6320.02: TORSO & PELVIC TRAUMA

INTRODUCTION

Torso injuries include those involving the chest, back, flanks, and abdomen. This guideline also includes assessment and management of pelvic injuries.

Torso trauma is one of the leading causes of trauma-related deaths. It can be caused by any number of penetrating or blunt forces, including MVCs, blast injuries, falls from heights, and/or gunshot and stab wounds. Blunt trauma can cause various mechanisms of injury: compression (organ rupture), direct trauma (fractures and soft tissue injuries), acceleration/deceleration forces (shearing and tearing) and blast injuries (pressure waves causing blood vessel tearing and disruption of bronchi, alveolar tissue, and/or the diaphragm). Large volumes of blood secondary to hemorrhage may be concealed within the torso.

A great deal of energy is often required to cause a pelvic fracture. When the cause of trauma involves large forces and there is injury to the pelvis and the organs within the pelvic cavity, there is a high likelihood of associated injuries to the abdomen, chest, back and/or extremities. There is also extensive blood supply to the pelvis, therefore significant blood loss can be associated with a fracture.

SAFETY

Ensure that the cause of the trauma is of no threat to the other responders on scene. Activate the appropriate resources if required.

As trauma can result in varying amounts of blood loss, appropriate PPE should be used to protect from direct or indirect contact with blood.

ASSESSMENT

A trauma assessment should be conducted as outlined in the General Major Trauma Clinical Practice Guideline. Non-life-threatening injuries should be managed only after the critical concerns are dealt with.

Manual cervical spine immobilization should occur for patients with torso or pelvic trauma as per the Neurological Trauma guideline and *Management* section below.

A patient with chest trauma should be assessed for the potential for abdominal/pelvic trauma and vice versa.

The amount of energy involved in the trauma must be thoughtfully considered, even in the absence of obvious injury. The mechanism represents the amount of energy transferred through the individual, and is a significant indicator of the potential for life-threatening injuries, even when they are not immediately apparent (e.g. patient ambulating at the scene after highway speed rollover). Keep in mind that in the geriatric population, major injury can occur with seemingly unremarkable mechanisms of injury (e.g. fall from standing height or slip stepping out of bathtub).

The clinician should attempt to determine the mechanism involved, for instance:

- If a knife or other similar object caused penetrating trauma, determine the length, the entry point and the direction it entered the soft tissue
- If a projectile, such as a bullet, was the cause of the injury, determine the type of weapon/object, the number of shots fired, the range/distance the projectile released from, and the direction it entered the soft tissue
- If the injury was due to an MVC, determine if there were any fatalities at the scene, if seatbelts were in use (and if they were positioned correctly), if airbags were deployed, what damage was done to the vehicle(s) involved, and what the approximate speed of the vehicle(s) was

Chest Trauma

Assessing for chest trauma should follow the general trauma assessment. Look for vital sign abnormalities (e.g. hypoxia, tachycardia) as well as signs and symptoms of serious chest trauma such as dyspnea, alterations in chest movement, or hyperinflation of the chest. During the general trauma assessment, the clinician should watch for 'the Deadly Dozen' of chest trauma. These are the 12 injuries that are a threat to life, with 6 of them being an immediate threat (and therefore should be found on the primary survey). The other 6 are possible life-threats which may not be noted until the

secondary survey. Many of these can lead to respiratory compromise; the clinician should closely examine for signs that the patient requires ventilatory support.

Immediately life-threatening

1. *Airway obstruction (upper or lower):* Patients with an airway obstruction may be agitated (hypoxia) or obtunded (hypercapnia) and could present with stridor or a hoarse voice. Any airway obstruction should be immediately managed by positioning, foreign body removal, suction, using a jaw thrust, inserting an OPA/NPA, or providing advanced airway management if required.

2. *Tension pneumothorax:* This is a clinical diagnosis based on signs and symptoms, which can include panic, tachypnea, JVD, dyspnea, hypotension, tracheal deviation (late sign), absent breath sounds and/or subcutaneous emphysema. If a tension pneumothorax is present, needle decompression should occur immediately (**PEP 2 neutral**).

