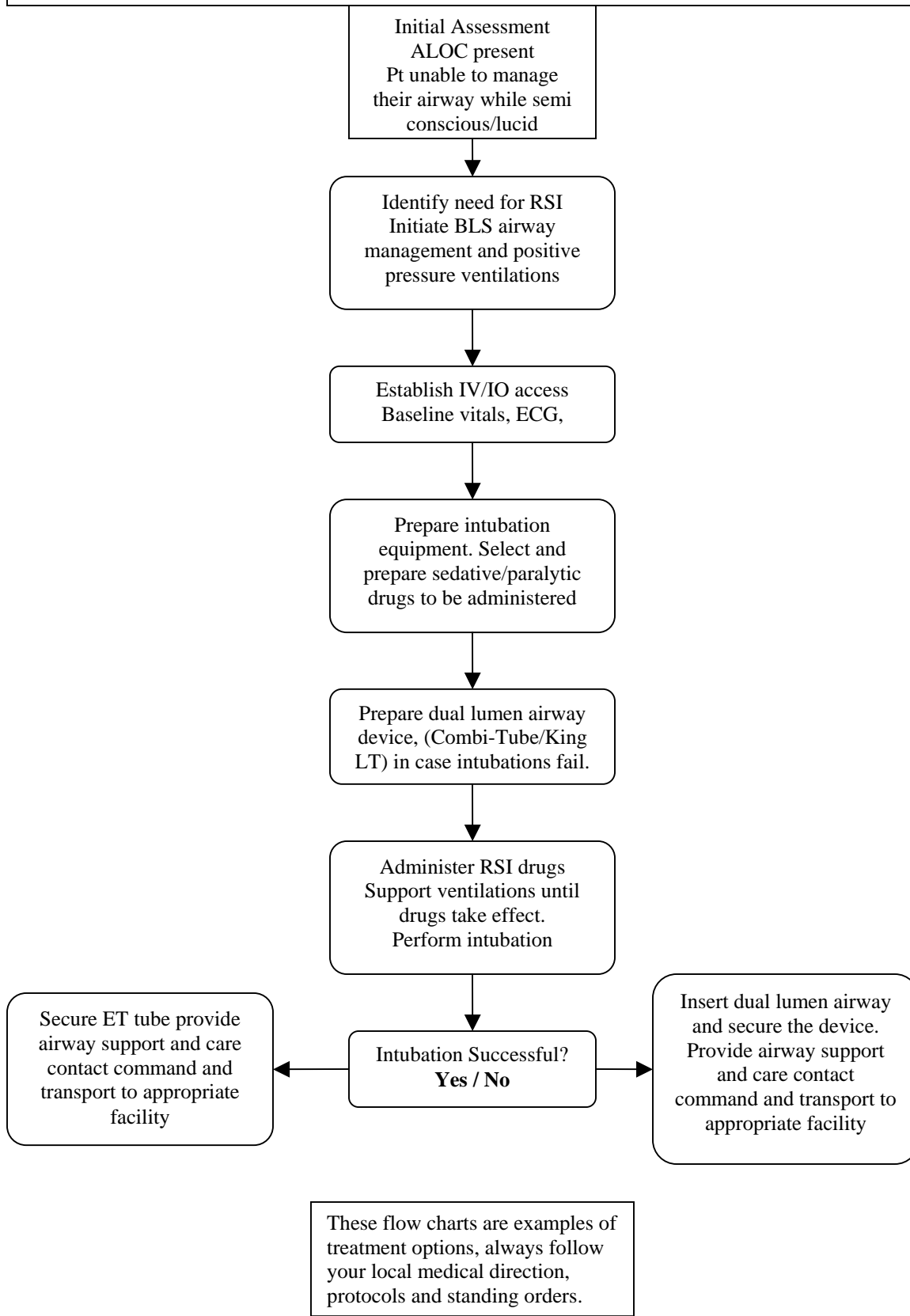


## Rapid Sequence Intubation



## Trauma systems & MOI

### Definitions

- **Kinematics** – Process of predicting injury patterns that can result from the forces and motions of energy. Based on MOI, force, anatomy, energy involved.
- **Cavitation** – A temporary or permanent opening produced by a force that pushes body tissues laterally away from the tract of the projectile.
- **Blunt Trauma** – A type of physical trauma caused to a body part, either by impact, injury or physical attack; the latter usually being referred to as blunt force trauma.
- **Note:** Unintentional injury is 5<sup>th</sup> leading cause of death in America. (in ages 1–34 years)

### Incident Phases of Care

- **Pre-Incident** = Prevention
- **Incident** = Bad things happen
- **Post Incident** = Scene management and prehospital care, definitive care, and rehabilitation.

### Drive or Fly the Patient?

- **Golden Hour** – 1 hour from the time of injury. Goal is to get them in surgery within this time frame.
- **Platinum 10 minutes** – Maximum on scene time for EMS management.
- Time and distance to appropriate facility.
- Local Protocols.
- Medical direction.

### Laws of Physics

- **Newton's First Law** – An object whether in motion or not remains in that state until some other force acts on it.
- **Conservation of Energy** – Energy cannot be created or destroyed. It just changes form.
- **Newton's Second Law** States: Force = mass x acceleration (or deceleration)
- **Kinetic Energy** =  $\frac{1}{2}$  mass x velocity squared.

### Car Accidents

- Have **3 types of impacts:** car to object, person to car, and organs to body cavity walls.
- Fourth impact would be loose objects striking the person.
- **Crash types** – Head on or frontal, lateral impacts (aka T bone), rear end, rotational, and rollovers.
- **Up and Over Injuries** – Expect head, face, thorax trauma, broke ribs, pericardial tamponade, pneumothorax, hemothorax etc.
- **Down and Under Injuries** – Expect abdominal, hollow/solid organ damage, femur fracture, pelvis fracture, distal lower extremity damage.
- Look for signs of intrusion and possible impact points of the patients against the vehicle.
- Acceleration injuries (whiplash)
- Deceleration injuries (rapid/abrupt stops)

