



Trauma & Shock for the EMT - Intermediate

Objectives

- Refer to Chapters 15 – 21 in textbook for objectives.
- We will spend more time on shock and just review the trauma injuries.
- Concentrate on etiology, pathophysiology, and signs/symptoms.
- You will be expected to make a working field diagnosis of the conditions covered.

Mechanism of Injury

- Statistically significant problem in this country.
 - Most common MVC; Falls; Poisoning; Drowning; Fires/Burns; Miscellaneous.
 - Intentional vs. Unintentional.
 - Random acts of violence?
- Phases of Trauma care:
 - Preincident.
 - Incident.
 - Postincident.

Trauma Systems

- Trauma Centers:
 - Levels.
 - Locations.
- Golden Hour:
- Trauma Registry:
 - Data Collection.
- Transport Considerations:
 - How do you get them there?

Kinematics of Trauma

- Predicting injury pattern based on MOI.
 - Energy -
 - Newton's first law of motion – A body at rest or in motion will remain in that state until acted upon by an outside source.
 - Newton's second law of motion – force = mass x speed.
 - Law of conservation of energy – energy cannot be created or destroyed. However it can change form.

Types of MOI

- Blunt or Penetrating.
- MVC:
 - Frontal (head-on).
 - Lateral (T-bone).
 - Rear-end.
 - Rotational.
 - Rollover.
 - Secondary impact.
 - Pedestrian accident.
 - Motorcycle.
 - Bicycle.
- Others:
 - Falls; Drowning; Burns; Electrocutation; Assault; Falling objects; Sports; Blast; More.
- Restraints:
 - Shoulder belt.
 - Lap belt.
 - Head rests.
 - Air bags.
 - Child safety seats.
- Safety Equipment.

Penetrating Injury

- Cavitation: Wave of energy created by opening a pathway through the body.
 - Temporary or permanent.
- Low Energy:
 - Usually hand held objects – low velocity.
- Medium Energy:
 - Handguns and lower caliber weapons.
- High Energy:
 - Hunting rifles and assault weapons.
- Entrance & Exit?
- Body Armor? – Look for blunt injury.

Review A&P of Cardiovascular System

- Parts.
- Concepts:
 - Preload.
 - Afterload.
 - Contractility.
 - Stroke Volume.
 - Cardiac Output.
 - Systemic Vascular Resistance (SVR) or Peripheral Vascular Resistance (PVR).
- Sympathetic Nervous System.
- Aerobic vs. Anaerobic metabolism.
- Blood vessels:
 - Arteries.
 - Veins.
 - Capillaries.
- Blood:
 - 50 – 70 ml/kg.

Blood

- Plasma:
 - Fluid or water portion.
 - Proteins, carbs, AA, lipids, and salts.
- Erythrocytes:
 - Red blood cells (RBC).
 - Most numerous and contains hemoglobin.
- Hemoglobin:
 - Iron protein that binds oxygen to cell.
- Leukocytes:
 - White blood cells (WBC).
- Hematocrit:
 - Volume % of RBC's.
 - 40-45 % is normal.
- Platelets:
 - Formed elements that are essential for blood clotting.

Blood Typing

- Antigen:
 - Protein on surface of RBC that triggers formation of antibody.
- Antibody:
 - Protein developed in response to an antigen.
- RH factor:
 - Antigen factor in approx. 85% of people.
- A Blood:
 - A antigen on RBC.
- B Blood:
 - B antigen on RBC.
- AB Blood:
 - A & B antigen on RBC
- O Blood:
 - Neither A or B antigen on RBC.

