

## **Independent emergency physician decision on patients undergoing Cranial computed tomography, a prospective cohort study**

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## Aims and objectives

"The provision of proper opportune care to patients visiting the emergency department is greatly dependent on the appropriate interpretation of requested radiographs by the emergency physician. Several studies have been conducted to evaluate the capabilities of non-radiologist to interpret different imaging modalities. These were undertaken to decide whether it may be proper for them to independently report radiological studies and thus help to meet the rising need for on-call radiology"

"In this study, we ask whether Emergency department staffs are competent and could make a safe independent decision upon their own interpretation of Brain computed tomography image."

## Methods and materials

"A prospective chart Audit of patients' undergone Brain Computed Tomography during the months April- November 2014 was done. Six hundred and fifty five charts were analyzed. The population was mixed of Adults and Children. Radiology reports were dictated by a certified radiology consultant or an assistant consultant. Data were entered and analyzed using statistical software SPSS version 21.0. By considering both, radiologist report and Emergency physician impression, inter-rater reliability was assessed by calculating the sensitivity, specificity, concordance and Kappa coefficient using the Radiologist opinion as the reference standard."

"Kappa value of  $>0.75$  considered as excellent agreement,  $0.40-0.75$  intermediate agreement, and  $<0.40$  poor agreement. A p-value of  $<0.05$  and 95% confidence intervals were used to indicate the statistical significance and prevision of the estimates."

## Results

"

Six hundred and fifty five Brain Computed Tomography images were interpreted. Five hundreds and ninety eight (91.3%) case were concordant with the radiologist report, whereas 57 (8.7%) were discordant due to missed lesion by the emergency physician. 17.5 % of those missed lesions were fatal (e.g. Acute ischemia, Acute hemorrhage, Multiple myeloma, pituitary mass). The remaining 82.5% were non-fatal lesions (e.g.

subgaleal hematoma, small vessel disease). Fatal lesions are those that will affect the overnight management and need subspecialty consultation, whereas the nonfatal ones are the cases that would not affect the management plan of the patient. However, patients with missed fatal lesions, were followed up after the release of the radiologist report. Patients with subgaleal hematoma, although the finding was not reported by the emergency physician impression, it was managed because it was apparent clinically."

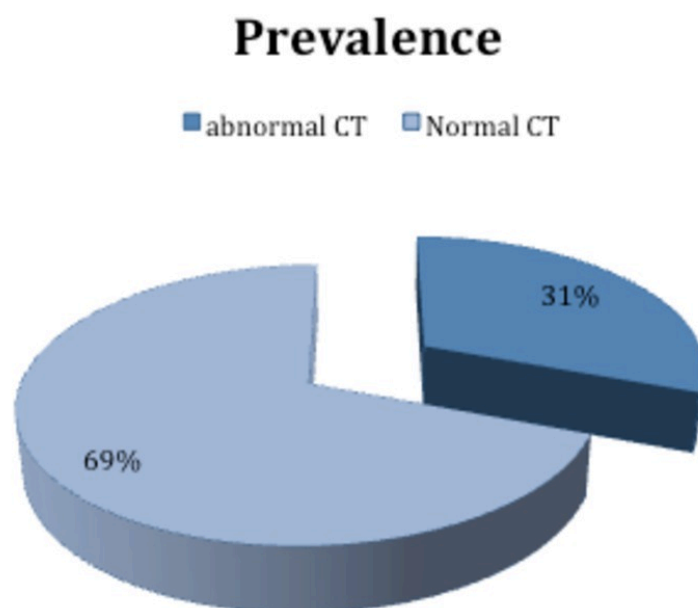
"The study results demonstrate that agreement between emergency physician and radiologist specialist is excellent with a kappa value of 0.778. The observed agreement of brain CT by emergency physicians as a diagnostic test compared with a reference standard of a radiologist report and other reliability measures obtained were:

**Images for this section:**

|                                  |                           |
|----------------------------------|---------------------------|
| <b>Accuracy</b>                  | <b>91.3%</b>              |
| <b>Agreement</b>                 | 77.8%                     |
| <b>Sensitivity</b>               | 71.6% (95%CI: 64.7-77.6)  |
| <b>Specificity</b>               | 100% (95%CI: 98-100)      |
| <b>Positive Predictive Value</b> | 100%(95% CI: 96.7-100)    |
| <b>Negative Predictive Value</b> | 88.8% (95% CI: 85.7-91.3) |

**Fig. 1**

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**Fig. 3**

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### Radiology Report

| ER interpretation | <u>Normal</u> | <u>Abnormal</u> | <u>Total</u> |
|-------------------|---------------|-----------------|--------------|
| <u>Normal</u>     | 454           | 57              | 511          |
| <u>Abnormal</u>   | 0             | 144             | 144          |
| <u>Total</u>      | 454           | 201             | 655          |

**Fig. 2**

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## Conclusion

"

A couple of studies have scrutinized the disagreement rates between radiologist and emergency doctors in interpreting trauma radiographs, revealing misreporting rates in the region of 1-3% . [1,2,3] With regards to cranial CT, previous studies have evaluated the clinically significant non-concordance rates between the provisional reports of emergency doctors and radiologist showing these to be 13.3-24 % [4,5] This study has audited the precision of emergency physician independent decision about Brain CT in comparison with radiology reports. The results of this study demonstrate that emergency doctors were able to read Brain CT with a high degree of precision of 91.3 % when compared to radiologist. A negative predictive value of 88.8% was calculated with a prevalence of abnormal brain CT scan was 30.6% and a positive predictive value of 100% with prevalence of normal brain CT was 69.3%. The False negative rate of our emergency physicians was 8.7%. Different methodologies were used in other studies have yielded variable results. Mucci et al examined 100 consecutive scans and found agreement of 86.6 % without any finding that would change the overnight management. <sup>6</sup> In 2003, a similar study conducted in Australia found that 14.8 % scans were misinterpreted, with 41.1 % of these had potential for acute consequence. <sup>7</sup> Anas Khan et al conducted a prospective cohort study reviewing 241 cases, and concluded that EPs interpretation accuracy is 90.5 %.<sup>8</sup> In 2007, Khoo and duffy reviewed a 287 scans, 11.1 % was the false negative rate. <sup>9</sup> However, the False negative rates were reported to range from 1% to 11% in different several studies <sup>(10-14)</sup>"

" Finally, we conclude that emergency physicians at King Khalid University Hospital are excellently accurate at Brain CT interpretation, yet there are still small percentage of missed lesions that could lead to fatal consequences. However this could be overcome with more emphasis on teaching session for emergency physicians so that they can improve their skills and ability in interpreting Brain CT images.

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