Introduction of the Canadian CT Head Rule Reduces CT Scan Use in Minor Head Injury

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Abstract

Background: The burden of traumatic brain injury (TBI) is rising in developing countries. Minor head injuries accounts for majority of non-fatal head injury and is associated with significant resource use. The utility of the CT scan in cases of mild head injury is undetermined although a big proportion of our patients are offered the investigation. We hypothesized that the introduction of the Canadian CT head rule (CCTHR) will reduce the utilization rate. **Methods**: Eighty four eligible patients diagnosed with minor head injury were recruited at the Accident and Emergency Department. The proportion of CT scan orders before (Group I-42 patients) and after (Group II- 42 patients) the introduction of the CCTHR was determined. Treatment in Group I patients followed the primary physician orders while group II patients were offered CT scans only if they presented with 'high risk' features of the CCTHR. Group II patients with 'moderate' risk factors were admitted for observation or discharged as appropriate to the rule. **Results**: The proportion of CT scans ordered in Group I was 95.2% while that in Group II was 21.4%. The proportion of patients with moderate risk factors Group I was 90.5%, representing the proportion of patients who did not require a CT scan. None of the patients required neurosurgical intervention and all had good recovery on follow up. **Conclusion**: The proportion of mild head injury patients requiring a CT scan at AKUH is 21.4%. Limiting CT scans to only this group was not associated with adverse outcomes. It is the recommended that CT scan rates for mild head injury be capped at 25% to save time and money currently being expended.

Key Words: Canadian CT Head Rule, Minor Head Injury, Outcomes

Introduction

Minor head injuries predominate in cases of Traumatic Brain Injury (TBI) whose burden is increasing in the developing countries due to increasing road traffic accident incidents (1,2). Defined by witnessed loss of consciousness, definite amnesia or witnessed disorientation in a patient with a GCS score of 13–15 who has suffered a traumatic event, the evaluation of minor head injury using Computerized Axial Tomography Scan of the Head (CT-head) has remained controversial.(1,3). CT–head is expensive, time consuming, strenuous to human resource available and associated with significant radiation exposure. It should therefore only be used if the indication is right.

The use of clinical assessment alone to guide whether and when to order a CT scan for patients with mild head injury is challenging. Many patients get unnecessarily scanned. The Canadian CT–Head rule (CCTHR) is a clinical decision tool designed to support the decision to order CT. In the rule five "high risk factors" and two "medium risk" criteria are identified and applied to make the decision (4-5). The tool improves the general management of minor head injury and has been shown to be accurate and sensitive for conditions requiring neurosurgical intervention (1,6).

The Aga Khan University hospital is a tertiary care private hospital in Kenya's capital, Nairobi. The care of trauma patients in the city is not systemized. The introduction of a decision making rule has a large potential to influence current practice but the applicability of such rules in a setting without a pre-hospital system is unknown. At our hospital, majority of patients with minor head injuries are offered a CT-scans of the head. The present study was designed to determine the impact of introducing the Canadian CT-Head Rule in a tertiary teaching hospital in Kenya on the number of CT–scans performed and applicability of its predictor variables.

Methods

Design: This was a before and after cross-sectional study of head injury patients reviewed between September 2012 and February 2013

Setting: The Accident and Emergency department of

the Aga Khan University hospital, a 300-bed private facility in the city of Nairobi. It also serves as the teaching hospital for the Aga Khan University and referral hospital for the East African region.

Patients and Methods: Patients presenting with head injury at the accident and emergency department were consecutively recruited. In the before (Group I) study, consenting patients were interviewed and treated according to prevailing standards. The data collection form used here only indicated the constituent risk factors of the CCHR did not instruct on decisions to be taken. In the after (Group II) study questionnaires with details of the risk factor criteria of the CCTHR were used by house officers at the A & E to interview eligible patients. The forms clearly outlined the high risk factors from the moderate risk factors and indicated instructions on when to do a CT scan, admit for observation or discharge the patient. Mandatory CT scans were mandatory for any one of the following five high risk factors in the CCTHR (i) GCS score less than 15 at 2h after injury or do not improve to a GCS level of 15 within two hours of the injury (ii) suspected open or depressed skull fracture (iii) any sign of basal skull fracture (iv) vomiting two episodes and (v) age 65 years.