3. *Open pneumothorax*: Also known as a sucking chest wound. Signs and symptoms include hypoxia, impaired ventilation and hypoventilation. The penetrating chest wound will appear to have air sputtering through it with respirations. The signs and symptoms are usually proportionate to the size of the hole.

4. *Massive hemothorax:* Patients with a massive hemothorax may present with dyspnea, signs of hemorrhagic shock, tachypnea, dullness to percussion over the affected area, unilateral absent or decreased breath sounds, and/or flat neck veins. It is important to note that in some cases neck veins may be distended due to mechanical effects of increased intrathoracic pressure.

5. *Flail chest:* A flail segment is when 2 or more ribs are fractured in 2 or more places, most often involving anterior or lateral ribs, as musculature around the posterior ribs provide increased stability. A patient with a flail segment may present with paradoxical movement of the chest wall, increased work of breathing, voluntary splinting and chest pain. A hand can be used to stabilize the segment in order to continue the assessment.

6. *Cardiac tamponade:* Any patient with a penetrating injury near the heart and a shock-like presentation should be considered to have cardiac tamponade until proven otherwise. Cardiac tamponade often presents with Beck's triad (JVD, hypotension and muffled heart sounds). If there is severe hemorrhage elsewhere, JVD may be absent.

The Cardiac Box

The Cardiac Box refers to the area inferior to the clavicles, superior to the costal margin and medial to the midclavicular line. This contains the heart/pericardium, great vessels, esophagus and intrathoracic trachea/main bronchus. Penetrating injuries within this area are the most worrisome for cardiac injury, however this does not imply a cardiac injury can be excluded if the wound lies outside the confines of the box.

Potentially life-threatening

For the following conditions, there are few treatments that can be administered in the prehospital setting, however, it is very important for the clinician to keep a high degree of suspicion and provide appropriate information to the emergency department.

7. *Pulmonary contusion:* This is one of the major causes of hypoxemia after blunt chest trauma. The patient may present with dyspnea, ineffective cough, hemoptysis, chest pain, adventitious breath sounds, and blood in the ETT.

8. *Myocardial contusion:* This is caused by blunt trauma and should be suspected in an MVC when there is damage to the steering wheel. An ECG should be done. Abnormalities such as tachycardia out of proportion to blood loss, PAVs, PVCs, A-fib, and/or ST-T wave changes may be seen. Arrhythmia in a chest trauma patient should be considered a myocardial contusion until proven otherwise.

9. *Aortic disruption:* This is most often caused by high speed deceleration or side impact and can lead to almost immediate death. If the patient survives initially, there is still a very high mortality rate with 24 hours if definitive treatment

is delayed. There may be no external evidence of thoracic injury. Assessment findings can include blood pressure discrepancy (e.g. right arm versus left arm), a widened pulse pressure, hypertension of the upper extremities, chest wall contusion, and/or hoarseness without laryngeal injury.

10. *Diaphragmatic disruption:* When the diaphragm is disrupted, abdominal contents can herniate into the chest cavity. The left side of the diaphragm is at higher risk of injury as it is not protected by the liver. Signs and symptoms can include abdominal pain, shoulder pain, respiratory distress, and/or bowel sounds in the chest. A patient is at high risk for diaphragmatic disruption if they have any stab wounds below the nipple line.

11. *Tracheobronchial disruption:* Most of the injuries involving a major bronchus occur close to the carina, and are usually due to blunt trauma. The impact creates a sudden increase in pressure at the glottis. There should be a high degree of suspicion for this condition if the patient suffered severe blunt trauma with involvement of the first 3 ribs. This disruption can occur higher up in the cervical trachea when the trachea strikes the anterior neck and can present with dyspnea, stridor, hemoptysis, hoarseness, hypoxia and/or subcutaneous emphysema around the neck. It could also occur in one of the major bronchi with rapid deceleration causing a shearing force. This can present with dyspnea, stridor, hemoptysis, hypoxia, sternal tenderness, pneumothorax and/or widespread subcutaneous emphysema. One of the other common findings is Hamman's sign, which is a crunching sound during diastole due to air in the mediastinum.

