EDITOR'S CHOICE

Screening Cervical Spine CT in the Emergency Department, Phase 3: Increasing Effectiveness of Imaging

Brent Griffith, MD[a], Phyllis Vallee, MD[b], Seth Krupp, MD[b], Melissa Jung, MD[a], Michelle Slezak, MD[b], Jumana Nagarwala, MD[b], C. Patrick Loeckner, MD[b], Lonni R. Schultz, PhD[c], Rajan Jain, MD[a,d]

Purpose: The aim of this study was to determine the effect of a clinical education initiative on the appropriate utilization of screening cervical spine CT in the emergency department. The purpose was to assess if clinical education can produce stricter adherence to the ACR Appropriateness Criteria and improve the utilization of screening CT examinations in the emergency department.

Methods: Institutional review board approval was obtained for this HIPAA-compliant study. All adult patients presenting to a level 1 trauma center with blunt trauma prompting screening cervical spine CT were eligible. For each study, the requesting clinician completed a survey selecting all clinical indications. CT examinations were evaluated by a board-certified radiologist blinded to survey data. Results were compared with retrospective and prospective studies performed before the institution of the education initiative.

Results: Of the 388 cervical spine CT examinations performed, 12 (3.1%) were positive for acute cervical spine injury, compared to only 1.0% before the clinical education program (phase 2). Of the 376 examinations without injury, 13% met all 5 National Emergency X-Radiography Utilization Study criteria for nonimaging (down from 16.1% in phase 2), and 15 (4%) required no imaging when both National Emergency X-Radiography Utilization Study and abbreviated Canadian cervical spine rule criteria were applied.

Conclusions: Implementation of a clinical education initiative resulted in improved adherence to ACR Appropriateness Criteria and improved clinical effectiveness of the studies by increasing fracture detection rate. Initiatives such as these could potentially influence imaging overutilization without burdening emergency department clinicians with excessive roadblocks to image ordering.

Key Words: Cervical spine, utilization, appropriateness criteria, NEXUS, Canadian cervical spine rule

J Am Coll Radiol 2014;11:139-144. Copyright © 2014 American College of Radiology

INTRODUCTION

The use of medical imaging has increased dramatically in the past decades, and imaging is a vital component of patient care [1,2]. This increased utilization, however, is not without potential drawbacks, including higher health care costs and increased radiation exposure to patients [3]. As such, the need to ensure the appropriate use of imaging is essential.

Clinical decision support has demonstrated success in reducing imaging utilization in some settings [4], but it is not without challenges. This is particularly true in the emergency setting, in which providers have expressed frustration with decision support tools because of reduced efficiency, delays in patient care, and, ultimately, a negative impact on patient safety [5]. One common reason for imaging in the emergency department is suspected cervical spine trauma. Because of the potential consequences of a missed injury, coupled with the availability, speed, and accuracy of current imaging modali-

[a]Department of Radiology, Henry Ford Health System, Detroit, Michigan.

[b]Department of Emergency Medicine, Henry Ford Health System, Detroit, Michigan.

[c]Department of Public Health Sciences, Henry Ford Health System, Detroit, Michigan.

[d]Department of Radiology, NYU Langone Medical Center, New York, New York.

Corresponding author and reprints: Brent Griffith, MD, Henry Ford Hospital, Department of Radiology, K3, 2799 West Grand Boulevard, Detroit, MI 48202; e-mail: brentg@rad.hfh.edu.

1546-1440/14/$36.00 • http://dx.doi.org/10.1016/j.jacr.2013.05.026

ties, clinicians often have a low threshold for ordering imaging. The end result is high numbers of negative examinations, increased cost, and increased radiation exposure to patients.

