Resource Document 3, Kinematics of Trauma.)

1. Blunt trauma

Blunt trauma results from automobile collisions, falls, and other transportation-, recreation-, and occupation-related injuries.

Important information to obtain about automobile collisions includes: seat belt usage, steering wheel deformation, direction of impact, damage to the automobile in terms of major deformation or intrusion into the passenger compartment, and ejection of the passenger from the vehicle. Ejection from the vehicle greatly increases the chance of major injury.

Injury patterns may often be predicted by the mechanism of injury which demonstrates the importance of an accurate history. Such injury patterns also are influenced by age groups and activities. (See Table 1, Mechanisms of Injury and Related Suspected Injury Patterns.)

2. Penetrating trauma

Penetrating trauma, injuries from firearms, stabbings, and impaling objects, is increasing rapidly. Factors determining the type and extent of injury and subsequent management include the region of the body injured, the organs in the proximity to the path of the penetrating object, and the velocity of the missile. Therefore, the velocity and caliber of the bullet, the trajectory, and the distance from weapon to wounded may provide important clues to the extent of injury. (See Resource Document 3, Kinematics of Trauma, and related Table 1, Missile Kinetic Energy.)
Table 1. Mechanisms of Injury and Related Suspected Injury Patterns

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<thead>
<tr>
<th>Mechanisms of Injury</th>
<th>Suspected Injury Patterns</th>
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<tbody>
<tr>
<td><strong>Frontal impact</strong></td>
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<tr>
<td>Bent steering wheel</td>
<td>Cervical spine fracture</td>
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<tr>
<td>Knee imprint in dashboard</td>
<td>Anterior flail chest</td>
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<tr>
<td>Bull's-eye fracture of windshield</td>
<td>Myocardial contusion</td>
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<tr>
<td></td>
<td>Pneumothorax</td>
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<tr>
<td></td>
<td>Transection of aorta (decelerating injury)</td>
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<tr>
<td></td>
<td>Fractured spleen or liver</td>
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<tr>
<td></td>
<td>Posterior fracture/dislocation of hip and/or knee</td>
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<tr>
<td><strong>Side impact</strong> to automobile</td>
<td>Contralateral neck sprain</td>
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<tr>
<td></td>
<td>Cervical spine fracture</td>
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<tr>
<td></td>
<td>Lateral flail chest</td>
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<tr>
<td></td>
<td>Pneumothorax</td>
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<td></td>
<td>Traumatic aortic rupture</td>
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<td></td>
<td>Diaphragmatic rupture</td>
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<tr>
<td></td>
<td>Fractured spleen or liver</td>
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<td></td>
<td>(depending on side of impact)</td>
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<tr>
<td></td>
<td>Fractured pelvis or acetabulum</td>
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<tr>
<td><strong>Rear impact</strong> automobile collision</td>
<td>Cervical spine injury</td>
</tr>
<tr>
<td><strong>Ejection</strong> from vehicle</td>
<td>Ejection from the vehicle precludes meaningful prediction of injury patterns, but places the patient at a greater risk from virtually all injury mechanisms. Mortality is increased significantly.</td>
</tr>
<tr>
<td><strong>Motor vehicle-pedestrian</strong></td>
<td>Head injury</td>
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<tr>
<td></td>
<td>Thoracic and abdominal injuries</td>
</tr>
<tr>
<td></td>
<td>Fractured lower extremities.</td>
</tr>
</tbody>
</table>

3. Injuries due to burns and cold

**Burns** are another significant type of trauma that may occur alone or may be coupled with blunt and penetrating trauma resulting from a burning automobile, explosion, falling debris, the patient's attempt to escape the fire, or an assault with a firearm or knife. Inhalation injury and carbon monoxide intoxication often complicate burn injury. Therefore, it is important to know the circumstances surrounding the burn injury.

Specifically, knowledge of the environment in which the burn injury occurred (open or closed space), as well as substances consumed by the flames (plastics, chemicals, etc), and possible associated injuries sustained is critical in the treatment of the patient.
Acute or chronic hypothermia without adequate protection against heat loss produces either local or generalized cold injuries. Significant heat loss may occur at moderate temperatures (15 to 20 degrees centigrade) if wet clothes, decreased activity, or vasodilatation caused by alcohol or drugs compromise the patient's ability to conserve heat. Such historical information can be obtained from prehospital personnel.