12. *Esophageal disruption:* Esophageal injuries should be considered in any patient with a hemo- or pneumo-thorax without rib fracture OR anyone sustaining severe force to the lower sternum or epigastrum who present with pain or shock out of proportion to the clinical findings. It is most often caused by penetrating trauma or forceful expulsion of gastric contents into the esophagus causing a linear tear which allows gastric contents to leak into the mediastinum and be pulled into the pleural space. The patient may present with painful swallowing, pleuritic sub-sternal chest pain, subcutaneous emphysema and/or pleural effusion.

Abdominal Trauma

When assessing the major trauma patient, maintain a high degree of suspicion for occult intrabdominal injuries, as these are often not immediately obvious. Many abdominal injuries are life-threatening.

Abdominal injuries can involve the solid organs (e.g. spleen, liver, kidneys) which may rupture or lacerate causing tachycardia, hypotension, and/or acute abdominal pain. There is significant risk of blood loss. These injuries should always be considered in the presence of lower chest trauma. Hollow organs (e.g. stomach, bowel) may also be injured resulting in abdominal pain secondary to contamination with stomach or bowel contents as well as intraabdominal hemorrhage. Hypotension and tachycardia may also be present. Pain from an abdominal injury may be referred to another area of the body (e.g. left shoulder pain in the case of a splenic injury).

The clinician should gather a history including the mechanism of injury, time since injury, and if there has been any hematemesis or lower GI bleeding.

On physical exam, the clinician should assess for hemodynamic stability as well as signs of hypoperfusion of shock.

The abdomen should be inspected for signs of bruising to the abdominal wall or flank as well as penetrating entry or exit wounds if appropriate. The abdomen should be gently palpated for signs of tenderness, in particular 'guarding' or an involuntary flexion of abdominal wall musculature on palpation. A firm or rigid abdomen suggests significant intraabdominal injury.

As the abdomen is not protected by a bony structure such as the pelvis or ribcage, penetrating injuries may cause the abdominal organs to protrude through the opening; do not attempt to place the organs back into the abdominal cavity.

Pelvic Trauma

A high index of suspicion for a pelvic fracture is based on the mechanism of injury. The clinician should suspect a pelvic injury whenever there is trauma to the torso or a fall from a height. Since pelvic injuries are associated with high energy

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forces, there should always be a high suspicion of associated injuries to the head, back, chest, abdomen and extremities. Early recognition of a potential pelvic fracture with binding and rapid transport will decrease the risk of death as a result of hemorrhage into the pelvis. It is possible to bleed 2L of blood volume into the pelvis, causing hemorrhagic shock.

During assessment, ask the patient if they have pain around the pelvic area. On inspection the pelvis should also be examined for soft tissue injury, symmetry, rotation of a lower extremity, and any differences in lower limb length. A shortened limb may be due to a hip injury, femoral injury or vertically unstable pelvic injury. Rotation in the iliac crest indicates a serious fracture. Hematoma over the inguinal area or perineum, hematuria and vaginal or rectal bleeding should increase suspicion of pelvic fracture.

Palpate lightly for tenderness. Refrain from maneuvers such as rocking or springing the pelvis, or pushing down on the iliac crests to check for stability. These maneuvers have not been proven to be reliable tests and will detect only major pelvic disruption. This type of pelvic examination could increase blood loss.

MANAGEMENT

General Management

As per the General Major Trauma guideline, interventions should occur as concerns are identified following the ABCDE approach. Major trauma patients should also receive oxygen in an attempt to obtain an SpO_2 of 100%.

All external bleeding should be controlled. If there is an impaled object, keep the object in place (stabilize it as is) (**PEP white**) unless it is causing airway or respiratory compromise.

Two large bore IVs should be inserted. Patients with traumatic hypotension should be given fluid however it should be administered in smaller boluses and repeated as needed with the aim of achieving a blood pressure of 100 mmHg. Tranexamic acid may also be indicated if severe hemorrhage is suspected (see General Major Trauma guideline).

Prior to moving the patient, analgesia should be provided as soon as possible if required. In the critically injured or unstable patient, avoid delaying transport to provide analgesia.