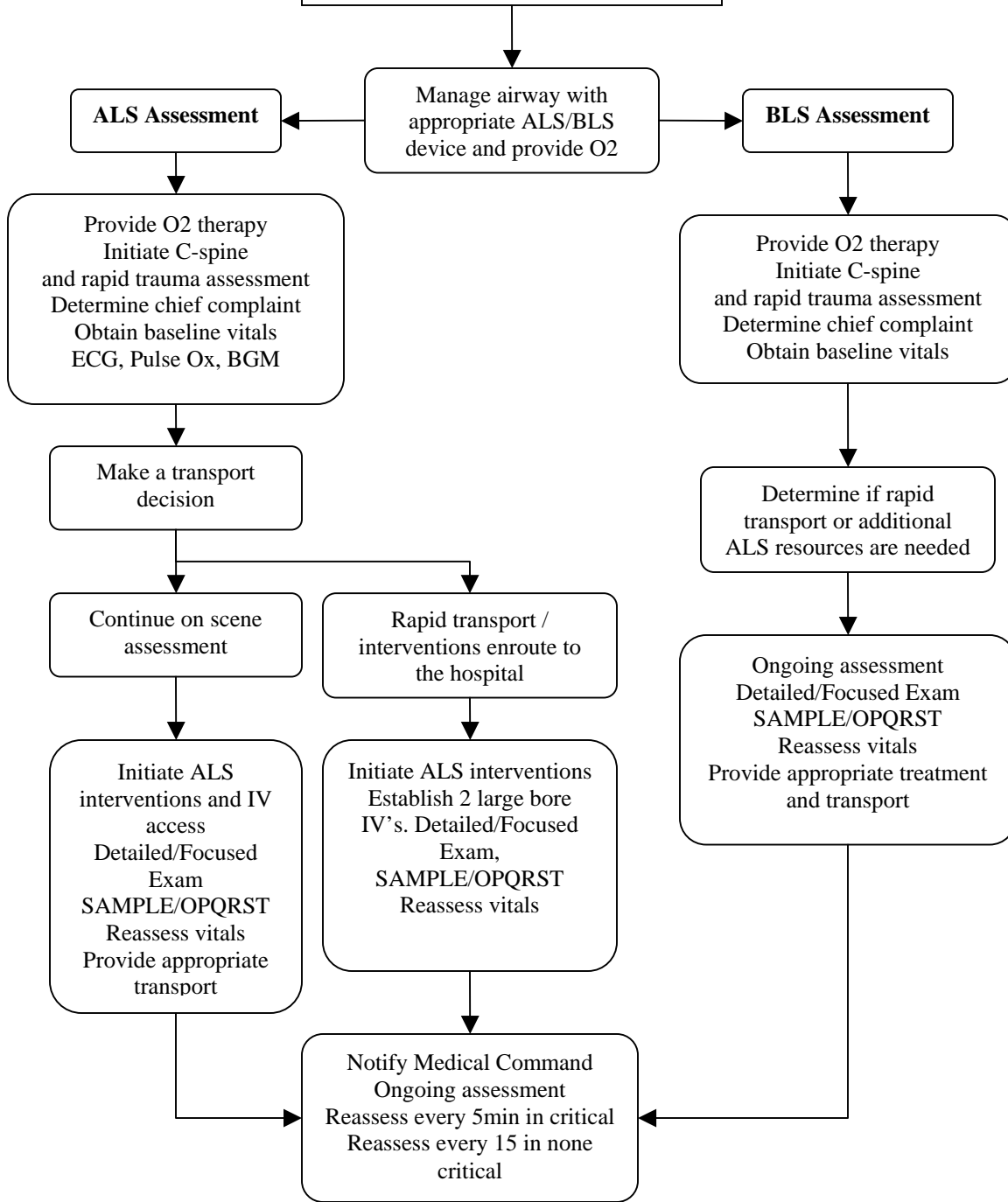
### Restraints Systems

- **Seat belts** – Improper use can cause severe abdominal injuries.
- **Air bags** – (Front passenger/driver, side curtain, rear) driver should remain 10" from bag deployment site passenger 18" from deployment site.
- **Car seats** – Account for age and weight of the child.
- **Booster seats** – For school age children, raises their center of gravity for seat belts.

## Trauma Assessment

Determine scene safety  
 Determine # of patients  
 Determine a MOI  
 Additional resources needed?  
 Establish level of consciousness.  
 Assess: airway, breathing circulation  
 Control Bleeding and or **manage all life threatening injuries**

These flow charts  
 are examples of  
 treatment options,  
 always follow your  
 local medical  
 direction, protocols  
 and standing orders.



## Head, Thorax, Abdominal Collision Injuries

- Many structures are attached to great vessels; note the possibility of rupture for any solid structure.
- Organs can detach from vessels and connective tissues that hold them in place causing severe bleeding or dysfunctions.
- Head injuries are open or closed; pressure can build and cause ICP which leads to brain swelling and severe neurological deficits.
- **Coup and Countercoup** – Coup = initial impact and Countercoup = impact of organ on opposite side of structure from which initial impact was received.
- The pelvis can hide up to a liter of blood without showing physical signs.
- If people see potential impact coming they tend to take a deep breath and hold it as a reaction, note potential for pneumothorax and hemothorax to develop in these patients.

## Motorcycles & ATV's

- Motorcycles have three types of impacts: head on, angular, and laying the bike down.
- ATV's have higher center of gravity than motorcycles.
- Most accidents result in ejections.
- Potential for large bone breaks, flail chest and head injuries.
- Note estimated speeds and what they impacted.
- Was rider safety gear used (helmet/leathers/jackets)? What damage has the gear sustained?
- An over the handle bars accident commonly yields bi-lateral femur fractures.

