

CAN ED PHYSICIAN INTERPRET NCCT BRAIN RELIABLY IN HEAD INJURY VICTIMS'S EMERGENCY MANAGEMENT?Harsh Shah¹, Bhavesh Jarwani², Mehul Gjar³**HOW TO CITE THIS ARTICLE:**

Harsh Shah, Bhavesh Jarwani, Mehul Gjar. "Can ED Physician Interpret NCCT Brain Reliably in Head Injury Victims's Emergency Management?". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 08, January 26; Page: 1306-1311, DOI: 10.14260/jemds/2015/183

ABSTRACT: INTRODUCTION: The use of Non-contrast CT (NCCT) Brain is a frequent radiological study and often becoming part of the screening tools in the emergency departments (EDs) for traumatic complaints. **AIMS AND OBJECTIVES:** This study aimed to see whether ED Resident with 1 year of experience in casualty with no formal training in radiology working in the emergency department could interpret CT scans performed for trauma with adequate sensitivity and specificity to allow safe discharge. **STUDY DESIGN:** This was a Cross Sectional Observational study done on 200 patients presented to Emergency Department. CT scan (brain) done for head injury patients initial interpretation done by ED resident. The radiologist's interpretation was considered as reference for comparison. **RESULTS:** During the four months period, 200 patients required NCCT Brain for trauma were enrolled in our study. Emergency physician could diagnosis EDH, SDH and SAH with 100 % specificity; and with 85.7%, 87%, 82% sensitivity respectively. Midline shift on scan could be diagnosed with 200 % sensitivity and specificity by EM physician. However in case of hemorrhagic contusion (particularly in the frontal lobe), the sensitivity (92%) and specificity (87%) was slightly lower. Overall accuracy was 91.4966 %. The sensitivity for calling the scan positive or negative irrespective of differential diagnosis was 80%, and with specificity of 97.4%. If we exclude facial bone fractures, his sensitivity was still higher (92%) with higher specificity (98 %.) **CONCLUSION:** This study concludes, emergency physician can very well manage patients of head injury without need of radiologist for NCCT Brain interpretation and plan for conservative versus operative management in trauma victims in remote trauma centers. However, still sensitivity can be increased by formal training and more rotations in radiology department while doing their residency.

KEYWORDS: ED, Head Injury, NCCT brain.

INTRODUCTION: The use of Non-contrast CT (NCCT) Brain is a frequent radiological study and often becoming part of the screening tools in the emergency departments (EDs) for neurologic and traumatic complaints. It is required both in critical and non-critical cases. In traumas and other critical cases, time is the essence and the emergency physician (EP) must act quickly according to his ordered and related investigations.

The workload of radiology departments has increased in recent years and the availability of trained radiologists is not always sufficient to meet this demand. As emergency medicine is a new emerging specialty in India, they are the first attending doctors in most trauma patients. As per MCI requirement also, CT scan brain plain should be available near the ED. Also as per trauma center classification, availability of CT scan brain (Plain) is a primary requirement.

Hence more and more CT scans brain plain are required to be interpreted at the time of emergencies. Till now the emergency physician had to depend upon the radiologists for diagnosing the images that are already taken by the available CT technician. Although the radiologist are

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available in the major tertiary care hospitals, they not easily available in the smaller setup. ED physicians are generally available. Hence, if they are competent enough to diagnose such cases, their dependence on the radiologist can be decreased. This will save time and patient can be treated or to shifted to better facility without delay. This will decrease the need for mobilizing radiologist or neuro-surgeon, which might be far away or doing some other important task.

This study aimed to see whether ED Resident with 1 year of experience in casualty with no formal training in radiology working in the emergency department could interpret CT scans performed for trauma with adequate sensitivity and specificity to allow safe discharge. The secondary aim was to describe which abnormalities, if any, were missed.

OBJECTIVES: To know the competency of EM physician to read common trauma related CT scan brain plan in term of sensitivity and specificity.

STUDY DESIGN: This was a Cross Sectional Observational study conducted from September to December 2013 in a teaching hospital. CT scan (Brain) done for head injury patients and then initial interpretation done by ED resident. The radiologist's interpretation was considered as reference for comparison.

We have recorded time of presentation, radiologist diagnosis and our diagnosis in the prescribed format. Analysed with the help of EPI 2002.

Data recorded for EDH, SDH, SAH, hemorrhagic contusion, midline shift and skull bone fracture.