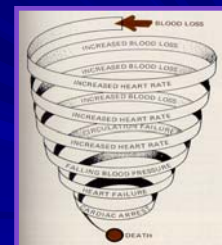
Universal Donor: O
 Universal Recipient: AB*

Soft – Tissue Injuries

- Contusions.
- Abrasions
- Penetrations/Punctures.
- Burns.
- Laceration.
- Swelling (Hematoma).
- Crush Injuries.
- Compartment Syndrome.
- Amputation.
- Avulsion.
- Hemorrhage:
 - External:
 - Arterial.
 - Venous.
 - Capillary.
 - Internal:
- Homeostatic attempts to control bleeding:
 - Local vasoconstriction.
 - Platelet aggregation.
 - Sympathetic stimulation to compensate for pressure loss.

Hypoperfusion (Shock)

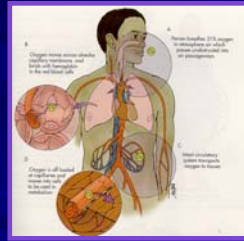
- Shock Defined:
 - Inability of the cardiovascular system to meet the metabolic demands of life.
 - Inadequate Tissue Perfusion.
 - Perfusion = a constant flow of blood through the capillaries & the exchange of metabolic materials.



Blood Pressure

- Low blood pressure is NOT shock:
 - Many normal people have low blood pressure.
- We use blood pressure for trending purposes.
- Rely on signs/symptoms for determining if your patient is in shock!
- Example:
 - 55 y/o male with history of hypertension of 240/120 daily. He may have S/S of hypoperfusion (Be in shock) and a blood pressure of 140/90.

Hypoperfusion (Shock)



- Fick Principle:
 - Inspiration of adequate oxygen in atmosphere.
 - On-loading of oxygen to the RBC's in pulmonary capillaries.
 - Delivery of RBC's to tissue cells.
 - Off-loading oxygen from RBC's to cells.

Hypoperfusion (Shock)

- Stage 1:
 - Compensated or Non-progressive Shock:
 - Baroreceptors detect drop in CVP.
 - Sympathetic NS causes catecholamine release.
 - Increased HR/RR.
 - Increase contractility.
 - Vasoconstriction.
 - Bronchodilation.
 - Pupillary dilation.
- Signs & Symptoms:
 - Altered mental status - restlessness.
 - Increased HR/RR.
 - Pale, cool skin.
 - Increased diastolic BP.
 - Decreased pulse pressure.
 - Circulation maintained.

Hypoperfusion (Shock)

- Stage 2:
 - Decompensated (Progressive) Shock:
 - Compensatory mechanisms are no longer able to maintain.
 - Blood is diverted from non-essential areas such as the abdominal organs and skin.
 - Cells & tissues become hypoxic.
- Signs & Symptoms:
 - Additional increase in HR/RR.
 - Cool, clammy skin.
 - Decreased CRT.
 - Thirst/Confusion.
 - Nausea and vomiting.
 - Sweating.
 - Narrowing of pulse pressure.

Hypoperfusion (Shock)

- Stage 3:
 - Irreversible Shock:
 - Rapid deterioration of the cardiovascular sys.
 - Blood is shunted from liver and kidneys to preserve heart and brain.
 - Organs begin to fail.
 - Cells and tissues begin to die.
- Signs & Symptoms:
 - Marked decrease in level of consciousness.
 - Decreased RR and/or HR.
 - Hypotension.
 - Feeling of impending doom.
 - Absent or minimal urinary output.

Hypoperfusion (Shock)

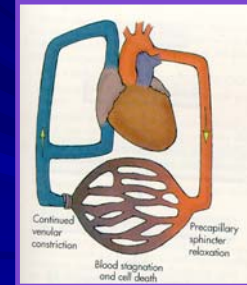
- Keys to successful recognition of shock:
 - Have a high index of suspicion.
 - Anticipate the potential for progression.
 - Remember the subtle S/S of compensated form.
 - DO NOT rely on any one sign to judge shock.
 - Use "Golden Hour" concept.
 - Hypotension is a late indication of shock. If the patient is hypotensive, they are dying.