4. Hazardous environment

History of exposure to chemicals, toxins, and radiation are important to obtain for two reasons. First, these agents can produce a variety of pulmonary, cardiac, or internal organ derangement in the injured patient. Secondly, these same agents also present a hazard to health care providers. Frequently, the physician's only means of preparation is to have knowledge of the general principles of management of such agents and immediate access to the Regional Poison Control Center.

B. Physical Examination

1. Head (See Chapter 6, Head Trauma.)

The secondary survey begins with evaluating the head and identifying all related and significant injuries. The entire scalp and head should be examined for lacerations, contusions, and evidence of fractures. Because edema around the eyes may later preclude an in-depth examination, the eyes should be re-evaluated for

   a. Visual acuity
   b. Pupillary size
   c. Hemorrhages of the conjunctiva and fundi
   d. Penetrating injury
   e. Contact lenses (remove before edema occurs)
   f. Dislocation of the lens.

A visual confrontation of both eyes can be performed by having the patient read a Snellen Chart or words on an intravenous container or 4x4 dressing package. This procedure frequently identifies optic injuries not otherwise apparent. (See Resource Document 13, Ocular Trauma.)

Pitfalls:

1. Hyphema
2. Optic nerve injury
3. Lens dislocation or penetrating injury
4. Head injury
5. Posterior scalp laceration.

2. Maxillofacial

Maxillofacial trauma, not associated with airway obstruction or major bleeding, should be treated after the patient is stabilized completely and life-threatening injuries have been
addressed. Definitive management may be safely delayed without compromising care at the discretion of appropriate specialists.

Patients with fractures of the midface may have a fracture of the cribriform plate. For these patients, gastric intubation should be performed via the oral route.

**Pitfalls:**

1. Pending airway obstruction
2. Changes in airway status
3. Cervical spine injuries
4. Exsanguinating midface fracture
5. Lacrimal duct lacerations
6. Facial nerve injuries.

3. **Cervical spine and neck** *(See Chapter 7, Spine and Spinal Cord Trauma.)*

Patients with maxillofacial or head trauma should be presumed to have an unstable cervical spine injury (fracture and/or ligamentous injury), and the neck should be immobilized until all aspects of the cervical spine have been adequately studied and an injury excluded. The absence of neurologic deficit does not exclude injury to the cervical spine, and such injury should be presumed until a complete cervical spine radiographic series is obtained.

Examination of the neck includes both inspection, palpation, and auscultation. Cervical spine tenderness, subcutaneous emphysema, tracheal deviation, and laryngeal fracture may be discovered on a detailed examination. The carotid arteries should be palpated and auscultated for bruits. Evidence of blunt injury over these vessels should be noted and, if present, should arouse a high index of suspicion for carotid artery injury. Occlusion or dissection of the carotid artery may occur late in the injury process without antecedent signs or symptoms.

Protection of a potentially unstable cervical spine injury is imperative for patients wearing any type of protective helmet. Extreme care must be taken when removing the helmet. *(See Chapter 2, Airway and Ventilatory Management.)*

In penetrating trauma, wounds that extend through the platysma should not be explored manually in the emergency department. This type of injury requires surgical evaluation in the operating room.

**Pitfalls:**

1. Cervical spine injury
2. Esophageal injury
3. Tracheal or laryngeal injury
4. Carotid injury (penetrating or blunt).
4. Chest (See Chapter 4, Thoracic Trauma.)

Visual evaluation of the chest, both anterior and posterior, identifies such conditions as open pneumothorax and large flail segments. A complete evaluation of the chest wall requires palpation of the entire chest cage - feeling each rib and the clavicle. Sternal pressure may be painful if the sternum is fractured or costochondral separations exist. Contusions and hematomas of the chest wall should alert the physician to the possibility of occult injury.

Significant chest injury is manifested by pain and/or shortness of breath. Evaluation of the internal structures is done with the stethoscope, followed by a chest roentgenogram. Breath sounds are auscultated high on the anterior chest wall for pneumothorax and at the posterior bases for hemothorax. Auscultatory findings may be difficult to evaluate in a noisy environment, but may be extremely helpful. Distant heart sounds and narrow pulse pressure may indicate cardiac tamponade. Cardiac tamponade or tension pneumothorax may be suggested by the presence of distended neck veins, although associated hypovolemia may minimize this finding or eliminate it altogether. Decreased breath sounds and shock may be the only indication of tension pneumothorax and the need for immediate chest decompression.

