

CLEARANCE OF THE CERVICAL SPINE IN THE OBTUNDED OR POLYTRAUMA TRAUMA PATIENT

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INTRODUCTION

The pressing nature of “clearing the cervical spine” in the obtunded (closed head injured; CHI) or polytrauma patient is fueled by the desire to identify all *significant injuries* in a timely manner. *Significant injuries* are those that carry the potential for injury or irreversible morbidity to the patient if they are left unidentified, and thus undertreated. The vulnerable nature of the unprotected spinal cord highlights the importance of an early and accurate assessment of the spinal column¹⁻³.

Historically, given the unknown status of the stability of a cervical spine, prolonged use of a cervical collar was common. However, continued collar use in the polytrauma patient, the CHI patient, or any patient requiring prolonged ventilator assistance, is associated with skin and soft-tissue problems, as well as basic nursing concerns⁴⁻⁶.

As the mechanism of injury increases in energy or the presence of associated injuries becomes prevalent, the dependence on radiographic assessment increases. Both spiral computed tomography (CT) and magnetic resonance imaging (MRI) are readily integrated into the work-up as needed, depending on the primary radiographic findings and the clinical presentation. As the physical examination loses its credence (distracting injuries, associated CHI, alcohol or drug presence) the number and complexity of the radiographic studies increases. The concern remains, however, that without a reliable clinical examination, the cervical spine CANNOT be cleared in the acute setting.

THE ROLE OF THE PHYSICAL EXAMINATION

Historically, the physical examination directed the work-up algorithm in the trauma patient. However, in order to safely and effectively evaluate the cervical spine in the polytrauma or obtunded (CHI) patient, the trauma community has grown far more dependent on the spiral CT with reconstructive views and, most recently, the MRI findings. As we proceed from plain

radiographs to the most sophisticated of current radiographic imaging, the clinical examination loses its essential nature. It has, to a large extent, evolved to play a more supportive or confirmatory role.

PLAIN RADIOGRAPHS AND CT SCANNING

Plain radiographs of the cervical spine, obtained via the “trauma series” protocol popularized by the Advanced Trauma Life Support Program⁸ is claimed to have a sensitivity of > 90% in the detection of significant “cervical spine injuries.”^{9,10} However, these plain radiographs are largely being supplanted by reconstructive views (coronal and sagittal) obtained from spiral CT scans. CT scans have long been accepted as both more sensitive and specific than plain films in the identification of bony injuries to the cervical spine¹¹⁻¹⁴. Therefore, if the CT scan of the entire cervical spine, including the junctions, is free of bony injury, the question arises of the necessity of plain films¹⁵. The CT scan studies are neither 100% accurate for bony injury identification, nor do they carry a 100% negative predictive value¹⁶; however, the clinical significance of these missed bony injuries has yet to be fully characterized. There is also the issue of increased radiation exposure to the trauma patient undergoing a CT in lieu of plain films. Rybicki et al¹⁷ measured radiation doses to the thyroid and found that CT of the entire cervical spine delivered 14 times greater the radiation dose than that delivered by plain radiographs. The authors suggest judicious use of helical CT in routine screening.

The current “consensus opinion” has the CT scan as the radiographic method of choice to assess for bony injury, particularly in the higher risk category of patients, i.e., those that have suffered high energy mechanism, associated head injuries or focal neurological deficits. This shift from the primary use of plain films is due in large part to the additional utility of CT sagittal and coronal reconstructions. Once the cervical spine has been evaluated and found to be free of bony injuries, the principal remaining problem of “clearing the cervical spine” is one of identifying soft tissue injuries.

OCCULT SOFT TISSUE INJURIES AND MRI

The pertinent soft tissues include the facet capsules, the interspinous and supraspinous ligaments, the ligamentum flavum, and the annular component of the intervertebral disc. Whereas CT scanning is highly proficient at identifying bony injuries, MRI, remains the “gold standard” with respect to the evaluation of the soft tissues about the spinal column^{16,18}. Despite utilizing this highly sensitive imaging modality, the MRI findings relating to spinal ligament injuries have yet to be

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consistently and definitively correlated to functional integrity of the cervical spine¹⁹. Therefore, an abnormal finding on MRI does NOT necessarily define an unstable cervical spine.

FLEXION-EXTENSION VIEWS

In the sub-acute setting, between 2 and 3 weeks post-injury, active (patient performed) flexion-extension lateral cervical spine x-rays remain the primary method to define “instability”. Unfortunately, this technique has proven ineffective and impractical in the acute setting^{20,21}. Additionally, it has little (if any) utility in the obtunded or polytrauma patient that cannot actively participate in the process. . Further confounding the utility of this method is the fact that this study often times does not visualize the cervicothoracic junction. In fact, if the cervicothoracic junction is not visible on the original plain films, the flexion-extension view should be contraindicated.

