

# Joint Trauma System



## Cervical and Thoracolumbar Spine Injury Evaluation, Transport and Surgery in the Deployed Setting

*Part of the Joint Trauma System (JTS) Clinical Practice Guideline (CPG) Training Series*



# Purpose



This presentation offers updated, accurate guidance to the deployed caregiver in order to provide the best care to patients who suffer a spine or spinal cord injury.

*This presentation is based on the **Cervical and Thoracolumbar Spine Injury CPG, 19 Jun 2020**. It is a high-level review. Please refer to the complete CPG for detailed instructions. Information contained in this presentation is only a guideline and not a substitute for clinical judgment.*

# Agenda



1. Summary
2. Background
3. Evaluation
4. Immobilization
5. Treatment
7. Transport Considerations
8. Performance Improvement (PI) Monitoring
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# Summary



- Patients should have a cervical spine collar placed as early as possible when appropriate and removed using the appropriate algorithm.
- Avoid hypotension and hypoxemia in patients with a spinal injury.
- Surgery should be delayed if possible until arrival at a location where definitive therapy will be provided.
- Transportation often involves use of a vacuum spine board.

# Background

- Spinal injuries are prevalent on the battlefield due to blunt and penetrating injuries commonly caused by blasts.
- Patients are generally placed into **3 clinical categories**:
  1. Complete spinal cord syndrome.
  2. Incomplete spinal cord injury.
  3. Spine fractures but normal neurological function.



*Patient on a spine board*  
Image courtesy of Defense Visual Information  
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# Evaluation



Complete an accurate and thorough neurological examination during workup of a trauma patient.

- Most common serial exam finding discrepancies are due to failure to perform and document findings of a neurological exam.
- The quality of examinations may also be impacted by medical interventions and other injuries.

# Evaluation



Thorough exam should include:

- Motor exam of the 10 American Spinal Injury Association (ASIA) key motor groups.
- Sensory examination (pin prick and light touch) using ASIA dermatomal standards.
- Digital rectal exam that assesses sphincter, pinprick sensation, resting tone and bulbocavernosus reflex
- Normal and pathological reflex testing

**ASIA** INTERNATIONAL STANDARDS FOR NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY (ISNCSCI) **ISCOS** PATIENT NAME \_\_\_\_\_ DATE/TIME OF EXAM \_\_\_\_\_  
 EXAMINER NAME \_\_\_\_\_ SIGNATURE \_\_\_\_\_

**RIGHT** **MOTOR** **KEY MUSCLES** **SENSORY** **KEY SENSORY POINTS** **LEFT** **MOTOR** **KEY MUSCLES**

**UER** (Upper Extremity Right) **UER** (Upper Extremity Left)

**LER** (Lower Extremity Right) **LER** (Lower Extremity Left)

**(VAC)** Voluntary Anal Contraction (Yes/No)  **(DAP)** Deep Anal Pressure (Yes/No)

**RIGHT TOTALS** (MAXIMUM) **LEFT TOTALS** (MAXIMUM)

**MOTOR SUBSCORES** **SENSORY SUBSCORES**

**NEUROLOGICAL LEVELS** **3. NEUROLOGICAL LEVEL OF INJURY (NLI)** **4. COMPLETE OR INCOMPLETE?** **5. ASIA IMPAIRMENT SCALE (AIS)**

*This form may be copied freely but should not be altered without permission from the American Spinal Injury Association.*

# Evaluation



- The Combat Neuro Exam, an alternative to the ASIA, is available and may be more amenable to completion by non-spine specialists.
- Determination of when to image the whole spine versus selective imaging is based on exam, patient mental status, and mechanism of injury.
  - Patients who have one identified fracture in the spine should have their entire spine imaged.
  - Certain mechanisms of injury, such as mounted blast, warrant imaging of the whole spine.

# Immobilization



Trauma patients who have sustained the following injuries should have a rigid cervical collar initially placed:

- Patient complaining of neck pain or displaying neurological impairment.
- Trauma resulting in loss of consciousness.
- Trauma resulting in temporary amnesia/loss of consciousness.
- Major explosive or blast injury.
- Mechanism that produces a violent impact on the head, neck, torso or pelvis:
  - Mechanism that creates sudden acceleration/deceleration or lateral bending forces on the neck or torso.
  - Fall from height.
  - Ejection or fall from any motorized vehicle.
  - Vehicle roll-over.