The chest roentgenogram confirms the presence of a hemothorax or pneumothorax. Rib fractures may be present, but they may not be visible on the roentgenograph. A widened mediastinum or deviation of the nasogastric tube to the right may suggest an aortic rupture.

Pitfalls:

1. Tension pneumothorax
2. Open chest wound
3. Flail chest
4. Cardiac tamponade
5. Aortic rupture.

5. Abdomen (See Chapter 5, Abdominal Trauma.)

Abdominal injuries must be identified and treated aggressively. The specific diagnosis is not as important as the fact that an injury exists and surgical intervention may be necessary. A normal initial examination of the abdomen does not exclude a significant intra-abdominal injury. Close observation and frequent re-evaluation of the abdomen, preferably by the same observer, is important in managing blunt abdominal trauma. Over time, the patient's abdominal findings may change. Early involvement by a surgeon is essential.

Patients with unexplained hypotension, neurologic injury, impaired sensorium secondary to alcohol and/or other drugs, and equivocal abdominal findings should be considered as candidates for peritoneal lavage. Fractures of the pelvis or the lower rib cage also may hinder adequate diagnostic examination of the abdomen, because pain from these areas may be elicited when palpating the abdomen.
Pitfalls:

1. Liver or splenic rupture
2. Hollow viscus and lumbar spine injury (seat belts, deceleration)
3. Pancreatic injury
4. Major intra-abdominal vascular injury
5. Renal injury
6. Pelvic fracture(s).

6. Perineum / rectum / vagina (See Chapter 5, Abdominal Trauma.)

The perineum should be examined for contusions, hematomas, lacerations, and urethral bleeding.

A rectal examination is an essential part of the secondary survey. Specifically, the physician should assess for the presence of blood within the bowel lumen, a high-riding prostate, the presence of pelvic fractures, the integrity of the rectal wall, and the quality of the sphincter tone.

For the female patient, a vaginal examination also is an essential part of the secondary survey. The physician should assess for the presence of blood in the vaginal vault and vaginal lacerations. Additionally, pregnancy tests should be performed on all females of childbearing age.

Pitfalls:

1. Urethral injury
2. Rectal injury
3. Bladder injury
4. Vaginal injury.

7. Musculoskeletal (See Chapter 7, Spine and Spinal Cord Trauma, and Chapter 8, Extremity Trauma.)

The extremities should be inspected for contusion or deformity. Palpation of the bones, examining for tenderness, crepitation, or abnormal movement, aids in the identification of occult fractures.

Anterior to posterior pressure with the heels of the hands on both anterior iliac spines and the symphysis pubis can identify pelvic fractures. Additionally, assessment of peripheral pulses can identify vascular injuries.

Significant extremity injuries may exist without fractures being evident on examination or roentgenograms. Ligament ruptures produce joint instability. Muscle-tendon unit injuries interfere with active motion of the affected structures. Impaired sensation and/or loss of voluntary muscle contraction strength may be due to nerve injury or to ischemia, including that due to compartment syndrome.
Thoracic and lumbar spinal fractures and/or neurologic injuries must be considered based on physical findings and mechanism of injury. Other injuries may mask the physical findings of spinal injuries, which may go unsuspected unless the physician obtains the appropriate roentgenograms.

**Pitfalls:**

1. Spine fractures
2. Fractures with vascular compromise
3. Pelvic fractures
4. Digital fractures.

**8. Neurologic** (See Chapter 6, Head Trauma, and Chapter 7, Spine and Spinal Cord Trauma.)

A comprehensive neurologic examination includes not only motor and sensory evaluation of the extremities, but also re-evaluation of the patient's level of consciousness and pupillary size and response. The GCS Score facilitates detection of early changes and trends in the neurologic status. (See Chart 1, Revised Trauma Score with GCS Score in Chapter 12, Stabilization and Transport.)

