

- 1. EPIC-Kids Algorithm**
- 2. EPIC-Adult-Algorithm**
- 3. External Hemorrhage Control Protocol**
- 4. Hemorrhage Control Algorithm**
- 5. General Trauma Management**
- 6. Tourniquet Protocol**
- 7. Spinal Motion Restriction**

EPIC4Kids Algorithm: For Children

Any Suspicion of TBI (Mechanism, GCS, Exam)

Automatically: 15 L/min O₂ NRB, IV Access
q3-5 min: Monitor O₂, BP, HR

Airway/Breathing

Circulation

Disability

O₂ sat <90 &/or hypoventilation
(despite NRB)

Hypotension** or other signs of shock

Evaluate
Mental
Status/GCS

No

Yes

No

Yes

Continue careful
monitoring of O₂
sat and airway

-BLS airway
maneuvers
-BVM *

-Continue careful
Monitoring BP/HR
-Pay attention for
early signs of shock:
-Tachycardia
-Dropping SBP

-20ml/kg bolus NS
-Repeat until hypotension
resolves

No

O₂ sat <90
despite BLS?

Yes

Consider ALS airway if experienced provider available:

- Place advanced airway:
 - Pre-oxygenate: BVM with 100% O₂ @ age-appropriate rate *
 - Check placement using ETCO₂ monitor/detector
- AVOID** even *MILD* hyperventilation with *Ventilation Rate Timer* and *Pressure-controlled Bag*:
 - Carefully keep rate @ age-appropriate rate *
 - **ETCO₂ available: Target ETCO₂ 40 mmHg (range: 35-45)**
 - Control Ventilatory volume:
 - Ventilator available: utilize *as soon as possible*
 - Tidal volume = 7 cc/kg
 - Ventilator *not* available: Continue Pressure-controlled BVM
- Monitor: O₂ sat and airway *every 3-5 minutes*:
 - If O₂ sat <90mmHg despite above interventions, consider:
 - Tension pneumothorax & needle thoracostomy

* **Ventilation Rates:**

- Infants:** (0-24 mo.):
-25 breaths/min (bpm)
- Children:** (2-14 yrs):
-20 bpm
- Adolescents:** (15-17 yrs):
-10 bpm (same as adults)

** **Identifying Hypotension in children**

- 0-9 yrs: 70 + (age x 2)
- ≥10 yrs: <90mmHg
- Rules of thumb:**
- Newborn: <70mmHg
- 5 year old: <80mmHg
- 10 and older: <90mmHg →
(Same as adults)

NOTE: NO ONE (not even Respiratory Therapists) can manually ventilate at the proper rate without ventilatory adjuncts (EVERYONE inadvertently hyperventilates unless meticulously preventing it):

- Ventilation Rate timers
- Pressure-controlled bags
- ETCO₂ monitoring with someone watching the level continuously
- Mechanical ventilator with careful ETCO₂ monitoring

EPIC TBI Algorithm: For Adults

Any Suspicion of TBI (Mechanism, GCS, Exam)

Automatically: 15 L/min O₂ NRB, IV Access
q3-5 min: Monitor O₂, BP, HR

Airway/Breathing

Circulation

Disability

O₂ sat <90 &/or hypoventilation
(despite NRB)

SBP <90 or other signs of shock
(If BP is dropping, do not wait until patient is hypotensive to begin IVFs)

Evaluate
Mental
Status/GCS

No

Yes

No

Yes

-BLS airway
maneuvers
-BVM-10bpm

-Continue careful
Monitoring BP/HR
-Pay attention for
early signs of shock:
-Tachycardia
-Dropping SBP

-Initial bolus-1 liter NS/LR
-Continue IVFs at sufficient
rate to keep SBP ≥90 mmHg

Continue careful
monitoring of O₂
sat and airway

No

O₂ sat <90
despite BLS?