Patients with either of the two moderate risk characteristics (amnesia less than 30minutes and dangerous mechanism of injury) could have clinically important lesions that would be seen on CT but were not at risk for needing neurological intervention. According to the study procedures this group was not to have a CT-scan done and planned for neuro – observation or discharged by the attending physician / surgeon. All patients were then followed up via telephone at 48 hours and in one week at the neurosurgery outpatient clinic. Contacts for patients who fell in this group were recorded to aid in the follow up of these patients. Patients who could not be reached were excluded from the study but continued with their management through the neurosurgery outpatient clinic.

Data quality and ethical issues: Training on the questionnaire was undertaken after which they were tested before commencement of the Group II study. Filled questionnaires were reviewed by the first author for accuracy, consistency and clarification of items as necessary. No information on the hypothesis being tested was disclosed to the interviewer. Written informed consent was sought from all the eligible patients before full enrolment into the study. Each enrolled study participant was given a study number which identified them for the remainder of the study. The proportion of patients with moderate risk factors and got a CT scan were assessed for clinically important brain injury. All patients encountered were assessed for any need for neurosurgical intervention and findings compared with that documented in literature. Outcomes of patients were documented on follow up using the Glasgow Outcome Score.

Data analysis: Data collected through the questionnaires were entered into a central database using Microsoft Access and further coded through the Statistical Package for Social Scientists 20.0 (SPSS). The Students t-test was used to compare age in the 'before' and after 'groups' while Chi-square test was used to compare the proportion of CT scans ordered in the two groups.

Results

The average age of patients was 34.8 + 10.6 and 34 + 10.6 in Group I and Group II respectively (p = 0.56). Gender proportions were also similar in favour of males in both groups (Group I males 92.8%; Group II male 97.6%). The proportion of patients who underwent CT scans in Group I was 95.2%. The rate was reduced to 21.4% after the introduction of the CT head rule, a reduction 73.8% (Table 1). The proportion of patients with moderate risk factors in Group I who were scanned was 90.5%. The CT scan findings were normal. No patient with moderate risk factors in Group II was scanned. No patient recruited in this study required a neurosurgical intervention and all had Glasgow Outcome Score of 5 on follow-up.

Table 1: Proportion of CT scan ordered before and after introduction of CCTSR

		CT scan done No (%)	CT scan not done No (%)	P value
Period of study	Before	40 (95.2)	2 (4.8%)	< 0.001
	After	9 (21.4)	33 (78.6%)	

Discussion

Minor head trauma is a common entity, seen in most emergency departments, yet there are varying recommendations on the care of these patients including the indication for head CT scan (7). The approach of ordering CT scan for all patients is time consuming and costly yet the clinical management almost always remains unchanged, of these patients is almost never changed by the result of the CT-scan. The search for valid guide has been long. Reinus et al proposed the use of four variables namely an abnormal neurological examination, intoxication, history of amnesia or focal neurologic deficit (8). These reduce CT utilization and detect patients with

an abnormal CT–scan and those requiring operative intervention with a sensitivity of 90% specificity of 60% (8). The current study used five risk criteria of the Canadian CT head rule to guide CT scan orders and demonstrated reduced the utilization rate by sixty three percentage points. The CT scan ordering rates were reduced without missing any intracranial hematomas that may have required neurosurgical intervention. Our findings are consistent with those of creators of the rule (13) and others (11).

Most patients in Group I who underwent CT scan of the head had moderate risk factors. The CT scan findings of these patients were all normal. As per the study protocol, this group of patients would not have had a CT scan done to save on time spent for diagnosis and costs incurred by the patient and the institution in terms of CT scan costs and human resource use.

Livingstone and Lavery have recommended that patients with no neurological findings and a negative CT scan can be safely discharged from the emergency department (14). Our results suggest that introducing the use of the decision rule to routine care of the injured will not only inform selective use of CT scans in busy A & E unit but also help with decision to discharge from A & E (13). Follow up results at 48 hours and one week in this study supports this line of management.

This study was sufficiently powered to detect the primary outcome. The impact of the CCHR may need to be established at other Accident and Emergency Departments due to the wide variation of practice in different hospitals. Training of medical officers is essential prior to implementation of the CCHR in different hospitals across the country. On the basis of this study the introduction of the Canadian CT Scan Head Rule reduces CT scan orders by more than 50% and correctly predicts non-intervention. We conclude that the head CT scan can be safely omitted in mild head injury patients with moderate risk factors using the CCTHR criteria.

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