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Utilization of an Electronic Best Practice Advisory Decreases Brain Computed Tomography in an Academic Emergency Department Setting

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Introduction

More than 1.3 million people seek emergency care following a mild traumatic brain injury (MTBI) each year. While most MTBI patients are safely discharged, a small proportion experience serious intracranial processes. The wide availability of computed tomography (CT) has generated a dramatic increase in the number of CTs performed to identify those patients with clinically important traumatic brain injury (ciTBI), generating expense and radiation exposure risks for patients. To address unwarranted variation in practice, we implemented an electronic best practice advisory (eBPA) based upon a validated clinical prediction rule that appears when emergency department (ED) clinicians order CT following MTBI.

The Canadian Head CT Rule (CHCTR)

High Risk (need 1 to scan)
- Failure to reach GCS 15 within 2 hours
- Open or basilar skull fracture
- Vomiting > 1 time
- Age > 65

Moderate Risk (need 1 to scan)
- Amnesia > 30 minutes before injury
- "High risk mechanism" – auto vs pedestrian, MVC ejection, fall > 3 feet / 5 stairs

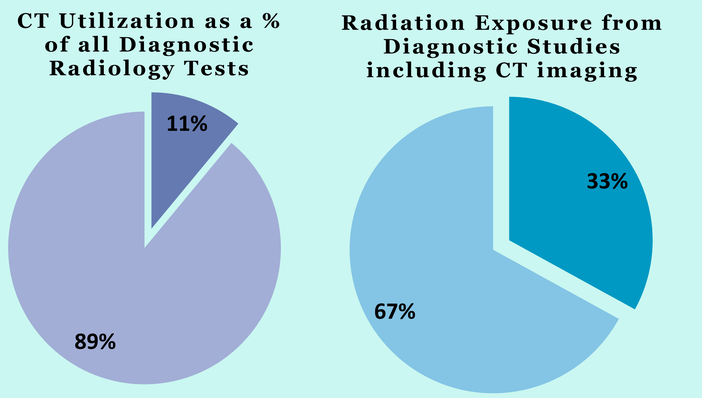

Figure 2. Percentage of CT scans used as a total of all radiological testing (left) and patient's exposure to radiation due to CT scan (right).

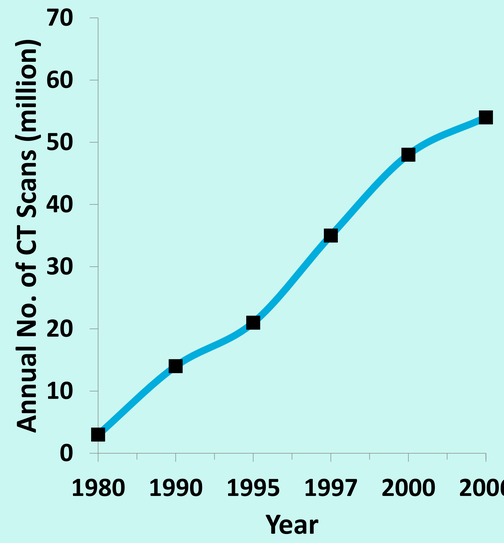

Figure 4. Estimated Number of CT Scans Performed Annually in the United States.

	Positive Scan	Negative Scan	
Criteria Met	65	1027	PPV = 6.0%
Criteria Not Met	17	118	
	79.3%	10.3%	
	Sensitivity	Specificity	

	Positive Scan	Negative Scan	
Criteria Met	81	1027	PPV = 7.3%
Criteria Not Met	1*	118	
	98.8%	10.3%	
	Sensitivity	Specificity	

*9% of the "criteria not met" was actually met and was due to provider error

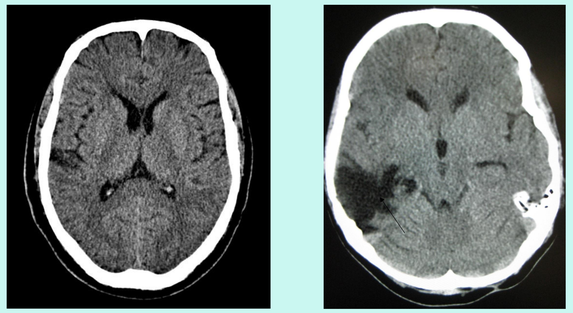

Figure 1. Representative Images for a normal brain CT scan (left) and a subarachnoid hemorrhage (right).

Results

Decrease in Head CT scan Utilization for MTBI
- Number of scans decreased by 6% relative to the number of patients seen
- 95% CI: 5-8%, χ^2=5.6243, df=2, p<0.001 with 1,897 CTs ordered pre-BPA and 2,419 CTs ordered during the post-BPA period.

Increase in identification of ciTBIs
- Proportion of CTs identifying ciTBI increased by 9%
- (95% CI: 8-13%, χ^2=, df=2, p<0.03) with 121/1773 and 131/2285 CTs

Loop-hole in eBPA through CHCTR
- During the post-BPA period, one patient (0.1%) with an unusual presentation failed to meet the BPA screening criteria and went on to have a CT positive for a ciTBI.

Conclusion

In this cohort, implementation of an evidence-based BPA decreased the overall number of post-MTBI CTs ordered while increasing the proportion of CTs identifying ciTBI. Use of an electronic BPA is an effective means of decreasing variation in CT ordering while providing evidence-based clinical decision support at the point of care.