The remaining methods for clearance of the obtunded or polytrauma patients’ cervical spine fall into one of three categories: early clearance, delayed clearance or pure radiographic clearance. *Early Clearance* is accomplished by means of fluoroscopic evaluation or gravity assisted lateral cervical films. It generally occurs within the initial 48-72 hours of the patients’ presentation to the Trauma Unit. The *Delayed Clearance* technique maintains the injured patient in a collar until the patient is capable of participating in the exam. The final category is the pure *Radiographic Clearance*, which is solely dependent on the CT and MRI findings and at present is NOT time dependent. .

EARLY CLEARANCE VIA PASSIVE CERVICAL MOTION TECHNIQUES

The most controversial method of clearance for the obtunded or polytrauma patient is via passive cervical motion. This can occur via a physician directed fluoroscopic evaluation or an upright lateral cervical spine film with the patient in a collar⁷. The fluoroscopic technique has been consistently successful in identifying unstable injuries in the presence of “negative” standard plain films and CT scans²⁴⁻²⁷.

Of the published fluoroscopic protocols, only one includes a “stretch test” to be performed prior to the flexion and extension views. The prerequisite of a negative stretch test prior to performing passive flexion/extension provides further safety to the “unprotected spinal cord” in the presence of a dangerously unstable cervical spine. Remaining issues include: Who should be performing the test? And, is spinal cord monitoring necessary or sufficient during the fluoroscopic examination?

An alternative method to assess the cervical spine in the obtunded patient is the upright lateral cervical film. The upright lateral cervical spine view is performed with a collar in place. This occurs only after secondary review of the helical CT and plain radiographs confirms the absence of any subtle abnormalities. The objective behind this study is to protect the spine (by maintaining the collar) while allowing it to be subject to a portion of its physiologic load. The absence of a discernible kyphosis or vertebral body collapse suggests a “stable” spine⁷. Though this technique has its ardent supporters, and in theory appears to be safe and helpful in the diagnosis of occult ligamentous injuries, the support of peer-reviewed literature is lacking.

THE DELAYED CLEARANCE TECHNIQUE

The *Delayed Clearance* technique is prudent and the most popular. It assumes the clinical scenario whereby the cervical spine has sustained either no appreciable injury or an occult injury that can be safely maintained in a cervical orthosis. The patient is maintained in a collar until he/she can effectively participate in the clinical examination. The obvious negative view of this method of management is the necessity for a collar to be worn for a non-specific (often lengthy) period of time. This extended collar use has been linked to skin breakdown in the chin and occipital areas. Nursing care protocols may be altered due to the presence of the collar. Additionally, the presence of a cervical collar has been demonstrated to affect the tidal volume in the anesthetized patient as well as altering the cerebral spinal fluid pressure^{22,23}. In most hospital settings, this is the preferred method of management for the CHI or polytrauma patient requiring prolonged ventilatory support, who is unable to participate in the clinical examination.

THE RADIOGRAPHIC CLEARANCE TECHNIQUE

The second most common method utilized for cervical spine clearance in the polytrauma or obtunded patient is the *Radiographic Clearance* technique. This method utilizes the sensitivity of the CT scan to identify bony injuries *and* the sensitivity of the MRI for soft tissue injuries. Typically the CT scan includes axial images as well as reformats in both the sagittal and coronal planes. If both the CT and MRI are negative, the likelihood of an occult injury that could lead to a *significant injury* is remote. However, abnormalities found on the MRI can be confusing and subject to individual physician interpretation. Currently there does NOT exist a standardized and validated classification system for soft tissue injuries of the spine as visualized on MRI. Nonetheless, this method has gained increasing support within the trauma community as it allows for an early and accurate disposition as to the status of the cervical spine. If both are negative, the collar is generally removed. If there is an abnormality identified on the MRI or CT, the spine consultant’s individual expertise is called upon for decision-making.

CONCLUSION

In summary, clearance of the cervical spine remains a difficult management issue in the three defined patient populations where the physical exam cannot be considered reliable: the polytrauma patient (distracting injuries), the closed head injured patient (no input), and the pediatric polytrauma patient (communication issues and distracting injuries). Institutional adoption of evaluation protocols is necessary to avoid errors in the difficult process of evaluating these patients²⁸. The clinical examination, once thought to be the principal determinant directing the formal evaluation, often cannot be relied upon due to the patients’ associated injuries. Improvements in both MRI and CT scanning have led to greatly improved diagnostic sensitivity Unfortunately, neither imaging method has been able to replace the necessity of other tests in the overall assessment of the bony and soft tissue elements of the cervical spine.

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