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Impact of intravenous acetaminophen therapy on the necessity of cervical spine imaging in patients with cervical spine trauma

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【**Abstract**】**Objective:** We evaluated a new hypothesis of acetaminophen therapy to reduce the necessity of imaging in patients with probable traumatic cervical spine injury.

Methods: Patients with acute blunt trauma to the neck and just posterior midline cervical tenderness received acetaminophen (15 mg/kg) intravenously after cervical spine immobilization. Then, all the patients underwent plain radiography and computerized tomography of the cervical spine. The outcome measure was the presence of traumatic cervical spine injury. Sixty minutes after acetaminophen infusion, posterior midline cervical tenderness was reassessed.

Results: Of 1 309 patients, 41 had traumatic cervical spine injuries based on imaging. Sixty minutes after infusion, posterior midline cervical tenderness was eliminated in 1 041 patients, none of whom had abnormal imaging.

Conclusion: Patients with cervical spine trauma do not need imaging if posterior midline cervical tenderness is eliminated after acetaminophen infusion. This analgesia could be considered as a diagnostic and therapeutic intervention.

Key words: ***Acetaminophen; Diagnosis; Spinal Injuries; Cervical vertebrae; Radiography***

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In Iran, the overall incidence of blunt traumatic cervical spine fractures among all trauma patients is 0.7% (95%*CI*, 0.61%-0.88%) and among all spine-fractured patients is 19.38% (95%*CI*, 16.34%-22.72%).[1] Failing to diagnose traumatic cervical spine injury could lead to catastrophic neurologic disability.[2] But the evaluation of patients with probable cervical spine injury is difficult. So far two clinical decision rules have been defined to provide a low-risk approach to trauma patients and avoid unnecessary radiography.[3]

According to the National Emergency X-Radiography Utilization Study criteria, cervical spine injury cannot be excluded if any of the following manifestations are present: the absence of tenderness at the posterior midline of the cervical spine, the absence of a focal neurologic deficit, a normal level of alertness, no evidence of intoxication, and absence of clinically apparent pain that might distract the patient from the pain of a cervical spine injury.[4,5]

Based on the Canadian C-spine rule, if there is one of three high risk factors (age≥65 years, dangerous mechanisms of injury, or sensory neurologic deficit) in alert patients, cervical spine imaging should be ordered. Additionally, if the patient is unable to rotate the neck 45 degrees to the right and left, then imaging is required.[4,6]

Pain only on dynamic active flexion-extension or lateral bending of the neck to the right and left might not be the sign of serious cervical vertebra fracture.[7]

On the other hand, CT scanning is more sensitive and specific than plain radiography to

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evaluate the cervical spine in trauma patients, and can be performed in a more expeditious fashion.[8-13] The current trend in most trauma centers is to use CT as the initial imaging modality to evaluate the cervical spine, and CT scanning is the imaging modality of choice for diagnosis of suspected cervical spine fractures.[3] Surprisingly, magnetic resonance imaging (MRI) is not found to be helpful to long-term outcomes in acute trauma patients with persistent midline cervical tenderness and negative CT scans.[14]

In general, clinicians have a liberal use of imaging.[3] This tendency exposes a large number of patients to imaging at extensive cost, while distinguishing injuries in a minority of cases.[3,4,15] According to the National Hospital Ambulatory Care Survey, only 4% of all cervical spine radiographs demonstrate a fracture.[16] On the other hand, there are great variations in practice among emergency physicians, with a 6-fold range in imaging-ordering rates.[16] Abolishing even a little part of imaging-ordered rates for these patients could lead to considerable cost savings and would decrease patients' exposure to radiation.

In this study, we designed and tested a new hypothesis of acetaminophen analgesic therapy to reduce the necessity of imaging in patients with probable traumatic cervical spine injury.

METHODS

This prospective longitudinal observational study was conducted in three large Iranian university hospitals: Imam Reza Hospital and Hashemi-Nejad Hospital (two teaching hospitals of Mashad University of Medical Sciences, located in Mashad), and Madani Hospital (a teaching hospital of Alborz University of Medical Sciences, located in Karaj) between January 2009 and January 2013 and included consecutive patients presented to the emergency department after sustaining acute blunt trauma to the neck and posterior midline cervical tenderness.

Exclusion criteria were: aged under 15 or more than 55 years, any history of loss of consciousness, a distracting injury, any focal neurologic deficit, an evidence of intoxication, and pregnancy. All patient assessments were made by specialist physicians certified in emergency medicine. Eligible patients received acetaminophen (15 mg/kg) intravenously after cervical spine immobilization with Philadelphia cervical collar. Then, all patients underwent plain radiography of the cervical spine. Radiography consisted of 3 views: anterioposterior, lateral, and odontoid views. Patients also underwent CT of the cervical spine. Radiographs and CT images were interpreted by radiologists who were not aware of the study. The outcome measure was traumatic cervical spine injury, defined as any fracture, dislocation, or ligamentous instability demonstrated by diagnostic imagings. Sixty minutes after acetaminophen infusion, the posterior midline cervical tenderness was reassessed and compared with the imaging results.

The research ethics committees of the hospitals approved the protocol without the need for informed consent. Patients had an opportunity to give verbal consent during the telephone interview conducted by a nurse.

We sought to correlate concurrent posterior midline cervical tenderness with imaging's findings to determine the sensitivity and specificity parameters, and positive and negative predictive values (PPV and NPV) for acetaminophen infusion in failure to improve tenderness of real traumatic cervical spine injury. True positives were determined by abnormalities in imaging and true negatives were determined by improvement after acetaminophen infusion without abnormal findings in imaging.

RESULTS

Between January 2009 and January 2013, 1 309 eligible patients with acute blunt trauma to the neck and midline cervical tenderness were included in the study (1 017 males and 292 females).

Based on the imaging, traumatic cervical spine injury was diagnosed in 41 patients (3.1%). Trauma-related abnormalities were detected in 39 CT and 27 X-ray images, respectively. Twenty-five patients had abnormality in both CT and X-ray images. A spinous process fracture in C_7 and a listhesis in C_3-