Yes

Consider ALS airway if experienced provider available:

- Place advanced airway:
 - Pre-oxygenate: BVM with 100% O₂ @ 10 breaths/min
 - Check placement using ETCO₂ monitor/detector
- AVOID** even *MILD* hyperventilation with *Ventilation Rate Timer* and *Pressure-controlled Bag*:
 - Carefully keep rate @ 10 BPM
 - **ETCO₂ available: Target ETCO₂ 40 mmHg (range: 35-45)**
 - Control Ventilatory volume:
 - Ventilator available: utilize *as soon as possible*
 - Tidal volume = 7 cc/kg
 - Ventilator *not* available: Continue Pressure-controlled BVM
- Monitor: O₂ sat and airway *every 3-5 minutes*:
 - If O₂ sat <90mmHg despite above interventions, consider:
 - Tension pneumothorax & needle thoracostomy

NOTE: *NO ONE* (not even Respiratory Therapists) can manually ventilate at the proper rate without ventilatory adjuncts (*EVERYONE* inadvertently hyperventilates unless meticulously preventing it):

- Ventilation Rate timers
- Pressure-controlled bags
- ETCO₂ monitoring with someone watching the level continuously
- Mechanical ventilator with careful ETCO₂ monitoring

Purpose

Maintain knowledge of indications, technique of hemorrhage control, arterial bleeding, venous bleeding, extremity bleeding in the tactical environment (RTF functions), and partial or total extremity amputation with or without hemorrhage.

Procedure

1. Follow external hemorrhage control algorithm.
2. Apply direct pressure/pressure dressing to injury (hemorrhage controlled)
3. If direct pressure ineffective or impractical (hemorrhage not controlled) follow **Tourniquet AO**.
4. Wound amenable to tourniquet placement (e.g. extremity injury) then apply tourniquet following **Tourniquet AO**.
5. Wound not amenable to tourniquet placement (e.g. junctional injury) apply hemostatic agent with direct pressure.
6. Consider packing wound with gauze bandage (plain or hemostatic impregnated) with continued direct pressure.