INCLUSION CRITERIA: All the head injury patient irrespective of age, sex, time of presentation, or with any GCS (Glasgow coma scale) at the time of presentation.

RESULT: During the four months period, 200 patients required NCCT Brain for trauma were enrolled in our study. Most patients were between age 10 to 60 years (Median age 30), male to female ratio in this cohort was 1: 1.09. Most patients (91%) had history of road traffic accidents, only few had history of fall from height.

NCCT scan Brain differential diagnosis	Sensitivity	Specificity
EDH	85.7%	100%
SDH	87%	100%
SAH	82%	100%
HC	92%	87%
MS	100%	100%
FRACTURE (facial and skull bones combined)	66%	70%
Over all interpretation (positive or negative scan only)	80%	97.42%
Over all interpretation (excluding facial bone fractures)	92%	98%

Table 1: Showing sensitivity and specificity of interpretation done by EM physician in various subsets of NCCT brain lesions

Emergency physician can diagnosis EDH, SDH and SAH with 100 % specificity; with 85.7%, 87%, 82% sensitivity respectively. That means Emergency physician would not wrongly diagnosis such cases on CT scan brain, however they may miss few small lesions.

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Midline shift on scan could be diagnosed with 100 % sensitivity and specificity by EM physician. However in case of hemorrhagic contusion (particularly in the frontal lobe) the sensitivity (92%) and specificity (87%) was slightly lower (Graph 1).

Overall accuracy was 91.4966 %. The sensitivity for calling the scan positive or negative, irrespective of differential diagnosis was 80% and specificity was 97.4%. That means in 97.4 out of 100 interpretations, he could correctly screen out the negative scans. But still specificity of diagnosing scan was 80%. That means he can interpret positive or negative scan in 80 out of 100 scans. That means he still can miss 20 % of the positive scans. However, this was because of poor interpretation of facial and skull bone fractures (table 1). But however to diagnose facial and skull bone fractures may not be relevant in emergency management of the patient, if we exclude fractures, that his sensitivity was 92% with higher specificity (98%).

DISCUSSION: Kraus et al define brain injury as "physician-diagnosed physical damage from acute mechanical energy exchange resulting in concussion, hemorrhage, contusion, or laceration of the brain.¹

Traumatic brain injury (TBI) is a common and potentially devastating clinical problem. Because prompt proper management of TBI sequelae can significantly alter the clinical course especially within 48 h of the injury, neuroimaging techniques have become an important part of the diagnostic work up of such patients.

The proper interpretation of abnormalities in NCCT brain by the ED physician in the emergency department of any referral hospital will play an important role in providing appropriate timely care to the traumatic patients.² This study has assessed the accuracy of EP in assessing the NCCT brain abnormalities when compared with the radiology reports.

Many studies have assessed the competence of non-radiologists to report various imaging investigations. These have usually been undertaken to determine whether it may be appropriate for such individuals to provisionally report radiological studies and therefore help to meet the increasing demand for on-call radiology. For instance, several studies have evaluated the discrepancy rates between radiologists and emergency doctors in reporting trauma radiographs.^{3,4,5}

However, there are very few studies which have addressed the comparison of different subsets of diagnosis (i.e. EDH, SDH, SAH, HC and raised intracranial tension etc.) in trauma cases made by ED physicians and radiologist.

In this study we wanted to see the competency of ED physician for different subsets of diagnosis. These subsets of victims are important to be diagnosed for better management of trauma victims.

The results of this study demonstrate that EP physicians were able to interpret NCCT brain with a high degree of accuracy of 90.5% when compared with radiologists.

In our study sensitivity and specificity for diagnosis of midline shift is 100%. It means ED physician is able to diagnose fatal complication of all head injuries. So he can plan the management, even in absence of radiologist. He can triage that patient is taken in for operation or can be managed conservatively.

Brain contusions commonly are identified in patients with traumatic brain injury (TBI) and represent regions of primary neuronal and vascular injury.^[6] Contusions are formed in 2 ways: direct trauma and acceleration/deceleration injury. Brain contusions are relatively common, occurring in up to 43% of patients with blunt trauma and frequently as coup or contrecoup injuries in

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deceleration or acceleration trauma.⁷ On non-contrast CT, contusions appear as low attenuation if hemorrhage is absent and mixed or high attenuation if hemorrhage is present.