Spinal Immobilization

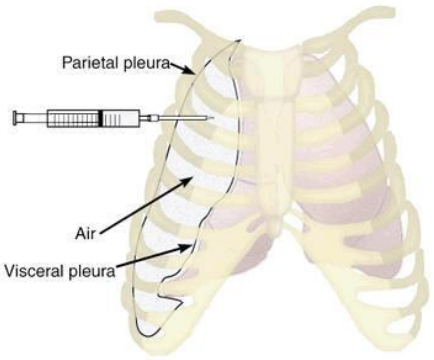
Spinal immobilization is warranted after any blunt trauma or in the case of penetrating injury to the chest, abdomen or pelvis **when a focal neurological deficit is present**. Prehospital spine immobilization takes time and has not shown to be of great benefit in patients with penetrating torso trauma. Immobilizing all patients with penetrating torso injuries can increase mortality and therefore should not routinely be used.

Chest Trauma Management

Needle Decompression for Tension Pneumothorax

Needle decompression (**PEP 2 neutral**) is indicated when there is a high degree of suspicion of pneumothorax in the setting of respiratory or hemodynamic compromise (e.g. SpO_2 less than 90% despite supplemental oxygen and/or SBP less than 90mmHg despite fluid resuscitation).

The needle is inserted into the 2nd intercostal space, just above the third rib.



Open Pneumothorax

An occlusive dressing should be applied and 3 sides taped (**PEP white**), allowing for air escape on exhalation, decreasing the likelihood of a tension pneumothorax occurring.

Flail Chest

Flail segments can be stabilized with a hand or object such as a saline bag or towel taped over the area.

Abdominal Trauma Management
There are no specific prehospital management strategies for abdominal trauma except for external hemorrhage control. If there are exposed organs, they should be covered with a moist dressing then covered with an occlusive dressing. The area should be kept clean and warm.

Pelvic Trauma Management
If there is clinical suspicion of a pelvic fracture, based on mechanism of injury, a pelvic binder should be applied if there is hemodynamic instability or the patient cannot be reliably assessed due to mental status or distracting injury (**PEP 2 supportive**). When a hemodynamically stable patient reports pain in the pelvic area, a pelvic binder should be applied if there is a mechanism suggestive of pelvic fracture. See Figure 1.

Pelvic binding is used to reduce the volume of the pelvis in order to minimize blood loss within the pelvic cavity. It also stabilizes the pelvic vasculature, so as to prevent dislodgement of clots. Pelvic binding should occur early in patient management, and not just as a packaging device. Also keep in mind that patients with pelvic fractures should not be logrolled as it could make a stable fracture an unstable one.

If there are associated injuries or concerns regarding airway, shock, head or spine injuries or extremity trauma, see the appropriate Clinical Practice Guideline.

Pediatric Torso & Pelvic Trauma

Assessment and management of the pediatric patient should proceed in the same manner as the trauma assessment for an adult. Always consider child abuse as an etiology in the pediatric trauma patient. If abuse is suspected document thoroughly and notify the appropriate agencies/personnel.

It is important to keep in mind that pediatric patients can have severe internal chest injuries with minimal or no external evidence due to the compliance of the chest wall. If a child has a rib fracture, significant injury should be suspected. Isolated chest injuries are rare in children, so assess for multiple injuries.

Pediatric trauma patients should be given analgesia, unless there are contraindications (e.g. hypotension for their age).

TRANSFER OF CARE

When transferring care to the receiving facility, it is important to explain the mechanism of injury and any information known about the object or forces involved. Inform staff of any pertinent assessment findings, amount of blood loss if known, and what treatments were provided on scene or on route.

If a pelvic binder has been applied, ensure the staff are made aware and do not remove it before further in-hospital assessment is done.

CHARTING

In addition to the mandatory fields it is important to document the following in the ePCR text fields:

- ✓ Mechanism of injury and scene findings
- ✓ Time of injury
- ✓ Initial presentation
- ✓ Treatment provided
- ✓ Reassessment findings

Key Points – Torso & Pelvic Trauma

If the mechanism is significant, keep a high index of suspicion for serious injuries (even if not immediately apparent)

Assess any trauma patient using the General Trauma Management Clinical Practice Guideline

Significant blood loss can occur within the chest, abdominal or pelvic cavities

Limit scene time; provide most treatments en route to definitive care

KNOWLEDGE GAPS

There is still research to be done on the optimum device and procedure for binding a pelvis in the prehospital setting.

