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HEAD COMPUTED TOMOGRAPHY IN THE EMERGENCY DEPARTMENT: A COLLECTION OF EASILY MISSED FINDINGS THAT ARE LIFE-THREATENING OR LIFE-CHANGING

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□ **Abstract—Background: The use of noncontrast head computed tomography (CT) has become commonplace in the emergency department (ED) as a means of screening for a wide variety of pathologies. Approximately 1 in 14 ED patients receives a head CT scan, and analyzing and interpreting this high volume of images in a timely manner is a daily challenge. Objectives: Minimizing interpretation error is of paramount importance in the context of life-threatening and time-sensitive diagnoses. Therefore, it is prudent for the physician to recognize particular pitfalls in head CT interpretation and establish search patterns and practices that minimize such errors. In this article, we discuss a collection of common ED cases with easily missed findings, and identify time-effective practices and patterns to minimize interpretation error. Discussion: There are numerous reasons for false-negative interpretations, including, but not limited to, incomplete or misleading clinical history, failure to review prior studies, suboptimal windowing and leveling, and failure to utilize multiple anatomic views via multi-planar reconstructions and scout views. We illustrate this in four specific clinical scenarios: stroke, trauma, headache, and altered mental status. Conclusion: Accurate and timely interpretation in the emergent setting is a daily challenge for emergency physicians. Knowledge of easily overlooked yet critical findings is a first step in minimizing interpretation error.** © **2014 Elsevier Inc.**

□ **Keywords—head CT; stroke; trauma; headache; altered mental status**

INTRODUCTION

With the mounting volume of cross-sectional imaging studies, emergency physicians are challenged to provide comprehensive and accurate image interpretation in an increasingly efficient manner. Computed tomography (CT) is the one of the most commonly utilized imaging modalities in the emergency setting, second only to conventional radiography (1). Approximately 1 in 14 emergency department (ED) patients receive a head CT scan, sometimes for time-sensitive and life-threatening diagnoses (2). It is thus prudent to recognize commonly missed pathologic conditions and establish search patterns and practices that minimize such errors.

Errors in interpretation may be classified as perceptual errors (not recognizing a finding) or cognitive errors (not correctly interpreting or understanding a finding) (3,4). In the context of commonly missed findings as described in this article, the radiologist is prone to perceptual errors. Overall resident miss rates reported in the literature range from 0.9–41%, depending on the definition and severity of interpretation error, whereas a 2.8% disagreement rate amongst practicing radiologists is reported for difficult cases (5,6). For head CT scans performed in the setting of trauma, reported major and minor interpretation discrepancy rates between residents and staff radiologists equal 1.7% and 2.6%, respectively (7).

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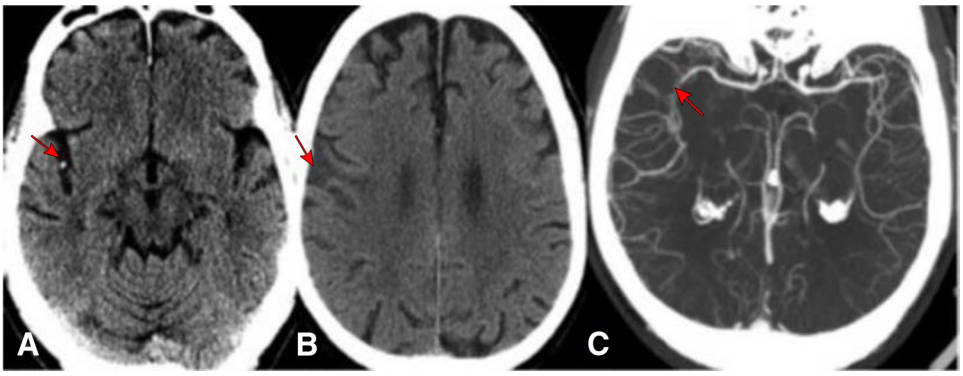

Figure 1. Demonstration of distal dense middle cerebral artery sign on noncontrast computed tomography (NCCT) with contrast-enhanced CT confirmation. (A) Focal hyperdensity of the right middle cerebral artery M2 segment within the cistern of the lateral cerebral fossa (arrow). (B) Hypodensity of the right inferior frontal gyrus representing recent infarction (arrow). (C) A maximum intensity projection image from the subsequent contrast-enhanced CT angiogram demonstrates a filling defect (arrow) within a right sylvian M2 branch, corresponding to the clot on NCCT and in the arterial territory of the infarct.