For hemorrhagic contusion sensitivity for ED physician diagnosis is high (92%), but specificity is slightly low (87 %) in our study. In this study certain EDH mostly at frontal region were falsely interpreted as hemorrhagic contusion, so false positive is more but this doesn't affect the patient's initial treatment because such patients are anyways kept in observation.

Subarachnoid hemorrhages are more common in children and the elderly, who have relatively large subarachnoid spaces, and occur in up to 11% of TBI patients. It is often seen adjacent to a contusion. CT is superior to conventional MRI sequences in detecting acute SAH because the blood in acute SAH has a low hematocrit and low deoxyhemoglobin, which makes it appear similar to brain parenchyma on T1- and T2-weighted spin echo images. However, FLAIR sequences may find small acute or subacute SAH missed by CT and conventional MRI.⁸

In our study ED physician could diagnose SAH with high specificity (100%), so no case of SAH was falsely reported. However sensitivity was 82 %.

Subdural hematomas are also relatively common (10–20% of patients with head trauma) and are associated with high mortality (50–85%).⁹ In our study ED physician could diagnose SDH and EDH with high specificity (100%), so no cases were falsely reported. Sensitivity was 87.5 and 85 % respectively. That means EM physician may miss few small SDH and EDH as compared to the radiologist. This may be because radiologist can enlarge the view on computer console and zoom-in on the area of interest.

In view of fracture of facial and skull bone, ED physicians are slightly weak according to this study but this doesn't effect much in initial treatment because most isolated fractures are treated conservatively. That mean overall management cannot change overnight because of such limitation.

Overall accuracy was 91.4966 %. The sensitivity was calling the scan positive or negative irrespective of differential diagnosis was 80%, and specificity was 97.4%. That means he still can miss 9 % of the positive scans. However, this was because of poor interpretation of facial and skull bone fractures (table 1). But however to diagnose facial and skull bone fractures may not be relevant in emergency management of the patient. If we exclude facial and skull bone fractures, that his sensitivity was 92% with higher specificity (98%.)

This study concludes, emergency physician can very well manage patients of head injury without need of radiologist for NCCT Brain interpretation and plan for conservative versus operative management in trauma victims in remote trauma centers. However, still sensitivity can be increased by formal training and more rotations in radiology department while doing their residency.

Limitations of the study were: EPs are aware of the clinical scenario of the case, while radiologist could see the images on the computer console, where they could enlarge and focus on the area of interest and that can increase the accuracy of diagnosis by them. Study should be done on a large scale taking care of the above points.

CONCLUSION: Emergency Physicians are moderately accurate in interpreting NCCT Brain in comparison to radiology specialists. Further studies are required to determine the most cost-effective method of minimizing consequential misinterpretations. NCCT Brain interpretations teaching sessions may further improve the EPs accuracy. Establishment of an appropriate level of accuracy is required as a benchmark.

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Figure 1: Graphic presentation of the sensitivity and specificity of interpretation done by EM physician in various subsets of NCCT brain lesions.

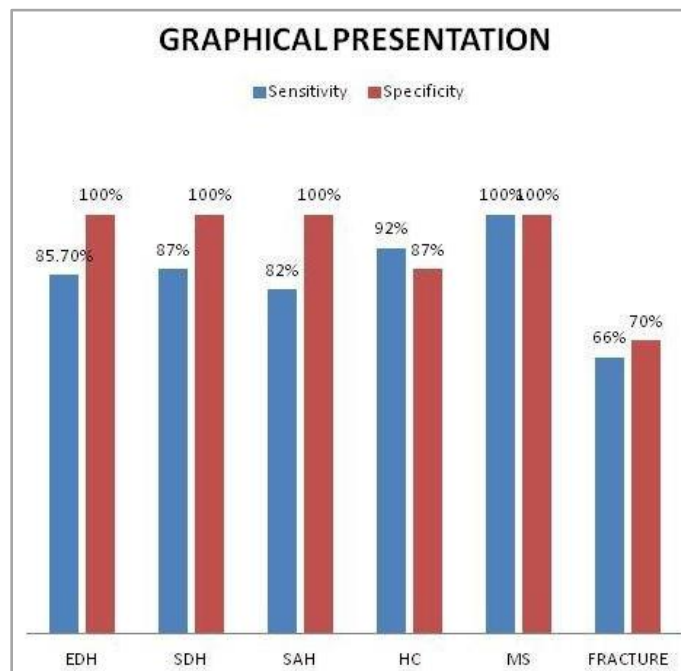


Fig. 1

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