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EDUCATION

Clinicians should continuously practice a general trauma assessment to maintain proficiency in the ABCDE systematic approach, and to ensure good communication with other clinicians.

QUALITY IMPROVEMENT

In the setting of major trauma, scene times should be limited, and if at all possible, procedures should be done en route to definitive care unless required for a life-threatening condition. Analgesia should be administered to patients with pain due to torso or pelvic trauma unless contraindicated.

Request for LifeFlight, Trauma Team, and/or notification to the receiving facility should be done early in the setting of major trauma.

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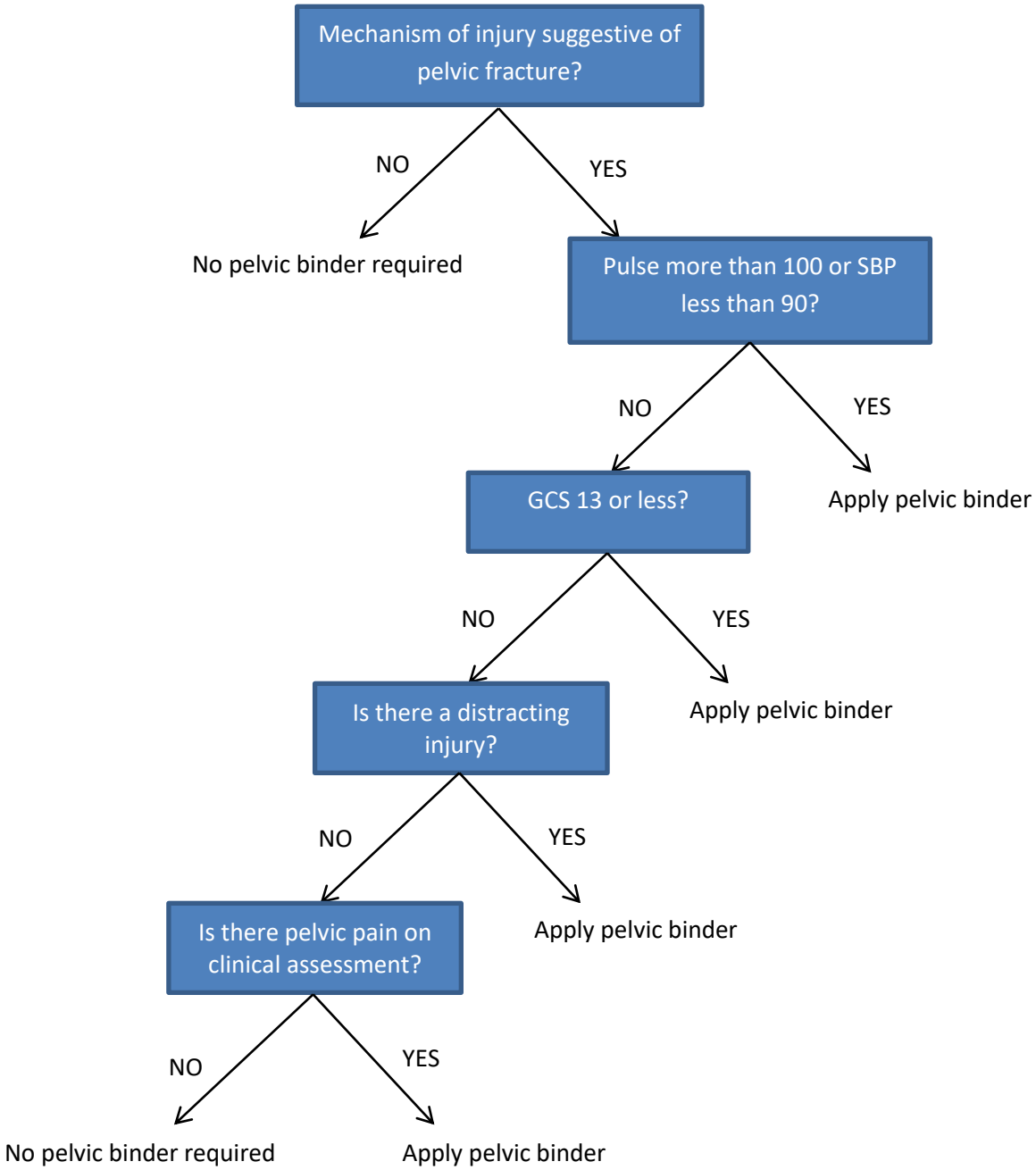