Any evidence of paralysis or paresis suggests major injury to the spinal column or peripheral nervous system. Immobilization of the entire patient, using short or long spine boards, a semirigid cervical collar, and/or other cervical immobilization devices, must be maintained until spinal injury can be excluded. The common mistake of immobilizing the head and freeing the torso allows the cervical spine to flex with the body as a fulcrum. **Complete immobilization of the entire patient is required at all times until a spinal injury is excluded, and especially when a patient is transferred.**

Early consultation with a neurosurgeon is required for patients with neurologic injury. Changes in the level of consciousness should be monitored as these may reflect progression of the intracranial injury. If a patient with a head injury deteriorates neurologically, oxygenation and perfusion of the brain and the adequacy of ventilation (ABCs) must be reassessed. Intracranial surgical intervention may be necessary. The neurosurgeon must make the decision whether such conditions as epidural and subdural hematomas or depressed skull fractures require operative intervention.

**Pitfalls:**

1. Increased intracranial pressure
2. Subdural or epidural hematoma
3. Depressed skull fracture

**VIII. Re-evaluation**

The trauma patient must be re-evaluated constantly to assure that new findings are not overlooked, and to discover deterioration in previously noted symptoms. As initial life-
threatening injuries are managed, other equally life-threatening problems and less severe injuries may become apparent. Underlying medical problems that may severely affect the ultimate prognosis of the patient may become evident. A high index of suspicion and constant alertness facilitate early diagnosis and management.

The relief of severe pain is an important part of the management of the trauma patient. Effective analgesia usually requires the use of intravenous opiates that may adversely affect the surgeon's ability to initially and continuously evaluate the patient accurately. The use of intravenous opiates may cause respiratory depression and mask neurologic signs. Therefore, opiates and other strong analgesics should be withheld until surgical consultation has occurred.

Continuous monitoring of vital signs and urinary output is essential. For the adult patient, maintenance of urinary output of 50 mL/hour is desirable. In the pediatric patient over one year of age, an output of 1 mL/kg/hour should be adequate. Arterial blood gas and cardiac monitoring devices should be employed. Pulse oximetry on critically injured patients and end-tidal carbon dioxide monitoring on intubated patients should be considered.

**IX. Definitive Care**

The interhospital triage criteria, published by the American College of Surgeons Committee on Trauma, helps determine the level, pace, and intensity of initial management of the multiple-injured patient. It takes into account the patient's physiologic status, obvious and anatomic injury, mechanisms of injury, concurrent diseases, and factors that may alter the patient's prognosis. Emergency department and surgical personnel should use these criteria to determine if the patient requires transfer to a trauma center or closest appropriate hospital capable of providing more specialized care. The closest appropriate hospital should be chosen based on its overall capabilities to care for the injured patient. (See Chapter 12, Stabilization and Transport; Table 1, Triage Decision Scheme in Resource Document 2, Prehospital Triage Criteria; Resource Document 9, Transfer Agreement; and Resource Document 10, Transfer Record.)

**X. Disaster**

Disasters frequently overwhelm local and regional resources. Plans for management of such conditions must be evaluated and rehearsed frequently to enhance the possibility of significant salvage of injured patients. (See Resource Document 12, Preparations for Disaster.)

**XI. Records and Legal Considerations**

**A. Records**

Meticulous record-keeping with time documented for all events is very important. Often more than one physician cares for the patient. Precise records are essential to evaluate the patient's needs and clinical status. Accurate records during the resuscitation can be facilitated by a member of the nursing staff whose sole job is to record and collate all patient information.
Medical-legal problems arise frequently, and precise records are helpful for all concerned. Chronologic reporting with flow sheets helps both the attending physician and consulting physician to quickly assess changes in the patient's condition. (See Resource Document 8, Trauma Flow Sheet; Resource Document 9, Transfer Agreement, and Resource Document 10, Transfer Record.)

B. Consent for Treatment

Consent is sought before treatment if possible. In life-threatening emergencies it is often not possible to obtain such prospective consent. In such cases treatment should be given first and formal consent obtained later. (See Resource Document 14, ATLS and the Law.)

C. Forensic Evidence

If injury due to criminal activity is suspected, the personnel caring for the patient must preserve the evidence. All items, such as clothing and bullets, must be saved for law enforcement personnel. Laboratory determinations of blood alcohol concentrations and other drugs may be particularly pertinent. (See Resource Document 3, Kinematics of Trauma.)

XII. Summary

The injured patient must be evaluated rapidly and thoroughly. The physician must develop treatment priorities for the overall management of the patient, so no steps in the process are omitted. An adequate patient history and accounting of the incident are important in evaluating and managing the trauma patient.

