

SPINE INJURY SURGICAL MANAGEMENT AND TRANSPORT

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Supersedes:	This is a new CPG and must be reviewed in its entirety		
<input type="checkbox"/> Minor Changes (or)	<input type="checkbox"/> Changes are substantial and require a thorough reading of this CPG (or)		
<input type="checkbox"/> Significant Changes			

1. **Goal.** The goal for the treatment and movement of US and Coalition patients with spine injuries is to maintain spine stability, prevent deterioration of the patient’s neurological condition during transport and avoid secondary injury. Other patients with spine injuries, such as some non-coalition third country and local nationals will need to be stabilized as best as possible using available methods; these may include external stabilization using bracing.

2. **Background.** The terms “stable” and “unstable” when applied to spinal fractures are markedly subjective and not always of clear significance. Traumatic injury of the spinal cord can occur in the absence of fracture -- particularly in children (Spinal Cord Injury Without Radiologic Abnormality “SCIWORA”), traumatic disc herniation or ligamentous disruption, and middle-aged or elderly patients with cervical spondylosis and hyperextension injuries (most frequently resulting in central cord syndrome presentation). Landstuhl Regional Medical Center (LRMC), with its spinal instrumentation options, MRI availability and consistent staffing should be capable of managing most, if not all, spinal injuries. The operative treatment of US and coalition spine fractures in theater is not a reliable first option given the variations of surgeon expertise, availability of various spinal instrumentation systems, operating environment, and likelihood of concomitant open or contaminated wounds elsewhere in the extremities or torso. However, the decision to proceed with in theater spinal fracture ORIF can be successfully applied to select hemodynamically stable patients who do not have other open or contaminated wounds and whose neurologic well being is jeopardized by further transport. Benefits of early ORIF of spinal fractures in theater include earlier mobilization (diminishing DVT risk and improving pulmonary toilet), better analgesia during transport to LRMC and protection of the neural elements. This risk/benefit analysis of in theater spinal fixation versus transport to LRMC decision should include both the spinal surgeon and Chief of Trauma. The goal should always be to optimize the patient’s neurologic outcome.

3. **Documentation and neurologic exam.**
 - a. Every effort should be made to document an accurate and thorough neurological examination. The quality of the examination can obviously be influenced by necessary pharmacological manipulations, presence of an airway adjunct or endotracheal tube, cardiovascular and pulmonary performance, and presence of other injuries to the head, torso or extremities. Documentation limited to vague terms such as “intact,” “incomplete,” or “complete” should be avoided.

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- b. Every reasonable effort should be made to document as thorough a neurologic exam as possible to include: motor exam using ASIA motor groups; sensory examination (pin prick and light touch) using ASIA dermatomal standards, this can be augmented by deep pressure; digital rectal exam assessing both resting tone and ability to squeeze the anal sphincter; normal and pathological reflex testing such as biceps, triceps, brachioradialis, knee, and ankle jerk responses as well as presence/absence of Babinski reflex. In patients with suspected spinal column injury, with or without neurologic deficit upon presentation, frequent repetition and surveillance of the neurologic examination (focusing upon motor and sensory performance) is imperative (*see Appendix A: ASIA Worksheet*).

4. Evaluation of cervical spine fracture.

- a. Patients without a distracting injury, normal neurological examination, and no spinal pain or tenderness who are fully cooperative and reliable do not require cervical spine imaging. Initial imaging of the cervical spine, if CT is unavailable, should include three view cervical spine series (AP, lateral, and odontoid views). Non-CT imaging of the thoracolumbar spine consists of two view series (AP and lateral). Fine cut CT scan with sagittal and coronal reconstruction should be accomplished at a Level III facility. In blunt trauma and in blast victims, presence of a cervical injury mandates full spinal imaging, as a cervical fracture is associated with a 10% incidence of concomitant thoracolumbar fracture. The cervical spine may be cleared with a complete cervical spine CT showing no fracture or occult evidence of acute injury (e.g. abnormal prevertebral soft tissue edema) in asymptomatic or comatose patients at the discretion of the Chief of Trauma.
- b. Unique circumstances may necessitate use of CT myelography at a Level III facility as a substitute for MRI when looking for “soft” compression of the spinal cord such as from a herniated disc or hematoma (*Refer to the Cervical Spine Evaluation CPG for further details*).