Hypoperfusion (Shock)

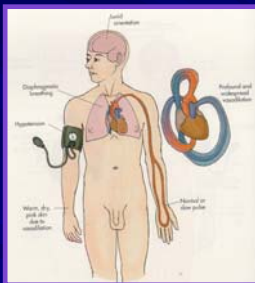
- Patients at risk for shock deterioration:
 - Multi-trauma patients due to decreased perfusion to already damaged organs.
 - Elderly patients due to previously diseased or compromised organs.
 - Pediatric patients because they can compensate for shock for longer than adults and may decompensate rapidly.
 - Pregnant patients due to the diversion of blood away from the fetus.

Hypoperfusion (Shock):

- Types of Shock:
 - Primary Mechanisms:
 - Fluid loss:
 - Hypovolemic Shock.
 - Volume Problem.
 - Vasodilation:
 - Neurogenic Shock.
 - Container Problem.
 - Pump failure:
 - Cardiogenic Shock.
 - Pump Problem.



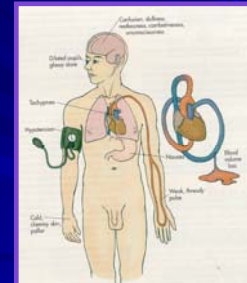
Hypoperfusion (Shock):



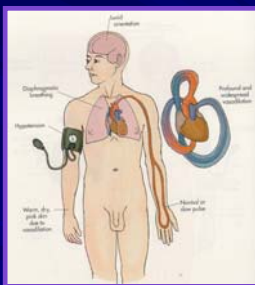
- Hypovolemic Shock:
 - Hemorrhagic Shock.
 - Metabolic Shock.
- Neurogenic Shock:
 - Spinal Shock.
 - Septic Shock.
 - Anaphylactic Shock.
 - Psychogenic Shock.
- Cardiogenic Shock:
 - Heart failure.
 - Obstructive Shock.
 - Tension Pneumo.
 - Cardiac Tamponade.

Hypoperfusion (Shock):

- Hemorrhagic Shock:
 - From severe blood loss.
 - Sympathetic nervous system discharge.
 - Support ABC's; keep pt. warm; no oral fluids; IV fluid replacement at 3:1; rapid transport; PASG.



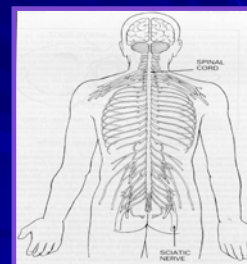
Hypoperfusion (Shock):



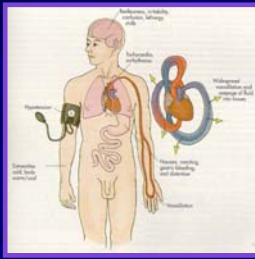
- Metabolic Shock:
 - From loss of body fluid other than blood.
 - Severe vomiting, diarrhea, burns, sweating, etc.
 - Treatment same as hemorrhagic.

Hypoperfusion (Shock):

- Spinal Shock:
 - Severe vasodilation from injury to spinal cord and loss of nervous control.
 - No sympathetic release.
 - Treat same as hemorrhagic.



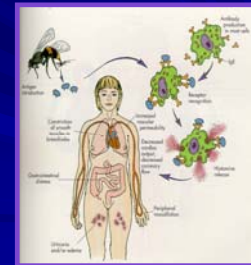
Hypoperfusion (Shock):



- **Septic Shock:**
 - Vasodilation from release of toxins after prolonged/massive infection.
 - Blood plasma also lost from leaking capillaries.
 - Treatment same as hemorrhagic.

Hypoperfusion (Shock):

- **Anaphylactic Shock:**
 - Vasodilation due to release of histamine after exposure to an allergic substance.
 - Respiratory distress and airway swelling.
 - Treat with epinephrine injection and same as hemorrhagic.

