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Original Contributions

FINDINGS OF CHRONIC SINUSITIS ON BRAIN COMPUTED TOMOGRAPHY ARE NOT ASSOCIATED WITH ACUTE HEADACHES

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☐ **Abstract—Background: Headache is a common complaint in emergency department (ED) patients. Nearly 15% of ED headache patients will have brain computed tomography (CT) done. One frequent finding on these scans is "chronic sinusitis." Assuming that "chronic sinusitis" is the cause of the patient's headache is a potential source of mis-diagnosis. Study Objective: We hypothesized that CT findings of chronic sinusitis occur with equal frequency in patients with atraumatic headache as in control patients with minor head injury. Methods: This is a retrospective, single-center medical record review of consecutive discharged patients who received noncontrast head CT scans in an urban ED for either minor closed head injury or atraumatic headache. Each patient's head CT radiologic report was reviewed for findings of sinusitis and classified as chronic sinusitis, indeterminate for sinusitis, air-fluid levels, or no findings of sinusitis. Results: We enrolled 500 patients (234 in the atraumatic headache group, 266 in the minor head injury group). The two groups were similar except that more women were enrolled in the atraumatic headache group. CT findings of chronic sinusitis in the atraumatic headache group (22.2%) and the minor head injury group (17.7%; difference 4.5%; 95% confidence interval of −2.5–11.6%). Conclusion: Prevalence of CT findings of sinusitis in ED patients with atraumatic headaches and mild head injury are similar. This strongly suggests that CT findings of chronic sinusitis in patients with atraumatic headache may be incidental, and are rarely the cause of a patient's acute headache.** © 2014 Elsevier Inc.

☐ **Keywords—headache; sinusitis; CT scan; chronic sinusitis; diagnostic error**

INTRODUCTION

Background

Headache is a common chief complaint among emergency department (ED) patients (1). Whereas the majority of these patients have benign primary headache disorders (often tension-type and migraine), a small percentage have more serious, secondary causes (2). Accurate distinction between these two categories is important to correctly treat both groups.

Nearly 15% of ED patients with acute headache have brain imaging done, usually computed tomography (CT) of the brain (1). These scans often show findings consistent with "sinusitis," sometimes with the modifier "chronic." In one large study, 42.5% of asymptomatic individuals had some sort of abnormality in one of the paranasal sinuses (3). Although patients and physicians alike often ascribe acute headache to "sinusitis" or "sinus headache," these types of headaches are actually not very common, as most "sinus headaches" are actually migraine or tension-type headaches (4–8).

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Thus, one potential cause of misdiagnosis is premature diagnostic closure after a patient is found to have chronic sinusitis findings on CT, then assuming that this is the cause of the patient's headache. The diagnosis of "sinusitis" is commonly reported in multiple studies of misdiagnosed subarachnoid hemorrhage; however, no causality with respect to incidental CT findings was reported in these studies (9–11). One specific cause of misdiagnosis of a serious headache is incorrectly diagnosing sinusitis in patients with headache whose brain CT scans were reported as showing evidence of chronic sinusitis (12).

Although prior studies have recorded the incidence of chronic sinusitis findings in asymptomatic individuals, none has specifically compared these findings in patients with acute headaches vs. a control group.

Goals of this Investigation

Our hypothesis was that CT findings of chronic sinusitis, such as mucosal thickening, occur with equal frequency in patients with atraumatic headache as in control patients. Our objective was to quantify and compare the frequency of radiographic findings indicative of chronic sinusitis in ED patients presenting with atraumatic headache to those presenting with minor closed head injury.

MATERIALS AND METHODS

Study Design

We performed a retrospective, single-center descriptive review of electronic medical records of consecutive patients who received noncontrast head CT scans in a busy urban, tertiary care ED between October 2007 and April 2008 for reasons of either minor closed head injury or atraumatic headache and who were subsequently discharged home. Our hospital's institutional review board approved the study.

Setting

The study institution is an academic, tertiary care, Level I trauma center located in Boston, Massachusetts. The annual ED census is approximately 55,000 patients.

Selection of Participants

We collected data on patients who had a head CT scan performed while in the ED. Noncontrast head CT scans were ordered at the discretion of the treating teams during each subject's ED evaluation, which resulted in the final ED diagnosis. The indication for each CT scan was determined by reviewing the provider order entry field. The study group included patients with a diagnosis of atraumatic headache. The control group was patients with a diagnosis of minor head injury. We enrolled only patients who were discharged home from the ED. We specifically chose discharged patients as our subjects for two reasons: 1) patients with headaches thought to be due to sinusitis would very rarely be admitted to the hospital and 2) to avoid the potential confounder of inadvertently including patients with more significant head trauma whose CT scans may show mucosal changes or air fluid levels due to acute bleeding from underlying skull fractures, rather than mucosal changes related to chronic sinusitis.

The raw data were obtained from medical center data management services, which queried the hospital's electronic medical record and billing database (Casemix TSI, Boston, MA) using a structured search designed to detect all patients who received a CT scan for these diagnoses during the study period. Patients were identified using discharge International Classification of Diseases, Ninth Revision (ICD-9) diagnosis codes (Appendix 1). For the study group, this excluded patients with specific secondary etiologies of their headache (e.g., subarachnoid hemorrhage, idiopathic intracranial hypertension). For the controls, this excluded patients with major head trauma (e.g., intracranial hemorrhage, skull fractures) in whom nonspecific sinus findings may have been due to acute blood.

Methods of Measurement and Data Collection

We reviewed patients' records to extract data on their noncontrast head CT scan interpretations and specific demographic information. One trained data collector (K.K.) abstracted data from the ICD-9 code-based database as well as from patient charts and recorded the information onto a prespecified spreadsheet. The abstractor was an emergency medicine resident who was not blinded to the purpose of the study.

Key demographic variables collected about each case included age, sex, race/ethnicity, date of visit, and trauma mechanism. Each patient's head CT radiologic report was reviewed for findings consistent with sinusitis and classified into one of four mutually exclusive categories: 1) chronic sinusitis, 2) indeterminate for sinusitis, 3) air-fluid levels (AFLs), or 4) no findings of sinusitis. Three investigators discussed and predetermined the sinusitis classification criteria prior to data abstraction.

We defined chronic sinusitis as CT findings of mucosal thickening, secretions, or opacification involving the ethmoid, frontal, or maxillary sinuses. The indeterminate category included CT scans with findings of polyps, polypoid thickening, or mucous retention cysts. Any CT report with mention of an AFL was included in the third category. AFLs are associated with acute sinusitis and thus may reflect a legitimate etiology for an acute atraumatic headache.