A Prospective Comparison of Helical CT vs Plain Film for Radiographic Evaluation of the Cervical Spine in Trauma Patients
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INTRODUCTION: Current Literature supports the use of the three-view plain film series supplemented with CT to radiographically evaluate bony injury in the cervical spine of trauma patients. To date we know of no prospective large scale studies comparing this to helical CT alone. The purpose of this study is to prospectively obtain plain films and a CT in a large number of trauma patients presenting to a level one trauma center and determine the sensitivity, specificity, and negative predictive value of helical CT when used alone to evaluate the cervical spine. Our hypothesis is that helical CT of the cervical spine will detect more bony injuries and miss few if any injuries that would otherwise be detected on plain films. Therefore, the specificity and negative predictive value of CT will approach that of plain film with adjunct CT thus obviating the need for any plain films if a CT of the cervical spine is obtained.

METHODS: Plain films of the cervical spine were obtained on 408 patients 18 years of age or older who presented to a level one trauma center as either a priority one or priority two trauma page and had a helical CT of the cervical spine during a 21 month period. The CT scanner was a GE Lightspeed and the trauma protocol includes occiput to T4 with 2.5mm by 2mm cuts. Bone and soft tissue algorhythms are included and coronal and sagittal reformats are standard. The plain films included at least lateral, AP, and odontoid views; a swimmers view was added if there was incomplete visualization of the cervico-thoracic junction. Only acute processes in the occiput, c-spine or T1 vertebrae were recorded. If the report stated “possible,” “probable,” or “cannot rule out” it was recorded as an acute process. Subluxations, dislocations, and jumped facets were recorded as acute processes. Mild listhesis of unknown chronicity were not recorded as acute processes because regardless of plain film or CT initial evaluation, continued neck pain in these patients would require flexion-extension views or MRI to address ligamentous injury to the cervical spine. At a later date, the plain films and CT were independently read by two radiologists who were blinded to the initial interpretation and to the corresponding CT or plain films. These results were then compared to the initial reading, any treatment, and discharge summary – which acted as the control.

RESULTS: Plain films alone were adequate to clear the cervical spine in only 48% of patients. Of these 213 “inadequate” films, additional films i.e. a swimmers view was obtained in 85%, showing an attempt to fully evaluate the
cervical spine with the plain films alone. The prevalence of traumatic injury identification was 14%. CT alone was 98% sensitive and 98% specific. Plain films were 45% sensitive and 97% specific. The negative predictive value of CT was 99.7% compared to 93% for “adequate” plain films. One injury was identified on plain film but missed on CT: an odontoid fracture. Review of the CT clearly demonstrates the fracture and we feel this false negative is due to human error. On average, it took less time (14 min) to obtain a cervical spine CT than the 3-4 view plain film series (18 min). This was based on 15 random CT’s and 16 random plain films timed during the study. At our institution, the cost of a cervical spine CT, $1150.50 is (4x) more than the plain film series, $268 (this price includes the portable lateral in trauma bay). However, due to the number of plain film series that were “inadequate” thus obviating a CT to further evaluation, the cost of CT alone, $1150.50/person, is only 33% more expensive than the cost of the current protocol, $865.80/person. Moreover there were 12 false negatives in the “adequate” plain film group – meaning that even when plain films do visualize the entire cervical spine, some injuries are missed. These missed injuries included a C1 posterior arch fractures and an odontoid fractures – which are injuries with potential significant consequences if missed.

CONCLUSION: Helical CT alone has a high sensitivity and specificity for detecting cervical spine injuries in the trauma patient. It identifies more injuries than plain film alone. The negative predictive value of helical CT alone, 99.7-100%, approaches that of plain film with adjunct CT. Although slightly more expensive (33%), obtaining a CT in all trauma patients saves time, nursing and adjunct resources, and identifies injuries that can be missed on plain films even when the plain films adequately visualize the entire cervical spine. Helical CT can and should be safely used without plain films to radiographically evaluate the cervical spine in trauma patients.

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