# Immobilization

- The cervical collar should be placed pre-hospital if the tactical situation allows or as early as possible.
- The collar should be maintained until removed by a qualified provider.
- If possible, a cervical spine (c-spine) should be cleared of injury and collar removed within 24 hours of collar placement.



## **Cervical collar application**

*Image courtesy of Defense Visual Information Distribution Service*

# Immobilization

## Reliable Patient

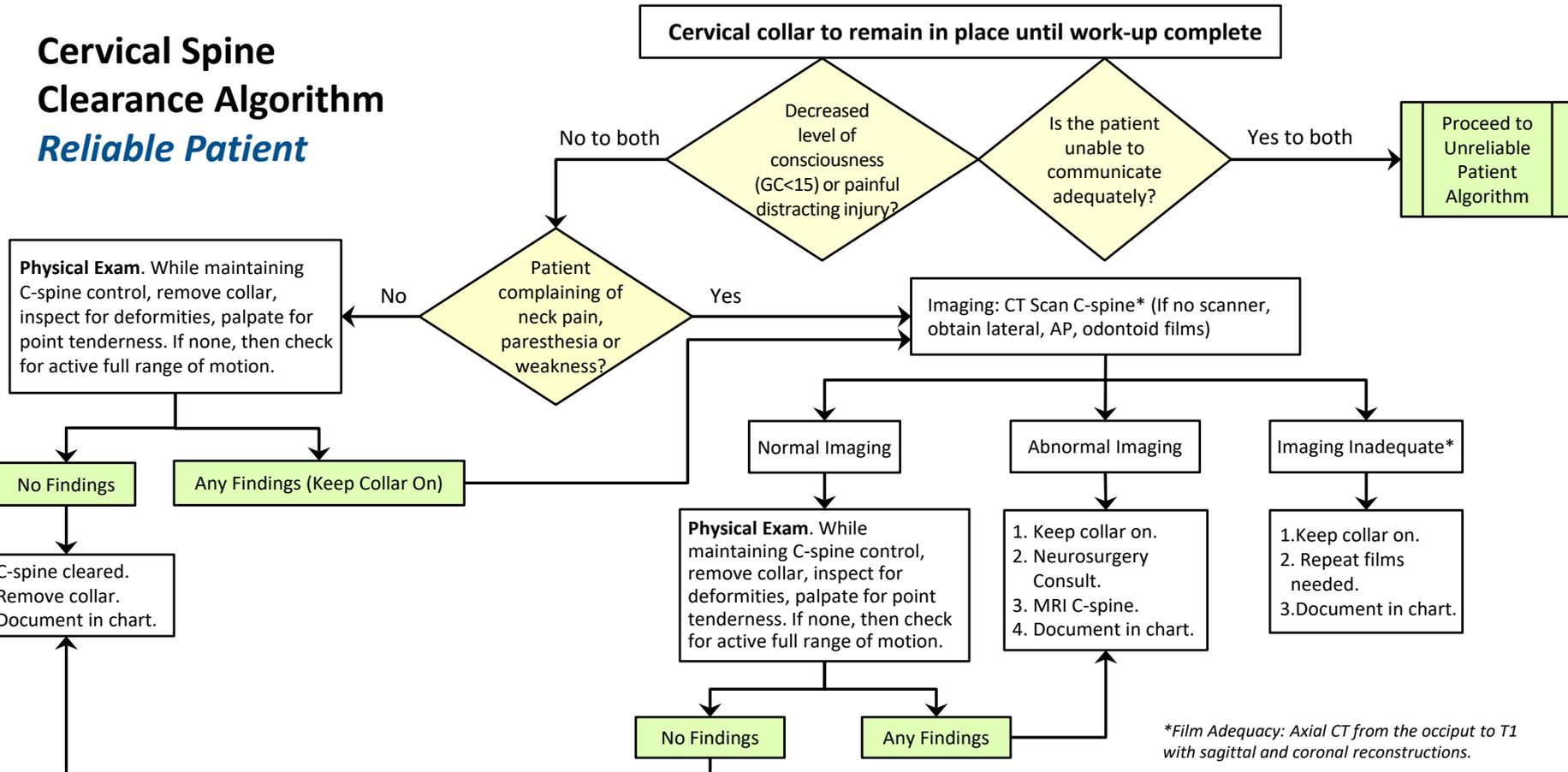


- **Reliable patients** are those who:
  - ❑ Can adequately communicate.
  - ❑ Exhibit a normal level of consciousness.
  - ❑ Lack a distracting injury.
- A distracting injury is any injury that may obscure the patient's ability to notice pain in the neck.
  - ❑ This is a judgement left to the treating physician.
- C-spine cleared algorithmically using the reliable or unreliable algorithm.