## Pedestrian Injures (from cars)

- Adults take protective posture and turn away from impacting vehicle.
- Adults have low initial impact point (distal lower extremities) femur, tibia etc.
- Pediatrics reaction is to turn toward impact or face it resulting in frontal impact.
- Pediatrics have higher impact point (upper femur, abdomen, lower thorax)
- For both pediatrics and adults there are three impacts.

**Initial Impact** – Struck by bumper.

**Second Impact** – Pedestrian strikes hood or grill of car.

**Third Impact** – Thrown from second impact point to ground or other object.

## Blast Injuries

- Caused by pressure field produced by explosions or volatile substances.
- **Primary Blast injuries** – Sudden change from environmental pressure damage to hollow organs, lungs, ear drums, GI track, cerebral embolisms and hemorrhages and so on.
- **Secondary Blast injuries** – Results from the shrapnel and flying debris. Lacerations and punctures wounds, avulsions and amputations.
- **Tertiary Blast injuries** – Victim is propelled through space to the ground or stationary object.
- **Miscellaneous injuries** include radiation and toxic chemicals.

## Penetrating Trauma

- Is crushing, stretching and puncturing of tissues.
- **Cavitation** – An opening by force, pushing body tissues laterally away from the track of the projectile.
- Size and speed of the object that is penetrating does matter.
- Anatomical location and organs involved.
- High velocity (rifles), medium velocity (Hand gun), and low velocity (Knife or ice pick.)
- Injuries produced by medium and high velocity weapons usually do damage 2–3 times the damage of the diameter of the actual projectile because of the sonic pressure rings around it.

- Hollow organ damage can “shunt or tamponade” themselves in a limited capacity.
- Solid organs tend to explode or rupture upon impact.
- Close GSWs will have damage from the gas pressure of the muzzle as well as projectile damage.
- GSWs close range may have powder burns or muzzle flash burns.
- Entry GSW tend to be smaller than exit wounds which tend to be jagged and ripped.
- The further distance from the gun the less potential damage. Wind, air friction and drag slow the projectile.
- Fragmentation can occur increasing the amount of area affected.
- Shot gun wounds involve multiple pellets and are effective only at closer ranges.

## Hemorrhage & Shock

### Definitions

- **Hemostasis** – The cessation of bleeding by mechanical or chemical means or by substance that arrests blood flow.
- **Pulse Pressures** – The difference between systemic and pulmonary pressures. (Systolic & Diastolic)
- **Disseminated Intravascular Coagulation** – (DIC) A grave coagulopathy that results from over stimulation of the clotting and anti clotting processes in response to disease or injury.
- **PASGs** – Pneumatic Anti Shock Garments

**Note:** The body is made up of a pump, pipes, fluid and a container. Problems with any or all of them can cause shock.

### External Hemorrhage

- Seriousness depends on 3 factors: anatomical source, degree of vasculature disruption (arterial, venous, capillary), and the amount of blood loss a patient can tolerate.
- Arterial bleeding
- Severed limbs (amputations/avulsions)

### Internal Hemorrhage

- Causes insufficient amounts of circulating blood.
- Can hide in abdominal, pelvic, thorax or the retroperitoneum
- Has higher mortality rates

### Signs/Symptoms (Internal)

- **Melena** – Black tarry stools, foul smelling.
- Bright red blood out of any orifice.
- Coffee ground like vomit.
- **Hematochezia** – Red blood from the rectum
- Orthostatic hypotension.
- Unexplained shock.
- Ridged tender, pulsating abdomen upon palpation.