Evaluation and care are divided into four phases.

A. Primary Survey - Assessment of ABCs

1. Airway and cervical spinal control
2. Breathing
3. Circulation with hemorrhage control
4. Disability: Brief neurologic evaluation
5. Exposure/Environment: Completely undress the patient, but prevent hypothermia.

B. Resuscitation

1. Oxygenation and ventilation
2. Shock management - intravenous lines, Ringer’s lactate
3. The management of life-threatening problems identified in the primary survey is continued
   4. Monitoring
      a. Arterial blood gases and ventilatory rate
      b. End-tidal carbon dioxide
      c. Electrocardiograph
      d. Pulse oximetry
e. Blood pressure.
C. Secondary Survey - Total Patient Evaluation

1. Head and skull
2. Maxillofacial
3. Neck
4. Chest
5. Abdomen
6. Perineum / rectum / vagina
7. Musculoskeletal
8. Complete neurologic examination
9. Appropriate roentgenograms, laboratory tests, and special studies
10. "Tubes and fingers" in every orifice.

D. Definitive Care

After identifying the patient's injuries, managing life-threatening problems, and obtaining special studies, definitive care begins. Definitive care, associated with the major trauma entities, is described in later chapters.

E. Transfer

If the patient's injuries exceed the institution's immediate treatment capabilities, the process of transferring the patient is initiated as soon as the need is identified. Delay in transferring the patient to a facility with a higher level of care may significantly increase the patient's risk of mortality. (See Chapter 12, Stabilization and Transfer.)
Skill Station I: Initial Assessment and Management

Resources and Equipment

This list is the recommended equipment to conduct this skill session in accordance with the stated objectives for and intent of the procedures outlined. Additional equipment may be used providing it does not detract from the stated objectives and intent of this skill, or from performing the procedure in a safe method as described and recommended by the ACS Committee on Trauma.

1. Live patient model
2. Nurse assistant
3. Case scenario with related roentgenograms
4. Blanket and sheet (or table padding and covering for patient comfort)
5. Makeup and moulage - see individual scenarios
6. Items needs for each scenario:
   a. 4x4s, roller bandage, and tape
   b. Blood pressure cuff and stethoscope
   c. Penlite flashlight (optional)
   d. 1000 mL Ringer's lactate - two or three per patient
   e. Assorted IV catheters and needles, ie, #14- to 16-gauge over-the-needle catheter, #20-gauge Butterfly needle - two to four per patient; and pericardiocentesis kit (optional)
   f. 12- and 50-mL syringes
   g. Spine immobilization devices - long and short (optional)
   h. Semirigid cervical collar
   i. Oxygen mask
   j. Oral airway
   k. Leg traction splint; molded splints
   l. Lighted view box for reviewing roentgenograms
   m. Laryngoscope blade, handle, and ET tube
   n. End-tidal CO₂ monitoring device (optional)
   o. Pulse oximeter (actual or simulated)
   p. #5 tracheostomy tube for cricothyroidotomy
   q. #36 French chest tube and drainage collection device
   r. Scalpel handle
   s. Nasogastric tube
   t. Peritoneal lavage kit
   u. Indwelling urinary catheter and collection bag
   v. Bag-valve mask device and face mask (type that includes a one-way valve preventing back flow of air and secretions)
   w. Soft and rigid suction devices
   x. Portable electrocardiograph monitor (actual or simulated)
   y. Pneumatic antishock garment (optional)
   z. Universal precaution equipment for participants, ie, goggles, gloves, masks, and gowns.
Objectives

Performance at this station will allow the participant to practice and demonstrate the following activities in a simulated clinical situation:

1. Using the four phases of patient assessment and management, verbalize to the Instructor while systematically demonstrating the initial management required to stabilize each patient.

2. Using the primary survey assessment techniques, determine and demonstrate:
   a. Airway patency and cervical spine control
   b. Breathing efficacy
   c. Circulatory status with hemorrhage control
   d. Disability: Neurologic status
   e. Exposure / Environment: Undress the patient, but prevent hypothermia.

3. Establish resuscitation (management) priorities in the multiple-injured patient based on findings from the primary survey.