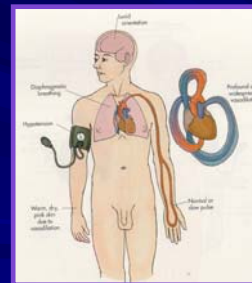


Anaphylaxis



- **Pruritus (itching):** Unpleasant sensation that provokes the desire to scratch.
- **Urticaria (hives):** Pale red swellings of skin that occur in groups on any part of the skin.
- **Erythema multiforme:** Redness and swelling.

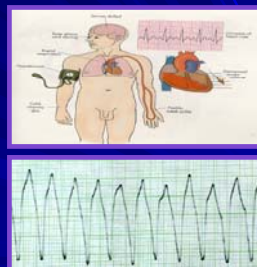
Hypoperfusion (Shock):



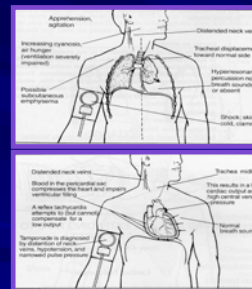
- **Psychogenic Shock:**
 - Simple fainting.
 - Syncope.
 - Sudden blood vessel dilation from standing or pressure on vagus nerve.
 - Usually corrects itself when pt. is supine.

Hypoperfusion (Shock):

- **Heart Failure:**
 - Severe tachycardia.
 - Severe bradycardia.
 - Dysrhythmias.
 - Myocardial Infarction.
 - Failure of heart muscle itself as in CHF.
 - Pericarditis.
 - Valvular disorders.



Hypoperfusion (Shock):



- **Obstructive Shock:**
 - **Pericardial Tamponade:**
 - Sac around heart fills with blood and obstructs pumping ability.
 - **Tension Pneumothorax:**
 - Air builds up under pressure between lung and thorax obstructing venous return by excess positive pressure in cx.

Hypoperfusion (Shock):

- Shock Management:
 - Assess & find shock.
 - Secure airway.
 - Provide oxygen.
 - Control bleeding.
 - Apply PASG/MAST.
 - Administer fluids.
 - Maintain body heat.
 - Monitor vitals & transport rapidly.



Consider PASG?

- Apply on unstable trauma patients that may deteriorate or those with S/S of hypoperfusion.
 - Let medical directors and medical control make the decision for inflation.
- Only contraindication is
- Very helpful for multiple lower extremity and pelvic fractures or intra-abdominal bleeding (traumatic or medical).
- Inflation steps.

IV Fluids?

- 3:1 rule for fluid:blood loss method of replacement gives you an estimate of how much fluid the patient needs.
 - But it doesn't mean they get it ALL enroute!
- 20 ml/kg is fluid bolus rate:
 - Administered wide open through more than one IV line.
- Fluid Challenge:
 - A single amount of fluid to "challenge" the cardiovascular system to work better.
 - Usually 200 – 300 – 500 ml. Given rapidly.

Titrate IV Fluids

- Patient should be continually monitored for improvement during fluid administration.
 - As soon as improvement is noted, slow fluids to KVO rate.
 - Only administer enough to restore perfusion without increasing pressure.
 - The ideal goal for the systolic blood pressure is 90-100 mmHg, but the perfusion is what we monitor.

Burns

- Thermal, Chemical, Electrical.
- Superficial.
- Partial Thickness.
- Full Thickness.
- Rule of Nines.
- Inhalation.
- Radiation.
- Electrocution.

Burn Shock

- Emergent Phase:
 - Initial decrease in blood flow to the area.
- Fluid Shift Phase:
 - Increase in arteriolar vasodilation from vasoactive substances.
 - Increased capillary permeability.
 - Vascular fluid loss and wound edema.
- Burn shock takes 24 – 72 hours to develop.
 - If your patient is in shock immediately following a burn injury, look for other trauma that is causing it.