# Immobilization Reliable Patient



## Cervical Spine Clearance Algorithm *Reliable Patient*



# Immobilization Unreliable Patient

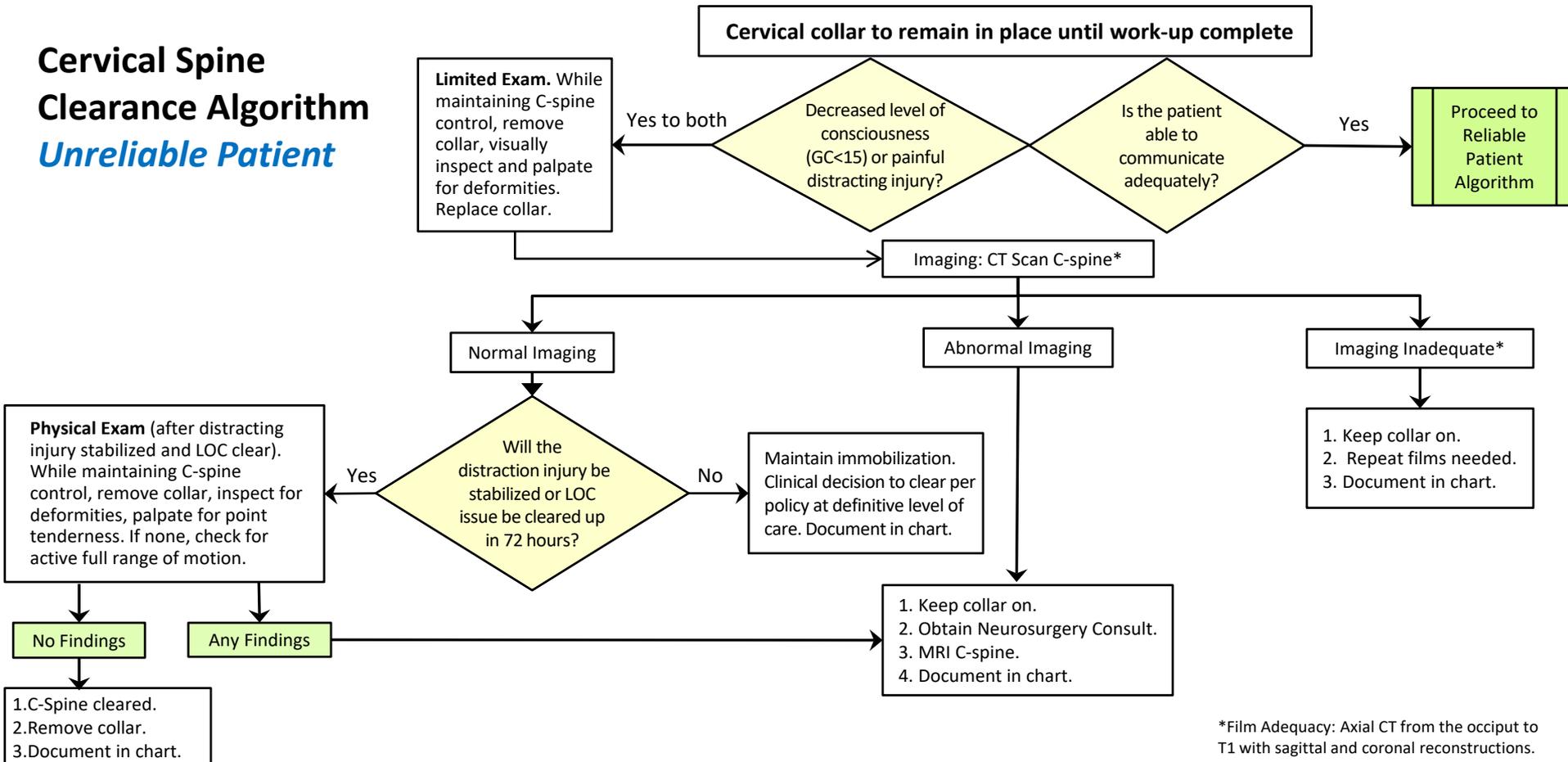


- **Unreliable patients** should undergo CT of the cervical spine (c-spine) with fine cuts to clear it of injury, but full c-spine plain radiography is adequate if it is the only option.
- Prior to removal of rigid cervical collars in unreliable patients, a general rule should be that two of three modalities (exam, MRI, CT) should be clear of injury.

# Immobilization Unreliable Patient



## Cervical Spine Clearance Algorithm *Unreliable Patient*



# Immobilization

- If unable to remove a cervical collar within 24 hours, the stiff extrication collars should be replaced with collars designed for long-term immobilization (i.e. Miami-J with Occian back).
- For an unreliable patient with negative imaging findings, the incidence of significant cervical instability is small, but not zero.
  - ❑ A reliable clinical examination or MRI in a cooperative, extubated patient is required before clearing the cervical spine.
  - ❑ A high-quality negative CT scan is considered adequate if a patient cannot undergo an MRI.



**Cervical collar application**

*Image courtesy of Defense Visual Information Distribution Service*

# Immobilization



- The decision to definitively clear a cervical spine without exclusion of ligamentous injury by reliable exam or MRI should be left to the level of care providing definitive treatment.
  - ❑ Risk of significant neck movement exists in obtunded patients while transiting aeromedical evacuation (AE) system.
  - ❑ Staff should maintain cervical spine immobilization until arrival at definitive care while transiting AE system.
  - ❑ Staff should be mindful of possible occipital skin breakdown from the cervical collar.