In 2000, the National Emergency X-Radiography Utilization Study (NEXUS) criteria were established to identify blunt trauma patients with a low probability of cervical spine injury, thereby saving them from unnecessary imaging [6]. To meet the NEXUS criteria, a patient must have the following: no tenderness at the posterior midline of the cervical spine, no focal neurologic deficit, a normal level of alertness, no evidence of intoxication, and no clinically apparent painful injury that might distract him or her from the pain of a cervical spine injury [6]. Patients meeting these criteria have a low probability of cervical spine injury, and imaging of the cervical spine is not indicated. A similar decision rule, the Canadian cervical spine rule (CCR), was later developed and uses 3 high-risk criteria (age ≥65 years, dangerous mechanism, and paresthesias in the extremities); 5 low-risk criteria (simple rear-end motor vehicle collision [MVC], sitting position in the emergency department, ambulatory at any time, delayed onset of neck pain, and absence of midline cervical spine tenderness); and the ability of patients to actively rotate their necks to determine the need for cervical spine imaging [7]. Although initially used to determine the need for radiography, these tools are now applied to the use of cervical spine CT and are used as part of the ACR Appropriateness Criteria® for determining the need for cervical spine imaging in the setting of blunt trauma [8]. However, these guidelines are often not followed, perhaps because of clinicians' lack of knowledge or trust in their utility.

A prior retrospective study (phase 1) at our institution found that 23.9% of patients with negative results on CT cervical spine examinations after blunt trauma had no documentation of the NEXUS criteria in their medical records [9]. A prospective study (phase 2) assessing utilization after the implementation of an ordering clinician survey found the number of studies ordered in the absence of the NEXUS criteria decreased to 16.1% [10]. This decrease was likely due to a combination of improved documentation, as well as changes in ordering practices as a result of the heightened awareness created by the survey itself.

After phase 2, a simple clinical education program targeting clinicians responsible for ordering studies in the emergency department was implemented. The purpose of this final phase 3 study was to determine if the clinical education program was successful in altering ordering practices, leading to stricter adherence to appropriateness guidelines and improved utilization of imaging services.

METHODS

This HIPAA-compliant prospective study was approved by our institutional review board.

Before beginning enrollment for phase 3, all emergency department clinicians (staff physicians, resident physicians, and physician assistants) responsible for ordering cervical spine CT were given a 45-min presentation reviewing the ACR Appropriateness Criteria for imaging in suspected cervical spine trauma, specifically addressing application of the NEXUS and CCR criteria [8]. The clinicians were, however, reminded that the final decision to order cervical spine imaging was at the discretion of the treating clinician, regardless of the presence or absence of criteria. The presentation also discussed phase 1 and 2 results, including data regarding clinician adherence to appropriateness criteria, as well as the incidence of cervical spine injury in patients meeting these criteria [9,10]. Reminders regarding the NEXUS and CCR criteria were placed throughout the emergency department.

Although the ACR Appropriateness Criteria for suspected cervical spine trauma include 8 variants, variants 1 and 2 address the need for imaging on the basis of the application of the NEXUS or CCR clinical criteria during initial patient evaluation [8]. Variants 3 through 8 describe specific scenarios involving cervical spine trauma (eg, myelopathy, suspected arterial injury) and were beyond the scope of this study [8].

After the educational initiative, phase 3 study enrollment began. During this phase, all adult patients presenting to the emergency department of a level 1 trauma center between March and October 2012 who underwent screening CT of the cervical spine as part of an evaluation for blunt trauma were eligible for the study. For each eligible patient, clinicians were instructed to complete a survey documenting the following: mechanism of injury, indications for ordering the study, and clinical suspicion for cervical spine injury. Among the survey indications were the NEXUS criteria and an abbreviated set of CCR criteria (age ≥ 65 years, dangerous mechanism, paresthesias in the extremities, and inability of the patient to actively rotate his or her neck). Among the low-risk CCR criteria, we chose only to include posterior midline tenderness. The other low-risk CCR criteria (simple rear-end MVC, sitting position in the emergency department, ambulatory at any time, and delayed onset of neck pain) were not included because documentation of these criteria was not felt to be accurate in the medical record. In addition to these guideline criteria, the survey also included a number of other potential indications and a free-text section where clinicians could document their own indications.

Because of a change in patient triaging methods between phases 2 and 3, initial triage levels could not be directly compared. Instead, a random subset of 100 patients from both phases was analyzed for initial triage location in the emergency department, which correlates with general acuity level (resuscitation room or category 1 = higher acuity; category 2, 3, or 4 = lower acuity).