Burn Treatment

- Safety.
- ABC – Oxygen/Ventilation/Airway.
- Stop the burning process:
 - Cool only enough to prevent hypothermia.
- Remove clothing and jewelry.
- Dress with sterile material.
- Consider Burn Center Referral.
- ALS for pain management.
- IV access in non-burned area to begin fluid replacement
 - Parkland Formula: $4 \text{ cc/kg/BSA} = \text{Total fluid for 24 hours.}$
 - $\frac{1}{2}$ administered in first 8 hours.
 - $\frac{1}{2}$ administered in last 16 hours.

Thoracic Trauma

- Rib Fracture.
- Sternal Fracture.
- Flail Chest.
- Pulmonary Contusion.
- Myocardial Contusion.
- Myocardial Rupture.
- Diaphragmatic Rupture.
- Esophageal/Tracheal/Bronchial Rupture.
- Aortic Rupture.
- Traumatic Asphyxia.
- Pneumothorax:
 - Open or closed.
 - Simple.
 - Tension.
- Hemothorax.
- Cardiac Tamponade.

Treating Chest Injuries

- Stabilize Spine? ABC.
- Airway – Oxygen – Ventilation.
- Stabilize flail chest with bulky material taped to uninjured chest.
- Seal open wounds with occlusive material.
- Basic shock treatment.
- Consider fluids to manage shock.
- Constantly monitor ventilation.
- Consider ALS for possible chest decompression.
- Transport to appropriate facility.

Head & Spine Injuries

- Soft – Tissue Injury.
- Facial Fractures.
 - Le Fort?
- Eye, Ear, Dental Injury.
- Anterior Neck Injury.
- Posterior Neck Injury.
- Skull Fracture.
 - Basilar?
- Brain Injury & Intracranial Pressure.
 - Concussion.
 - Contusion.
 - Intracerebral Hemorrhage.
 - Subdural Hematoma.
 - Epidural Hematoma.
- Spinal Injury.
 - Blunt or Penetrating.
- Helmets?

Treatment of Head & Spine Injury

- Stabilize Spine.
- ABC – Airway – Oxygen – Ventilation.
- C-Collar.
- Movement? Fast or slow? KED/LBB.
- Cervical Immobilization Device (CID).
- Treat shock first.
- ICP does NOT need fluid resuscitation.
- Appropriate facility.
- ALS for better airway control and/or medication management.

Abdominal Injury

- Penetrating.
- Solid vs. Hollow organ.
- Retroperitoneal.
- Pelvic Organ.
- Vascular Structure.
- Evisceration.
- Trauma in Pregnancy.
- Impaled Objects.

Treating Abdominal Injury

- High index of suspicion.
- Stabilize Spine? ABC.
- Airway – Oxygen – Ventilation.
- Treat for shock – Basic and Fluids.
- Stabilize impaled objects.
- Dress evisceration properly.
- Lateral positioning for pregnancy.
- Appropriate facility.

Extremity Injury

- Bone Injury:
 - Sprain or Strain.
 - Fracture.
- Joint Injury:
 - Dislocation.
- Open or Closed Injury?
- Stable vs. Unstable Patients.
 - Don't delay transport of a critical patient to manage extremity injuries.

Stable Patients

- Long bone immobilization:
 - Rigid splints.
 - Soft splints.
 - Air splints.
 - Traction splints.
 - Ladder splints.
 - Malleable splints.
 - Commercial splint kits.
 - Vacuum splints.
- Joint Immobilization:
 - Sling and swathe.
 - Any of the other splints?
- Hip Injury:
 - Scoop stretcher.
 - LBB.
 - KED.
- Splint before movement if patient is stable.
- Pelvis injury or Bilateral Femur Fracture becomes unstable patient.

Unstable Patients

- Stabilize Spine? ABC.
- Airway – Oxygen – Ventilation.
- Load and Go before splinting!
- Anatomic splint.
- PASG?
- Treat for shock.
- Appropriate Facility.
- Splint enroute if time and patient condition permits.