4. Integrate appropriate history taking as an invaluable aid in the assessment of the patient situation.

5. Identify the injury-producing mechanism and discuss the injuries that may exist and/or may be anticipated as a result of the mechanism of injury.

6. Using secondary survey techniques, assess the patient from head to toe.

7. Using the primary and secondary survey techniques, re-evaluate the patient's status and response to therapy instituted.

8. Given a series of roentgenograms,
   a. Diagnose fractures
   b. Differentiate associated injuries.

9. Outline the definitive care necessary to stabilize each patient in preparation for possible transport to a trauma center or closest appropriate facility.

10. As referring physician, communicate with the receiving physician (Instructor) in a logical, sequential manner:
   a. Patient's history, including mechanism of injury
   b. Physical findings
   c. Management instituted
   d. Patient's response to therapy
   e. Diagnostic tests performed and results
   f. Need for transport
g. Method of transportation
h. Anticipated time of arrival.

Skills Procedures

Initial Assessment and Management

Note: Universal precautions are required whenever caring for the trauma patient.

I. Primary Survey and Resuscitation

The student should outline preparations that must be made to facilitate the rapid progression of assessing and resuscitating the patient.

The student should indicate that the patient is to be completely undressed, but that hypothermia should be prevented.

A. Airway with Cervical Spine Control

1. Assessment

a. Ascertain patency.
b. Rapidly assess for airway obstruction.


a. Perform a chin lift or jaw thrust maneuver.
b. Clear the airway of foreign bodies.
c. Insert an oropharyngeal or nasopharyngeal airway.
d. Establish a definitive airway.
   1) Orotracheal or nasotracheal intubation
   2) Jet insufflation of the airway
   3) Surgical cricothyroidotomy.

3. Maintain the cervical spine in a neutral position with manual immobilization as necessary when establishing an airway.

B. Breathing: Ventilation and Oxygenation

1. Assessment

a. Expose the neck and chest - assure immobilization of the head and neck.
b. Determine the rate and depth of respirations.
c. Inspect and palpate the neck and chest for tracheal deviation, unilateral and bilateral chest movement, use of accessory muscles, and any signs of injury.
d. Percuss the chest for presence of dullness or hyperresonance.
e. Auscultate the chest bilaterally.
2. Management

a. Administer high concentrations of oxygen.
b. Ventilate with a bag-valve-mask or face-mask device.
c. Alleviate tension pneumothorax.
d. Seal open pneumothorax.
e. Attach an end-tidal CO₂ monitoring device (if available) to the endotracheal tube.
f. Attach the patient to a pulse oximeter, if available.

C. Circulation with Hemorrhage Control

1. Assessment

a. Identify source of external, exsanguinating hemorrhage.
c. Skin color.
d. Blood pressure, time permitting.

2. Management

a. Apply direct pressure to external bleeding site.
b. Insert two large-caliber intravenous catheters.
c. Simultaneously obtain blood for hematologic and chemical analyses, type and crossmatch, and arterial blood gases.
d. Initiate vigorous IV fluid therapy with warmed Ringer's lactate solution and blood replacement.
e. Apply the pneumatic antishock garment or pneumatic splints as indicated to control hemorrhage.
f. Attach the patient to an ECG monitor.
g. Insert urinary and nasogastric catheters unless contraindicated.
h. Prevent hypothermia.

D. Disability: Brief Neurologic Examination

1. Determine the level of consciousness using the AVPU method.

2. Assess the pupils for size, equality, and reaction.

E. Exposure/Environment: Completely undress the patient, but prevent hypothermia.
II. Reassess the Patient - ABCDs and Consider Need for Patient Transfer

III. Secondary Survey and Management

A. AMPLE History and Mechanism of Injury

1. Obtain AMPLE history from patient, family, or prehospital personnel.
2. Obtain history of injury-producing event, identifying injury mechanisms.

B. Head and Maxillofacial

1. Assessment
   a. Inspect and palpate entire head and face for lacerations, contusions, fractures, and thermal injury.
   b. Re-evaluate pupils.
   c. Re-evaluate level of consciousness.
   d. Assess eyes for hemorrhage, penetrating injury, visual acuity, dislocation of the lens, and presence of contact lens.
   e. Evaluate cranial nerve function.
   f. Inspect ears and nose for cerebrospinal fluid leakage.
   g. Inspect mouth for evidence of bleeding and cerebrospinal fluid.