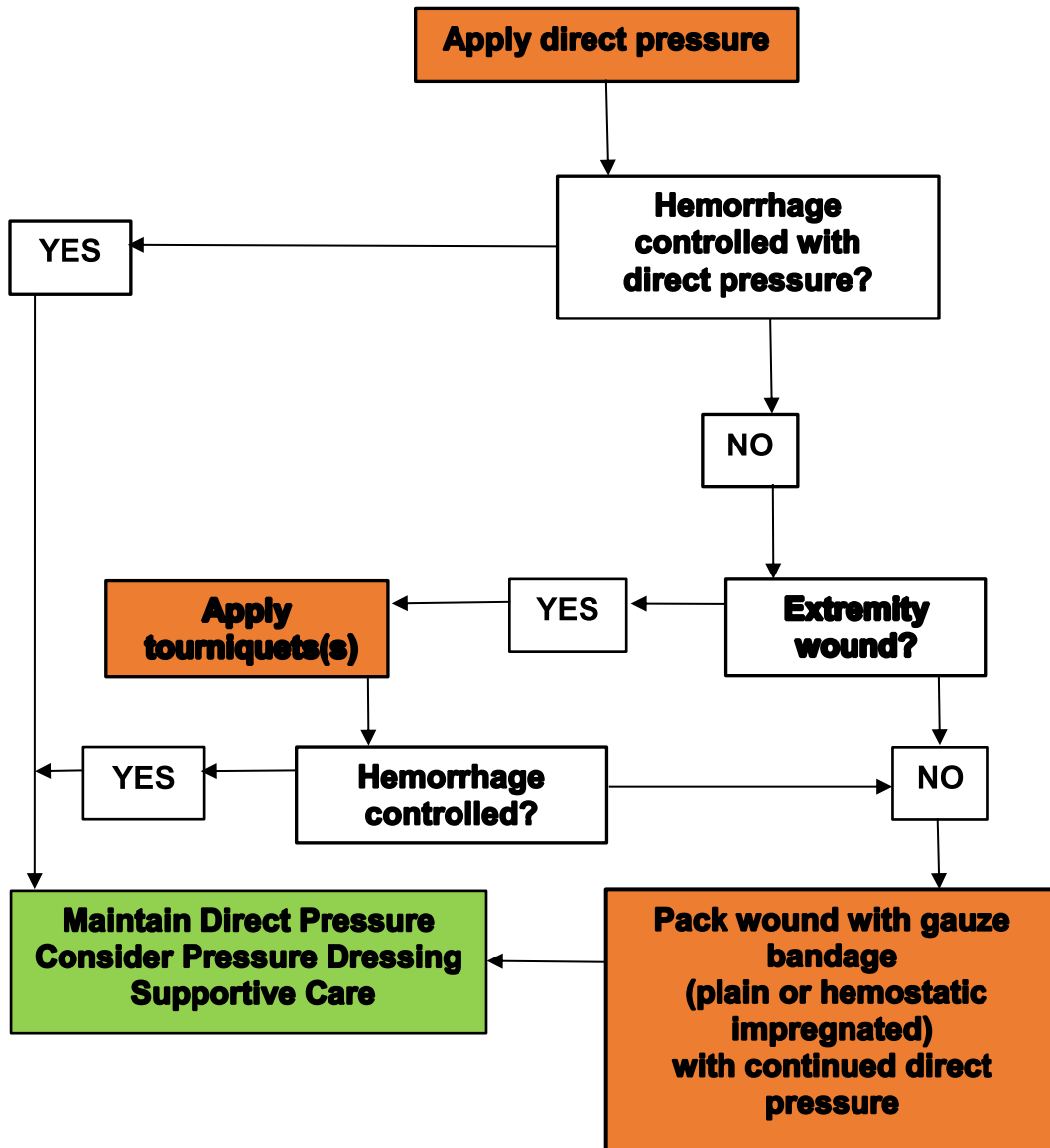
Pearls

1. Use of tourniquet for extremity hemorrhage is strongly recommended if sustained direct pressure is ineffective or impractical
2. Use a commercially-produced, windlass, pneumatic, or ratcheting device, to occlude arterial flow and avoid narrow, elastic, or bungee-type devices.
3. Apply a topical hemostatic agent, in combination with direct pressure, for wounds in anatomic areas where tourniquets cannot be applied, and sustained direct pressure alone is ineffective or impractical. Only apply topical hemostatic agents in a gauze format that supports wound packing.
4. Only utilize topical hemostatic agents which have been determined to be effective and safe in a standardized laboratory injury model.

Trauma - Amputated Body Parts

1. Control external bleeding via direct pressure or tourniquet.
2. Transport amputated body part wrapped in a dry, sterile dressing. Place in a water tight container or plastic bag. Keep cool but do not place directly on ice.
3. Partially severed: Clean with Normal Saline (NS), splint extremity, apply NS soaked dressing, Cover with bulky dressing and elevate.

External Hemorrhage Control Algorithm



Trauma Management and Field Triage of the Injured Patient Protocol

Purpose

Guidelines for field triage of injured patients. Patients who have sustained an injury as a result of mechanical injury (blunt and penetrating), burns, extremity injury, and facial trauma. Explosive force injuries may include any or all of the following: blunt and/or penetrating, burns, pressure-related injuries (barotrauma), and toxic chemical contaminations.

General Trauma Management

1. Assess scene safety
2. Determine number of patients
3. Determine mechanism of injury
4. Request additional resources if necessary
5. Consider declaration of mass casualty if needed
6. Use appropriate personal protective equipment (PPE)

Primary Survey

1. ABCDE assessment
2. Establish patent airway with cervical spine precautions (see **Airway Management** and **Spinal Motion Restriction** protocols).
3. Hemorrhage control (See **External Hemorrhage** protocol)
 - Apply direct pressure or tourniquet (if extremity hemorrhage) as needed. Area's not suitable for tourniquet use wound packing as needed.
4. Monitor oxygen saturation; provide supplemental oxygen per **Stabilization Protocols**.

General Treatment

1. Establish IV access (EMT if permitted)
2. **Adult:** If SBP < 90 mm Hg or HR >120, give bolus of 20ml/kg NS/LR and reassess.
Pediatric: If tachycardia for age with signs of poor perfusion, give 20 mL/kg NS/LR bolus and reassess.
3. Provide pain medications per **Pain Management AO**.
4. **Paramedics:** If absent or diminished breath sounds in a hypotensive patient, consider tension pneumothorax, perform needle decompression.
5. If open chest wound, place semi-occlusive dressing.
6. Pelvic injury, if unstable and patient is hypotensive, place pelvic binder or sheet to stabilize pelvis.
7. Burns: Follow **Burn SO**.
8. Avoid hypothermia on all trauma patients.
9. Monitor GCS during transport to assess for changes.