There are numerous reasons for false-negative interpretations, including, but not limited to, incomplete or misleading clinical history, failure to review prior studies, suboptimal windowing and leveling, and failure to utilize multiple anatomic views via multi-planar reconstructions and scout views.

In this article, we demonstrate and discuss a collection of common time-sensitive and life-threatening ED cases with easily missed findings, and identify time-effective practices to minimize interpretation error.

DISCUSSION

Ischemic Stroke

CT is widely considered to be the first diagnostic step for patients with acute focal central neurologic deficit, and can be employed to rule out competing diagnoses such as intracranial hemorrhage, brain neoplasm, encephalitis, and abscess. Identification of ischemic brain tissue by CT enables the positive diagnosis of cerebral ischemia and delineates that volume of brain tissue prone to die. Moreover, noncontrast head computed tomography (NCCT) serves a critical role in determining whether thrombolytic therapy is a possibility, as it is contraindicated in the context of hemorrhagic infarction. Modern CT technology can directly depict sequelae of brain ischemia at about 6 h after onset. Early CT signs of brain tissue ischemia are subtle, and include hyperdensity of the middle cerebral artery sign (HMCAS) or hyperdensity of other cerebral vessels, parenchymal hypodensity, or focal brain swelling (8).

Hyperdense vessels. The HMCAS is a highly specific but insensitive NCCT sign representing middle cerebral artery (MCA) clot. HMCAS is seen in 35–50% of angiographically proven MCA occlusions. HMCAS is associated with a higher rate of early parenchymal hypodensity, hemorrhagic transformation, and development of large infarctions. Some studies show HMCAS to be

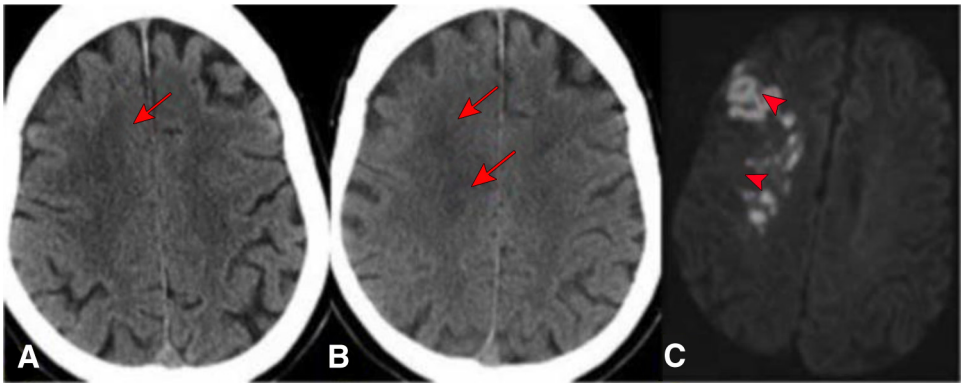

Figure 2. A 71-year-old man with previous anterior cerebral artery and middle cerebral artery internal border-zone ischemia presents with new left-sided weakness. (A) Prior computed tomography (CT) demonstrates focus of hypoattenuation within the right frontal lobe (arrow). (B) CT on presentation shows new and larger foci of hypoattenuation and loss of gray-white differentiation suspicious for a new infarct (arrows). (C) Diffusion restriction on diffusion-weighted magnetic resonance imaging confirms new infarcts (asterisks).