Management

   a. Maintain airway, continue ventilation and oxygenation as indicated.
   b. Control hemorrhage.
   d. Remove contact lenses.

C. Cervical Spine and Neck

1. Assessment
   a. Inspect for signs of blunt and penetrating injury, tracheal deviation, and use of accessory breathing muscles.

   b. Palpate for tenderness, deformity, swelling, subcutaneous emphysema, and tracheal deviation.

   c. Auscultate the carotid arteries for bruits.

   d. Obtain a lateral, crosstable cervical spine roentgenogram.

2. Management: Maintain adequate in-line immobilization and protection of the cervical spine.
D. Chest

1. Assessment

   a. Inspect for the anterior, lateral, and posterior chest wall for signs of blunt and penetrating injury, use of accessory breathing muscles, and bilateral respiratory excursions.

   b. Auscultate the anterior chest wall and posterior bases for bilateral breath sounds, and heart sounds.

   c. Palpate the entire chest wall for evidence of blunt and penetrating injury, subcutaneous emphysema, tenderness, and crepitation.

   d. Percuss for evidence of hyperresonance or dullness.

   e. Obtain a chest roentgenogram.

2. Management

   a. Tube thoracostomy, as indicated.

   b. Attach the chest tube to an underwater seal drainage device.

   c. Correctly dress an open chest wound.

   d. Pericardiocentesis, as indicated.

E. Abdomen

1. Assessment

   a. Inspect the anterior and posterior abdomen for signs of blunt and penetrating injury, and internal bleeding.

   b. Auscultate for presence/absence of bowel sounds.

   c. Percuss the abdomen to elicit subtle rebound tenderness.

   d. Palpate the abdomen for tenderness, involuntary muscle guarding, and unequivocal rebound tenderness.

   e. Obtain a roentgenogram of pelvis.

   f. Perform diagnostic peritoneal lavage, if warranted.

2. Management

   a. Transfer the patient to the operating room, if indicated.
b. Apply the pneumatic antishock garment, if indicated.

**F. Perineum/Rectum/Vagina**

1. **Perineal assessment**
   
a. Contusions and hematomas
   
b. Lacerations
   
c. Urethral bleeding

2. **Rectal assessment**
   
a. Rectal blood
   
b. Anal sphincter tone
   
c. Bowel wall integrity
   
d. Bony fragments
   
e. Prostate position

3. **Vaginal assessment**
   
a. Presence of blood in the vaginal vault
   
b. Vaginal lacerations

**G. Musculoskeletal**

1. **Assessment**
   
a. Inspect the upper and lower extremities for evidence of blunt and penetrating injury, including contusions, lacerations, and deformity.
   
b. Palpate the upper and lower extremities for tenderness, crepitation, abnormal movement, and sensation.
   
c. Palpate all peripheral pulses for presence/absence.
   
d. Assess the pelvis for evidence of fracture and associated hemorrhage.
   
e. Palpate the thoracic and lumbar spine for evidence of blunt and penetrating injury, including contusions, lacerations, tenderness, deformity, and sensation.
   
f. Evaluate roentgenogram of the pelvis for evidence of fracture.
g. Obtain roentgenograms of suspected fracture sites as indicated.

2. Management

   a. Apply and/or readjust appropriate splinting devices for extremity fractures as indicated.

   b. Maintain immobilization of the patient's thoracic and lumbar spine.

   c. Apply the pneumatic antishock garment if indicated.

   d. Administer tetanus immunization.

   e. Administer medications as indicated or as directed by specialist.

H. Neurologic

1. Assessment

   a. Re-evaluate the pupils and level of consciousness.

   b. Determine the GCS score.

   c. Evaluate the upper and lower extremities for motor and sensory responses.

   d. Evaluate for evidence of paralysis or paresis.

2. Management

   a. Continue ventilation and oxygenation.

   b. Maintain adequate immobilization of the entire patient.

IV. Patient Re-evaluation

Re-evaluate the patient, noting, reporting, and documenting any changes in the patient's condition and responses to resuscitative efforts. Judicious use of analgesics may be employed only after surgical consultation. Continuous monitoring of vital signs and urinary output is essential.

V. Definitive Care: Stabilization and Transport

Outline rationale for patient transfer, transfer procedures, patient's needs during transfer, and indicate need for direct physician-to-physician communication.