Extremity Trauma

1. For active bleeding, see **External Hemorrhage Control** protocol
2. Evaluate for deformity instability
3. Evaluate neuro status of extremity
4. Evaluate for pallor, pulse, capillary refill, degree of bleeding/blood loss, with assessment of the color of the blood and if it is pulsatile or not.
5. Strongly consider pain management before attempting to move a suspected fracture.
6. Stabilize suspected fractures/dislocations.
 - If distal vascular function is compromised, gently attempt to restore normal anatomic position
 - Use splints as appropriate to limit movement of suspected fracture

Trauma Management and Field Triage of the Injured Patient Protocol

- Reassess distal neurovascular status after any manipulation or splinting
 - Elevate extremity fractures above heart level whenever possible to limit swelling.
7. Apply ice/cool packs to limit swelling in suspected fractures or soft tissue injury; do not apply ice directly to skin.
 8. Transport amputated body part (s) wrapped in a dry, sterile dressing. Place in a water tight container or plastic bag. Keep cool but do not place directly on ice.

Facial Trauma

1. For isolated facial injuries.
2. ABCDE assessment with focus on ability to keep airway patent.
 - Stable midface
 - Stable mandible
 - Stable dentition
 - Bleeding
3. Oxygen supplementation based on hypoxia to maintain O₂ sat > 90%.
4. Overall trauma assessment for spinal injury, head injury.
5. Avulsed teeth should be collected on scene.
 - Avoid touching the root of the avulsed tooth. Do not wipe off tooth
 - Pick up at crown end. If dirty, rinse off under cold water for 10 seconds
 - Place in milk or saline as the storage medium
6. Eye trauma: consider eye shield.
 - If globe is avulsed, do not put back into socket; cover with moist saline dressings
7. Mandible unstable: have suction available
8. Epistaxis: Clear clots by having patient blow nose, then squeeze nose for 10-15 minutes
9. Nose/ear avulsion: recover tissue if it does not waste scene time; wrap tissue in sterile Gauze moistened with sterile saline.
10. IV access (EMT permitted), for fluid or pain medication administration.
11. **Follow Pain Management AO.**
12. Use ETCO₂ to help monitor for hypoventilation and apnea.

Blast Injuries

1. Follow **General Trauma Management and General Treatment** (pg. 1).
2. Hemorrhage control (see **External Hemorrhage Control Protocol**).
3. Splint extremity deformities per **Extremity Trauma** (pg. 1).
4. If clinical signs of traumatic brain injury, see **Traumatic Brain Injury** (below).
5. Establish IV access with 2 large bore IVs or IO's.
6. Consider IVF per **General Treatment** or **Burn AO**.
7. **Paramedic:** If thermal or chemical burn to airway is suspected, early airway control is vital (see **Airway Management Protocols**)
8. Burns: Follow **Burn SO**.

Traumatic Brain Injury

1. ABCDE assessment with focus on ability to keep airway patent, GCS.
2. Follow **EPIC TBI Algorithm for Adult/Peds**.
3. Maintain cervical stabilization (See **Spinal Motion Restriction Protocol**)
4. Control bleeding with direct pressure if no suspected open skull injury and/or see **External Hemorrhage Control protocol**.
5. Evaluate blood glucose (see **Hypoglycemia AO**)
6. Trend neurologic status assessment (GCS or AVPU).

Trauma Management and Field Triage of the Injured Patient Protocol

Guidelines for Field Triage of Injured Patients

1. Follow **SAEMS Trauma Triage Decision Scheme Protocol** as appropriate per location of EMS unit.
2. Transport to a trauma center or hospital capable of timely and thorough evaluation and initial management of potentially serious injuries. Consider consultation with medical direction.
3. Attempt to identify the most seriously injured patients. These patients should be transported preferentially to the highest level trauma center within the trauma system.
 - Glasgow Coma Scale ≤ 13
 - Systolic blood pressure (mmHg) < 90 mmHg
 - Respiratory rate < 10 or > 29 breaths per minute (< 20 in infant aged < 1 year), or need for ventilator support
 - All penetrating injuries to head, neck, torso, and extremities proximal to elbow
 - Chest wall instability or deformity (e.g., flail chest or evident multiple rib fractures)
 - Two or more proximal long-bone fractures
 - Crushed, de-gloved, mangled, or pulseless extremity
 - Amputation proximal to wrist or ankle
 - Pelvic fractures
 - Open or depressed skull fracture
 - Neurologic deficit or paralysis
4. Transport to an appropriate trauma center following **Trauma Triage Decision Scheme Protocol**.
 - Falls
 - Adult: > 20 feet (one story is equal to 10 feet)
 - Children: > 10 feet or two times the height of the child
 - High-risk auto crash
 - Intrusion, including roof: > 12 inches' occupant side; > 18 inches any side
 - Ejection (partial or complete) from motorize mode of transport
 - Death in same passenger compartment
 - Vehicle telemetry data consistent with high risk of injury
 - Extrication time > 20 minutes
 - Rollover
 - Auto vs. pedestrian/bicyclist thrown, run over, or with significant (> 20 mph) impact
 - Motorcycle crash > 20 mph
 - Hanging or near hanging
 - Multiple trauma with head injury and loss of consciousness
5. CO-Morbid Factors.
 - Assess co-morbid factors which may increase index of suspicion
 - Risk of Injury/death Increases with age < 14 and > 55 years. Low impact mechanisms (e.g. ground level falls) might result in severe injury
 - SBP < 110 might represent shock after age 65 years
 - Anticoagulation and bleeding disorders; patients with head injury are at high risk for rapid deterioration
 - Pregnancy < 20 weeks
 - Burns
 - Without other trauma mechanism: triage to burn facility
 - With trauma mechanism: triage to trauma center
 - EMS provider judgment