Summary of Trauma Care

- Be highly suspicious of MOI.
- Stabilize spine early.
- Initial Assessment and administer O₂ or Ventilate quickly.
- If Stable, evaluate and treat injuries.
- If Unstable, perform Rapid Trauma Assessment and treat enroute.
- Apply C-Collar.
- Seal chest wounds.
- Splint flail chest.
- Dress eviscerations.
- Stabilize impaled objects.
- PASG?
- LBB/KED?
- Proper positioning.
- ALS?
- Appropriate Facility?
- Ongoing Assessments.
- Treat minor wounds.
- Detailed physical Exam.

Mass Casualty Incidents (MCI)

- An occurrence inflicting widespread destruction & distress, a grave misfortune, or a total failure.
 - This is the dictionary's perspective.
- Disaster:
 - Incident larger than local resources can manage.
 - Will vary based on ability of the community.
- MCI – Misnomer:
 - May involve more patients than EMS providers.
 - Multiple patient incidents.
 - Usually more than 5 – 7 patients.

Essential Components of Disaster Management

- Command or Control.
- Triage.
- Transportation.
 - These three functions are the basic nucleus around which all other activities are ORGANIZED.



Command or Control



- The person ultimately in charge of the disaster response.
 - Established by first arriving unit on the scene.
 - May be transferred to person of higher qualification or experience when they arrive.

Command or Control

- Multiple agencies are often involved:
 - EMS officers focus on incidents with multiple patients.
 - Fire Officers focus on incidents with fire or rescue.
 - Police Officers focus on incidents with crime or potential public harm (riots).

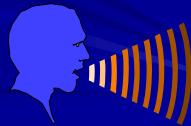


Interagency Cooperation

- Understanding the need for each agency eliminates the duplication of efforts & conflict at the scene.
- One person must be in control to prevent “freelancing” or acting without purpose to the incident.

Communications

- One of the most essential elements of disaster control.
 - Many incidents have had poor outcomes simply due to poor communication.
 - Maintain silence unless information is specifically requested or necessary in carrying out your duties.
- Use face to face communication when inside sectors.
 - Only communication that is absolutely needed.



Documentation

- Record keeping should be done by incident commanders and leaders of each branch or division of command (sector).
 - # of patients, vehicles used, personnel, hospitals used, conditions, & cause of incident.



Sectorization

- One can only control approx. 5-7 groups or people at a time.
- Sectors may need to be established to divide responsibilities of incident control.
 - Incident commander is in charge of overall incident and delegates control to others.
- Sectors that may be needed:
 - Safety sector.
 - Staging sector.
 - Triage sector.
 - Treatment sector.
 - Transportation sector.
 - Extrication sector.
 - Resources sector.
 - Rehabilitation sector.

Triage

- French word meaning “to sort”.
 - Trevor Barnes description:
 - Triage requires compassion tempered with wisdom. It has been suggested that the ideal triage officer should be blind to the horrific sights, deaf to the cries of the injured, have the wisdom of Solomon, the patience of Job, and his hand tied behind his back.

Three Stages of Triage

- Tagging:
 - No tx. administered.
 - Pts. are labeled by severity.
- Movement & Collection:
 - Moved to safe area, re-triage, & treatment.
- Field Hospital:
 - Only done at larger incidents or where transport is delayed.

START Method of Triage

- Simple Triage And Rapid Treatment:
 - Utilizes RPM assess method.
 - Evaluate Respiration:
 - RR <10 or >30.
 - Evaluate Perfusion:
 - CRT > 3 seconds.
 - Evaluate Mental Status:
 - Any deviation in A&O x 4.

START Method of Triage

- First arriving crews will find patients, triage them, and tag pts. according to severity.
- Only immediately life saving tx. will be done:
 - Opening airway.
 - Bleeding control.
 - Use bystanders to hold these treatments & move on to next patient.
- Goal is to save as many pts. as possible.