5. Evaluation and treatment for cerebrovascular injuries.

- a. Evaluation and management of penetrating injuries of the neck are covered elsewhere (*refer to the Vascular CPG for further details*). Diagnosis of blunt cerebrovascular injuries requires an index of suspicion for diagnosis before neurological presentation and manifestation of clinical sequelae that may reduce associated morbidity and mortality. Signs and symptoms that should prompt angiography include unexplained focal neurologic deficits (such as hemiparesis or aphasia), evidence of blunt anterior nuchal injury such as cervical ecchymosis, expanding cervical hematoma, or carotid bruit. Findings that should prompt evaluation include cervical fracture involving the foramen transversarium; fracture involving C1, C2 or C3 or subluxation at any cervical level; midface fractures; fractures of the skull base extending into the carotid canal; diffuse axonal injury with a GCS < 6 and near hanging with anoxic brain injury.
- b. Optimal treatment of these injuries is unresolved. Options for anticoagulation include heparinization and then warfarin (or therapeutic lovenox) or antiplatelet agents such as aspirin or clopidogrel. The former may have a lower hemorrhagic complication

rate than the latter. Timing of the institution of one of these agents must be weighed against potential contraindications such as intracranial hemorrhage and other significant hemorrhage prone injuries. The Trauma Team Leader and the neurosurgeon and/or spinal surgeon should work closely to make a determination of anticoagulant administration. If a stroke has already occurred, heparinization has been shown to reduce morbidity and mortality.

6. Treatment of spinal injuries.

- a. External immobilization options for the cervical spine in theater include semi-rigid cervical orthosis (e.g., Aspen collar), halo, and SOMI-like devices or cervico-thoracic braces (e.g. Aspen CTO). Aspen TLSO and LSO devices are available at CJTH for bracing of thoracolumbar injuries and are primarily suitable for use on patients not being transported out of theater.
- b. If logistically feasible, consideration should be given to appropriate surgical management of spinal fractures with incomplete or progressive neurologic deficit. The anticipated benefits of early surgical intervention need to be weighed against potential contraindications such as open contaminated wounds or unsatisfactory cardiopulmonary performance. The decision to proceed with decompression of the neural elements in the setting of a fracture without appropriate internal stabilization should be made with great trepidation. Improvements in spinal instrumentation systems available in theater may broaden the surgical options available to the spine surgeon.

7. Transport of patients with spinal injuries.

- a. The majority of patients with cervical spine injuries will be transported using semi-rigid orthosis such as an Aspen collar. Clinical scenarios may arise wherein halo immobilization may be suitable, but this would be rare. Transporting patients in traction is not a good option given the dynamics of air transport, particularly G-Forces during aircraft takeoff and landing, and the multiple transfers required from hospital-vehicle-aircraft-vehicle-hospital.
- b. If the patient has a thoracolumbar fracture that is potentially unstable, then he/she should be transported by CCATT using a vacuum spine board (VSB). Use of a VSB is preferable to supine transport in a TLSO or other external brace. Prior to transport the theater spine surgeon and CCATT members should agree upon suitability of VSB deflation and log-roll to reduce stress on pressure points. Log-rolling in a VSB without deflation does not significantly reduce skin pressure. Additionally, care must be given to padding and pressure reduction maneuvers of the occiput and heels. Patients can be safely transported on a VSB for up to 10 hours. If total transport time is anticipated to be greater than 10 hours – IAW USAF skin assessment standards, team should open the valve, release straps, log-roll patient (holding patient in appropriate alignment) and provide adequate time for relief of pressure points as part of their normal turning schedule.