TOURNIQUET PROTOCOL

Purpose

This AO is to be used in conjunction with the ALS/BLS Stabilization AO

Indications

Use this AO on patients with the following symptoms:

- Significant hemorrhage
- Arterial bleeding
- Significant venous bleeding
- Extremity bleeding in the tactical environment (RTF functions)
- Any partial or total extremity amputation with or without hemorrhage
- Extremity bleeds where direct pressure and pressure dressings are not feasible due to limited manpower or where the patient has multiple life threatening injuries

Contraindications

- Mild bleeding
- Bleeding that can be controlled with direct pressure or pressure dressings

Procedure

Patients meeting inclusion criteria:

- Firm, direct pressure to bleeding site
- Fully expose the injury. Remove clothing as needed
- Apply TQ to bare skin, approx 2-3 inches proximal (above wound). TQ should not be placed distal to the knee or elbow
- If the patient is in extremis, has massive hemorrhage or the tactical situation is unsafe, then the device should be placed high up on the extremity and over the clothing
- Remove all slack from the strap so that it is snug prior to tightening
- Tighten TQ until cessation of bleeding. (venous oozing is acceptable)
- Check for absence of distal pulse (if still palpable, tighten until no longer is)
- Do not cover the tourniquet with a dressing
- Note the time the TQ was placed
- Reassess the wound and TQ each time the patient is moved to ensure it is still tight
- If bleeding is not controlled with first TQ, apply a second TQ proximally
- Monitor patient for signs of shock

Field removal

- Consider consultation with medical direction authority is recommended
- If unable, apply pressure to the injury site, slowly release TQ, and check for bleeding. If there is significant bleeding, retighten TQ. If bleeding is controlled by a pressure dressing, keep TQ loosely on affected extremity in case bleeding resumes.

Special Note

All TQ patients should go to a Level I Trauma facility

Field TQ's should not remain in place for more than 2 hours

Indications

To apply spinal motion restriction to any patient identified to have a potential spine injury that might benefit from splinting and packaging.

Procedure

1. Provide manual stabilization to restrict gross head movement. The alert patient (s) may be allowed to self-limit movement with or without a cervical collar, especially if already ambulating prior to your arrival.
2. Place appropriate sized cervical collar and/or maintain manual stabilization during assessment.
3. Obtain history and perform careful examination to evaluate for complaints of pain, numbness or tingling as well as cognitive status, GCS, neurologic deficits, spine tenderness, deformity, or painful distracting injury.
4. Extricate patient while limiting flexion, extension, rotation, and distraction of the spine. Tools such as pull sheets, scoop stretcher or slide boards may be used as needed. If the patient is to be transported on a hard device, apply adequate padding to prevent tissue ischemia and increasing patients comfort.
5. Place the patient in the best position to protect the airway.
6. Repeat neurologic examination and regularly assess motor/sensory function.
7. For patients receiving O₂, the use of capnography is advised based upon the patient transport and severity of the patient.
8. Document your exam findings prior and post movement and packaging.