START Method of Triage

- Tagging:
 - First Priority:
 - Red.
 - Any deviation in RPM assessment.
 - Second Priority:
 - Yellow.
 - Potentially Unstable.
 - Third Priority:
 - Green.
 - Walking wounded.
 - Fourth Priority:
 - Black.
 - Dead or Non-
- Locate all walking wounded patients and send them to the green area of treatment sector.
 - These patients will receive a full assess. & be re-triaged as needed.
- Perform RPM assess on all remaining patients.
 - They will be moved to treatment area according to color.

START Method of Triage

- Treatment areas are established based on # & condition of patients.
- Larger incidents or unstable scenes require movement of all patients to treatment.
- Immediate (red) priority treatment area may be around where pts. are found in smaller incidents.

Triage Tags

- Colored tape.
 - Colored Ribbon.
 - METTAG System.
 - Colored markers.
- All systems must be applied to a common area of the patient after triaged.
 - Color can be changed during second phase & treatment as needed.

Second Phase of Triage

- Patients are placed in treatment area according to color or priority.
 - Full assessments are performed.
 - Treatment begins under standards of care.
 - Treatment sector coordinates with transport sector for removal of worst patients first.

Second Phase of Triage

- Priority of triage can be changed if patient's condition has worsened or was missed.
 - Treatment areas should be identified by colors with flags or covers to make identification easier & movement of patients between sectors convenient.

Third Phase of Triage

- Not commonly done unless incident is very large or transport of patients is delayed.
 - Hospital personnel are assembled at the scene at a "field hospital" area to provide definitive treatment.
 - Decreases the number of patients who are transported from the scene.

Communication Between Sectors

- Incident commander communicates with dispatch and each sector commander.
- Sector commander communicates with incident commander and individuals in sector.
 - Sector commanders may divide sector into manageable groups (5-7 people or groups).
- Transport sector, triage sector, and treatment sector should be located close to each other to facilitate communication & movement of patients.

Transport of Patients

- Transportation sector coordinates with area hospitals to determine the volume of patients that can be handled by each.
 - Transportation sector officer is the only one to communicate with hospitals.
 - Transportation sector must communicate with staging sector to ensure adequate resources of transporting vehicles (ambulances, helicopters, etc.).
- Sectors may be combined in a single function at smaller incidents.

Steps of Disaster Management

- Planning.
- Warning & Evacuation.
- Event.
- Response.
- Management.
- Recovery.
- Post-incident follow-up.
- Make plans for the incident to be a failure.
 - Realize that all situations cannot be predicted.
 - Make arrangements to have access to a variety of resources available when needed.
 - Emphasis should be placed on communication and interagency relations.

Arrival at the Scene

- Scene size-up.
- Establish a command presence.
- Call for additional resources.
- Make assignments to crew members.
- Identify areas to be established as sectors.
- All sector responsibilities lie within first unit until relieved by others.

Disaster Drills

- Method of training providers to act in simulated situations.
 - Allows prediction of problems to increase knowledge or need for resources before and actual event occurs.
 - Preplan your service area for the common types of MCI that may occur & be realistic.

Problems with Disaster Management

- No unified command presence:
- Freelancing.
- Poor communication.
- Too much communication.
- Attempting resuscitation on dead patients, tying up resources.
- Poor area for staging.
- Inadequate entry & exit point for vehicles.
- Not requesting additional assistance early.
- Becoming involved in physical tasks.
- Inadequate control of perimeter.
- Treating patients where found instead of moving them.
- Inadequate safety.
- Treatment area too small.
- Not advising ED of last patient transport.

Summary

- No one looks forward to having a disaster; however, it is necessary to be prepared to respond should one occur. It is the responsibility of each EMT to be know about the disaster plan in his/her agency and to be familiar with all the elements of successful disaster management. The first EMT on the scene sets the tone for the outcome of the operation.