8. Patient management.

- a. Patients who sustain neurologic compromise should have an arterial line for continuous blood pressure monitoring with a goal MAP of 85-90 mm Hg for up to seven days following the injury. Hypotension (SBP < 90 mm Hg) and hypoxemia (SaO₂ <92%) must be avoided. Pressor therapy (in the euvoletic patient) and/or supplemental oxygen is recommended, when necessary, to achieve these goals.
- b. While many spinal fractures require flat bed rest prior to surgical correction or external bracing, the bed can usually be placed in 30 degrees reverse Trendelenberg. Log-rolling the patient can be safely performed in most cases every 2 hours to prevent skin breakdown. It is incumbent upon the spine surgeon to alter these assumptions based upon the specific clinical scenario.
- c. The use of corticosteroids in the setting of acute blunt spinal cord injury is controversial. The frequent associated open or contaminated wounds of battle casualties further complicate steroid administration. Methylprednisolone administration is NOT recommended for spinal cord injuries sustained in theater.
- d. An aggressive DVT prophylaxis regimen should be established early and maintained beyond the evacuation process. Pneumatic compression devices in conjunction with chemoprophylaxis are established treatment standards. Prophylactic dosing of a subcutaneous low molecular weight heparin (LMWH -- e.g. enoxaparin) is preferred. Early active or passive mobilization of the patient helps to reduce DVT formation and is frequently cited in support of early surgical fixation, when appropriate. Patients should be screened for DVT with Duplex Doppler ultrasound and, if present, fully anticoagulated. If full anticoagulation is contraindicated, an IVC filter should be considered.

9. Penetrating spine injuries.

- a. The need for surgical intervention of penetrating spine injuries is sometimes unclear and staged debridement of the wound maybe required given the cavitory injury to soft tissues. Indications for surgery may include cauda equina injury, progressive neurologic deficit, incomplete deficit (particularly if a missile or fragment is still within the canal) or the presence of a CSF leak. If surgery is undertaken, good dural closure is paramount. Anterior and oblique entry to the lumbar and lower thoracic spine are at increased risk of infectious complications. If instability is present, infectious risks and neurologic status are key factors to determining the timing of stabilization and a staged procedure may be considered.
- b. Cefazolin is sufficient for penetrating spine injuries without evidence of contamination. Fragments passing through enteric contents require extended anti-microbial coverage for enteric organisms.

- 10. Responsibilities.** It is the trauma team leader's responsibility to ensure familiarity and appropriate compliance with this CPG.

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11. References.

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3. Ringer AJ, Matern E, Parikh S, Levine NB: Screening for blunt cerebrovascular injury: selection criteria for use of angiography. *J Neurosurg*: 2009
4. Cothren Cc and Moore EE: Blunt cerebrovascular injuries. *Clinics* 60:489-96, 2005.
5. Ordog GJ, Albin D, Wasserberger J, Schlater TL, Balasubramaniam S: 110 bullet wounds to the neck. *J Trauma* 25:238-46, 1985.
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Approved by CENTCOM JTTS Director and Deputy
Director and CENTCOM SG

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APPENDIX A

ASIA Worksheet for documenting neurologic injury

Patient Name _____
 Examiner Name _____ Date/Time of Exam _____

ASIA AMERICAN SPINAL INJURY ASSOCIATION **STANDARD NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY** **ISCOS**

MOTOR
KEY MUSCLES (scoring on *dominant* side)

R	L	
C5	<input type="checkbox"/>	Elbow flexors
C6	<input type="checkbox"/>	Wrist extensors
C7	<input type="checkbox"/>	Elbow extensors
C8	<input type="checkbox"/>	Finger flexors (distal phalanx of middle finger)
T1	<input type="checkbox"/>	Finger abductors (little finger)
UPPER LIMB TOTAL (MAXIMUM) <input type="checkbox"/> + <input type="checkbox"/> = <input type="checkbox"/> (25) (25) (50)		