- The JTS Cervical Spine Clearance Status Sheet or Trauma Resuscitation Record (DD Form 3019) should be used to document the cervical spine evaluation and clearance status.

# Treatment



- Patients with neurologic compromise from a spine injury should have an invasive arterial line for continuous blood pressure monitoring with a goal MAP of 85-90 mm Hg for up to 7 days following injury and maintain a SaO<sub>2</sub> > 92%.
  - Vasopressor therapy and supplemental oxygen may be necessary in an euvolemic patient.
  - Vasopressors can cause ischemic loss in tissue, so fluids remain the initial therapy for hypotension.
- Corticosteroids are not recommended.

# Treatment



- Keep patients flat prior to surgical correction or external bracing, although the bed can be placed in 30 degrees reverse Trendelenburg.
- Logrolling can be done safely in most cases to prevent skin breakdown.
- Start deep vein thrombosis (DVT) prophylaxis early and maintain beyond evacuation.
  - ❑ Pneumatic compression devices
  - ❑ Early active or passive mobilization when able
  - ❑ Chemical prophylaxis is usually initiated within 24-72 hours of injury.
  - ❑ If DVT is present, anticoagulation should be started, but if contraindicated, an IVC filter should be considered.
- It is incumbent upon the spine surgeon to alter patient handling and DVT prophylaxis/treatment assumptions.

# Treatment



- External immobilization options in theater should include semi-rigid orthosis, halo, and sternal-occipital-mandibular immobilizer (SOMI)-like devices or cervico-thoracic braces.
- Operative treatment in theater that can be delayed until after transport of the patient should be delayed.
- Surgical instrumentation in theater can be limited. Procedures are often performed with the understanding that additional procedures may need to be performed.