### Physiology of Shock

- **Hemostasis** – (Clotting) is the initial response to hemorrhage.
- **Shock** – Inadequate tissue (capillary) perfusion.
- **Perfusion** – Adequate blood volume and oxygenation of tissue cells.
- **Fick Principle** – The amount of O<sub>2</sub> the lungs deliver to the blood is directly related to the amount of O<sub>2</sub> that the body consumes. **Cardiac Output = Heart Rate x Stroke Volume.**

## Vasculature

- All vessels larger than capillaries have layers of tissue surrounding the endothelium known as tunicae.
- **Systemic pressure** is left ventricle pressure.
- **Pulmonic pressure** is right ventricle pressure.
- **Systemic pressure** has two phases systolic and diastolic pressure. The pulse pressure is the difference between the two.
- **Peripheral Vascular Resistance** is afterload, total resistance against which blood must be pumped
- **Preload** – Ventricular diastolic pressure. (venous return / ventricles at rest)
- **Viscosity** – The physical properties of a liquid, characterized by the degree of friction between its component molecules.
- **Stenosis** – Abnormal narrowing of vasculatures.
- **Rouleaux Formulation** – Occurs as acidosis progresses, pH levels fall which causes RBCs to cluster together. This halts organ perfusion disrupting nutritional flow.
- **Nutritional flow** – Delivery of oxygen and nutrient rich blood and removal of cellular waste and byproducts.
- **Disseminated Intravascular Coagulation** – A grave coagulopathy that results from over stimulation of the clotting and anti-clotting processes in response to disease or injury.

**Note:** Capillaries act as storage channels and can account for 70% of blood volume

## Organ Failure (from shock)

- Shock will cause organ failure.
- Usually liver fails first followed by kidneys then heart failure.
- **MODS – Multiple Organ Dysfunction Syndrome.** This is in part due to irreversible shock.

## Classifications of Shock

- **Hypovolemic** – Volume shock
- **Hemorrhagic** – Bleeding specific shock
- **Cardiogenic** – Inadequate heart perfusion/function
- **Neurogenic** – Spinal shock, distributive shock or vasogenic shock; usually paralyzed people experience this type of shock; however severe trauma can cause it.
- **Anaphylactic** – Severe allergic reaction, excessive histamine release causing severe systemic reaction.
- **Septic** – From massive systemic infections.

## Stages of Shock

- Compensated
- Uncompensated/Decompensated
- Irreversible
- Death

## Compensated

- Body shunts blood to vital organs.
- Vasoconstriction & PVR increase.
- Increases heart rate.
- Increases respiratory rate.

## **Uncompensated**

- Occurs when body can no longer maintain systemic blood pressure.
- Systolic pressure depends on circulating volume.
- Narrowing pulse pressures.
- Low systolic pressures.
- Tachypnea
- Tachycardia, cyanosis, pallor
- Decrease urine output
- Poor capillary refill
- Cool to touch
- Low PO<sub>2</sub> levels
- Acidosis (respiratory or metabolic)
- Cardiac rhythm disturbance.

## **Irreversible**

- High mortality rate.
- Cells and organs die from lack of energy and O<sub>2</sub>.
- Cellular membranes fail, leaking organelles out of the cells.
- Frank hypotension
- Pale cool clammy skin.
- Cardiopulmonary collapse

## **Variation Factors (from person to person)**

- Age
- Health status
- Physical condition
- Preexisting disease
- Medications
- Specific organ systems affected

## **Shock Assessment**

- ABCs
- Level of consciousness (AVPU)
- MOI /disease process
- Expose your patient
- **Orthostatic vitals:** An increase in pulse rate >10bpm & B/P Change >10mmhg systolic.  
(Laying supine, sitting, then standing)

## **Differential Assessment**

- Disruptive (neurological, anaphylactic, septic)
- Obstructive (obstructed blood flow)

## **Fluid Ratios**

- It takes 3 liters of crystalloid solution to replace 1 liter of blood (3:1 ratio)

## **Contraindications for PASG's**

- Pregnant
- Abdominal injuries (impalements, eviscerations etc.)
- Prolonged use over an hour.