Comments: _____

L2	<input type="checkbox"/>	Hip flexors
L3	<input type="checkbox"/>	Knee extensors
L4	<input type="checkbox"/>	Ankle dorsiflexors
L5	<input type="checkbox"/>	Long toe extensors
S1	<input type="checkbox"/>	Ankle plantar flexors
LOWER LIMB TOTAL (MAXIMUM) <input type="checkbox"/> + <input type="checkbox"/> = <input type="checkbox"/> (25) (25) (50)		

Voluntary anal contraction (Yes/No)

SENSORY
KEY SENSORY POINTS

	R	L	R	L
C2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
L1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
L2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
L3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
L4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
L5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
S1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
S2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
S3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
S4-5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

TOTALS: + = (MAXIMUM) (56) (56) (56) (56)

Any anal sensation (Yes/No)

PIN PRICK SCORE (max: 112)

LIGHT TOUCH SCORE (max: 112)

0 = absent
 1 = impaired
 2 = normal
 NT = not testable

• Key Sensory Points

NEUROLOGICAL LEVEL (The most caudal segment with normal function)

SENSORY	R	L
MOTOR	<input type="checkbox"/>	<input type="checkbox"/>

COMPLETE OR INCOMPLETE? (Incomplete - Any sensory or motor function in S4-S5)

ASIA IMPAIRMENT SCALE

ZONE OF PARTIAL PRESERVATION (Caudal extent of partially innervated segments)

SENSORY	R	L
MOTOR	<input type="checkbox"/>	<input type="checkbox"/>

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APPENDIX B

ADDITIONAL INFORMATION REGARDING OFF-LABEL USES IN CPGs

A. Purpose.

The purpose of this Appendix is to ensure an understanding of DoD policy and practice regarding inclusion in CPGs of “off-label” uses of U.S. Food and Drug Administration (FDA)–approved products. This applies to off-label uses with patients who are armed forces members.

B. Background.

Unapproved (i.e., “off-label”) uses of FDA-approved products are extremely common in American medicine and are usually not subject to any special regulations. However, under Federal law, in some circumstances, unapproved uses of approved drugs are subject to FDA regulations governing “investigational new drugs.” These circumstances include such uses as part of clinical trials, and in the military context, command required, unapproved uses. Some command requested unapproved uses may also be subject to special regulations.

C. Additional Information Regarding Off-Label Uses in CPGs.

The inclusion in CPGs of off-label uses is not a clinical trial, nor is it a command request or requirement. Further, it does not imply that the Military Health System requires that use by DoD health care practitioners or considers it to be the “standard of care.” Rather, the inclusion in CPGs of off-label uses is to inform the clinical judgment of the responsible health care practitioner by providing information regarding potential risks and benefits of treatment alternatives. The decision is for the clinical judgment of the responsible health care practitioner within the practitioner-patient relationship.

D. Additional Procedures.

1. Balanced Discussion. Consistent with this purpose, CPG discussions of off-label uses specifically state that they are uses not approved by the FDA. Further, such discussions are balanced in the presentation of appropriate clinical study data, including any such data that suggest caution in the use of the product and specifically including any FDA-issued warnings.

2. Quality Assurance Monitoring. With respect to such off-label uses, DoD procedure is to maintain a regular system of quality assurance monitoring of outcomes and known potential adverse events. For this reason, the importance of accurate clinical records is underscored.

3. Information to Patients. Good clinical practice includes the provision of appropriate information to patients. Each CPG discussing an unusual off-label use will address the issue of information to patients. When practicable, consideration will be given to including in an appendix an appropriate information sheet for distribution to patients, whether before or after use of the product. Information to patients should address in plain language: a) that the use is not approved by the FDA; b) the reasons why a DoD health care practitioner would decide to use the product for this purpose; and c) the potential risks associated with such use.

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