Pearls

1. Long backboards have low friction surfaces and may result in more spine movement from torso and head slippage. These should have limited utilization.
2. If the patient experiences negative effects from a particular SMR method, alternative measure should be implemented.
3. Patients with acute or chronic difficulty breathing: SMR is known to reduce respiratory function as much as 20%.
4. Respiratory compromise is experienced most by geriatric and pediatric patients secured to a long spine board.
5. Exercise caution when applying SR to patients with difficulty breathing and remember to position the patient appropriately.
6. Patients with mental delays are considered unreliable when obtaining information during the assessment
7. Combative patients: avoid methods or interactions that provoke increased spinal motion or agitation
8. Pediatric patients: avoid movements that provoke increased spinal motion. If the choice of SMR is the use of a car seat, ensure that the proper assessment of the patient's back is performed

Spinal Motion Restriction (SMR) Protocol

9. Watch for non-movement of the neck and head, especially in the very young patient which is indicative of pain with movement (think nursemaids elbow)
10. Unstable spine fractures and spinal cord injury from penetrating head trauma are extremely rare.
11. Neuro deficits often present at moment of injury.
12. Life threatening conditions and evacuations from imminent threat take priority.
13. SMR algorithm does not constitute “Clearing” of the spine. The patient needs to be aware of what you’re doing so “involve them in your decision and document it”. Assessment and reassessment are crucial to validate your neurological findings.
14. A complete patient assessment should be performed prior to application and subsequent movement/transfer of patient following SMR procedure.
15. Documentation should be reflective of assessments and care rendered.

TMC Base Hospital Spinal Motion Restriction (SMR)

Indications

- Apply spinal motion restriction to any patient identified to have a potential spine injury that might benefit from splinting and packaging
- A complete patient assessment should be performed prior to application and subsequent movement/transfer of patient following SMR procedure
- Documentation should be reflective of assessments and care rendered

Procedure

Acceptable methods and tools that achieve spinal motion restriction. Listed from least invasive to most restrictive.

- Fowler's, semi-fowlers or spine positing on gurney with cervical collar. Patient instructed to keep head movements to a minimum
- Child care eat with appropriate supplemental padding
- Spine positioning on breakdown stretcher, scoop stretcher, secure with straps, appropriate padding, and head blocks
 - Avoid log rolling movement adds benefits
- Supine positioning with longboard, secured with straps, appropriate padding and head blocks

Motor/Sensory Exam
<ul style="list-style-type: none"> • Wrist/hand extension-bilaterally • Foot plantar/dorsi flexion bilaterally • Gross sensations in all extremities • Check for paresthasias

Unreliable Patient Interactions
<ul style="list-style-type: none"> • Language barriers, inability to communicate • Lack of Cooperation during exam • Evidence of Drug/Alcohol • Cognitive Impairment • Painful distracting injury; such as longbone

TMC Base Hospital Spinal Motion Restriction (SMR)

PENETRATING TRAUMA - HEAD, NECK, TORSO

No neurological deficit or complaint

Neurological deficit or complaint

↓
Consider NOT Using SMR

↓
Select appropriate SMR - Possible Spinal Injury

BLUNT TRAUMA	BLUNT TRAUMA	BLUNT TRAUMA
<p>Low Risk Mechanisms/Characteristics</p> <ul style="list-style-type: none"> • Simple rear-end collision • Ambulatory on scene (any time) • No neck pain on-scene • GCS= 15 • No Cognitive Impairment <p>↓</p> <p>Low risk factor allow safe omission of SMR</p>	<p>Potential mechanism for unstable spine injury</p> <ul style="list-style-type: none"> • Altered LOC, GCS ≤ 15, Cognitive Impairment • Unreliable interaction** <p>↓</p> <ul style="list-style-type: none"> • Spinal pain/tenderness, limited neck movement • Anatomic deformity of the spine • Neurologic deficit or complaint <p>↓</p> <p>All above are No: Omit SMR Yes for any of above, select appropriate SMR application</p>	<p>High Risk Mechanism/Characteristics</p> <ul style="list-style-type: none"> • Age ≤ 14 or ≥ 65 • Mechanism Trauma Triage Criteria • Axial loads/diving injuries • Sudden Acceleration/Deceleration • Lateral bending forces to neck/torso • Violent impact to head, neck, torso, pelvis • Numbness, tingling, paresthesias • High Risk MVC, Rollover, Ejection • Death in Same Vehicle, Speed ≥ 55 <p>↓</p> <p>Yes for any of the above, select appropriate SMR application</p>