Figure 1: Determining Need for Pelvic Binding*

*Adapted from Scott K, Porter K, Laird C, et al. The prehospital management of pelvic fractures: initial consensus statement. Emerg Med J. 2013; 30(12): 1070-1072

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PEP 3x3 TABLES for TORSO & PELVIC TRAUMA

Throughout the EHS Guidelines, you will see notations after clinical interventions (e.g.: **PEP 2 neutral**). PEP stands for: the Canadian **P**rehospital **E**vidence-based **P**rotocols Project.

The number indicates the Strength of cumulative evidence for the intervention:
1 = strong evidence exists, usually from randomized controlled trials;
2 = fair evidence exists, usually from non-randomized studies with a comparison group; and
3 = weak evidence exists, usually from studies without a comparison group, or from simulation or animal studies.

The coloured word indicates the direction of the evidence for the intervention:
Green = the evidence is supportive for the use of the intervention;
Yellow = the evidence is neutral;
Red = the evidence opposes use of the intervention;
White = there is no evidence available for the intervention, or located evidence is currently under review.

PEP Recommendations for Torso & Pelvic Trauma Interventions, as of 2022/10/24. PEP is continuously updated. See: https://emspep.cdha.nshealth.ca/TOC.aspx for latest recommendations, and for individual appraised articles.

Chest Trauma

Recommendation		RECOMMENDATION FOR INTERVENTION			
		SUPPORTIVE (Green)	NEUTRAL (Yellow)	AGAINST (Red)	NOT YET GRADED (White)
STRENGTH OF EVIDENCE FOR INTERVENTION	1 (strong evidence exists)	• Ultrasound			• 3 Sided/Occlusive Dressing • Bougie-assisted Chest Tubes (CCT) • Thoracostomy
	2 (fair evidence exists)	• Chest Tube (CCT)	• Needle Decompression		
	3 (weak evidence exists)				

*PEP is the **Canadian Prehospital Evidence-based Protocols Project.** Every clinical intervention is given a recommendation based on the strength of available research evidence (1 = randomized controlled trials and systematic reviews of RCTs; 2 = studies with a comparison group; 3 studies without a comparison group or simulation) and direction of the compiled evidence: **supportive** of intervention; **neutral** evidence for intervention; or **opposing** evidence for intervention). See: **https://emspep.cdha.nshealth.ca/TOC.aspx***

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Abdominal Trauma

Recommendation		RECOMMENDATION FOR INTERVENTION			
		SUPPORTIVE (Green)	NEUTRAL (Yellow)	AGAINST (Red)	NOT YET GRADED (White)
STRENGTH OF EVIDENCE FOR INTERVENTION	1 (strong evidence exists)				• Stabilize Impaling Object
	2 (fair evidence exists)				
	3 (weak evidence exists)	• FAST	• Direct Pressure		

Pelvic Trauma

Recommendation		RECOMMENDATION FOR INTERVENTION			
		SUPPORTIVE (Green)	NEUTRAL (Yellow)	AGAINST (Red)	NOT YET GRADED (White)
STRENGTH OF EVIDENCE FOR INTERVENTION	1 (strong evidence exists)				
	2 (fair evidence exists)	• Circumfrential Sheet • Corsette Style Compression Device (e.g. T-Pod) • External Mechanical Compression Device			
	3 (weak evidence exists)		• MAST		

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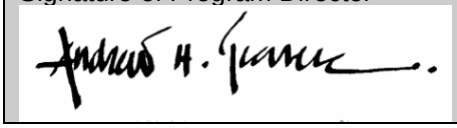
Signature of Program Director 	Signature of program Document Coordinator *Electronically Signed* *Tanya Fraser*	