# Treatment



- Patients that may benefit from immediate surgery in-theater include:
  - ❑ Patients with incomplete injuries.
  - ❑ Patients with progressive neurologic deficit.
  - ❑ Patients with an open cerebrospinal fluid (CSF) leak.
  - ❑ Patients with expected prolonged delay in transport.
  - ❑ Urgent reduction may improve the degree in “root sparing” in a cervical spinal cord injury.

# Treatment



- For penetrating spinal injuries with an incomplete injury with continued canal compromise, decompression, if attempted, should be done within 24-48 hours.
  - ❑ If instability is present, stabilization should be considered at the time of surgery.
- Cefazolin 2 gm IV q 8 hours for 24-72 hours is sufficient for penetrating injuries without evidence of contamination.
  - ❑ Fragments passing through contaminated viscus structures require longer, broader coverage (e.g., 3rd generation cephalosporin for 7-10 days).
  - ❑ Open wounds with a CSF leak also require broad spectrum coverage.

# Transport Considerations



- A vacuum spine board is frequently used to transport patients with thoracolumbar fractures.
  - ❑ The vacuum spine board protocol dictates periodic deflation and re-inflation to reduce risk of pressure sores.
  - ❑ Logrolling without release of vacuum does not reduce risk of pressure sores.
  - ❑ Care should be given to padding and pressure reduction, namely the occiput and heels.
- Thoracolumbosacral orthosis or other external braces should not be worn during the transport process.

# PI Monitoring

## ■ Population of Interest

All patients at risk of or diagnosed with cervical or thoracic spine injury defined as: (1) mechanism of injury explosion, fall, or motor vehicle crash; and (2) head or neck injury with AIS head or neck > 1; or (3) diagnosis of fracture of vertebral column with spinal cord injury (806), or spinal cord injury without evidence of spinal bone injury (952); and (4) less than 1 day between time of injury and arrival at initial medical treatment facility.

## ■ Intent (Expected Outcomes)

- Patients have documented application of cervical collar or any other method for cervical spine stabilization in the prehospital setting or on MTF arrival.
- Patients with diagnosis of fracture of vertebral column with spinal cord injury (806), or spinal cord injury without evidence of spinal bone injury (952) have a documented neurologic exam to include GCS and completed ASIA or Combat Neuro Exam worksheet.
- Patients have the C-spine clearance status documented on the JTS C-spine Clearance Status sheet and Trauma Resuscitation Record (DD Form 3019).
- Patients with spinal cord injury and abnormal neurologic exam have an arterial line placed within 24 hours of injury or documentation that not indicated.
- Patient who have an unreliable exam due to decreased level of consciousness (GCS < 14) do not have C-spine cleared prior to arrival at definitive level of care.

# PI Monitoring

## ■ Data Source

- Patient Record and the ASIA or Combat Neuro Exam worksheet
- Department of Defense Trauma Registry (DoDTR)

## ■ Performance/Adherence Metrics

- Number and percentage of patients in population of interest with documented application of cervical collar or any other method for cervical spine stabilization in the prehospital setting or on MTF arrival.
- Number and percentage of patients with diagnosis of fracture of vertebral column with spinal cord injury (806), or spinal cord injury without evidence of spinal bone injury (952) with documented neurologic exam to include GCS completed ASIA or Combat Neuro Exam worksheet.
- Number and percentage of patients in population of interest with C-spine clearance status documented on the JTS C-spine Clearance Status sheet and Trauma Resuscitation Record (DD Form 3019).
- Number and percentage of patients with spinal cord injury and abnormal neurologic exam who have an arterial line placed within 24 hours of injury or documentation that not indicated.
- Number and percentage of patients in population of interest with Role 2 and/or Role 3 discharge GCS < 14 who have a C-collar in place on arrival to Role 3 for host nation patients or Role 4 for coalition patients.

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# Appendices



**Appendix A:** American Spinal Injury Association Worksheet

**Appendix B:** Combat Neuro Exam Worksheet

**Appendix C:** Cervical Spine Clearance Algorithm—Reliable Patient With  
No Neurologic Deficit

**Appendix D:** Cervical Spine Clearance Algorithm—Unreliable Patient

**Appendix E:** Cervical Spine Clearance Status

**Appendix F:** Additional Information Regarding Off-Label Uses in CPGs

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