



Head Computed Tomography Scan in Isolated Traumatic Brain Injury in a Low-Income Country

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■ **BACKGROUND:** Head computed tomography scan (HCTS) is the cornerstone of the management of traumatic brain injury (TBI). The impact of performing a HCTS in TBI has been scarcely investigated in low-income countries (LICs). Furthermore, the cost of a HCTS is a burden for family finances.

■ **METHODS:** A prospective observational study was conducted in Burkina Faso. All consecutive patients with isolated TBI needing a HCTS were included. Result and impact of HCTS were evaluated.

■ **RESULTS:** There were 183 patients prescribed a HCTS for an isolated TBI. Mild, moderate, and severe TBIs represented 55%, 31%, and 14% of the cases, respectively. In 72 patients, HCTS was not performed because of economic barrier. Among the 110 HCTSs performed, there were intracranial lesions in 81 (74%) patients. Among the 110 performed HCTS, 34 (31% [22.3%–39.5%]) HCTSs altered the management of TBI, with 16 (15%) cases of surgical indications, and 20 (18%) cases of modification of the medical treatment. In patients without neurologic signs, the rate of alteration of management was 28%. The realization of the HCTSs was associated with the presence of neurologic signs and income level. In-hospital mortality was 11% (n = 21). Among the 162 patients discharged alive from the hospital, 27 (20%) were discharged with a severe disability state (Glasgow Outcome Scale score ≤3). The rate of return to work was 77%.

■ **CONCLUSIONS:** No modification of guidelines can be advocated from this study. However, given the financial burden on family of performing HCTS, research may identify criteria allowing for avoiding HCTS. Guidelines specific to LICs are needed to get closer to the best interest of patients.

INTRODUCTION

Head computed tomography scan (HCTS) is the cornerstone for decision-making in the management of moderate and severe traumatic brain injury (TBI).¹ Even in patients with mild TBI, it may be advocated to perform a HCTS according to specific clinical criterion varying between available guidelines.^{2,3} Most medical guidelines are established from studies conducted in the setting of health care systems of high-income countries.⁴ Despite variations in the adherence to these guidelines,³ it is advocated for worldwide physicians to follow these rules. There is no evidence that physicians could deviate from these rules in the setting of low-income countries (LICs). On the other hand, like in other medicine areas, only a few studies have evaluated the impact of applying the guidelines in those countries.⁴⁻⁶ The neuroimaging strategy is necessary for surgical procedure decisions, indications of admission for medical supervision or specific medical therapy (e.g., secondary systemic

Key words

- Computed tomography scan
- Evaluation
- Traumatic brain injury

Abbreviations and Acronyms

- CI:** Confidence interval
CT: Computed tomography
ED: Emergency department
GOS: Glasgow Outcome Scale
HCTS: Head computed tomography scan
LIC: Low-income country
TBI: Traumatic brain injury

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insults to the brain prevention¹), decision of discharge to home, and functional prognosis of TBI.⁷ Some African studies have well assessed the specific role of HCTSs in isolated TBI, but with no focus on its socioeconomic impact.⁸ An attempt has been made to adapt the guidelines for neuroimaging decision-making to a low-resource environment.⁹

In most developing countries, the objective of availability over 24 hours of specialized teams dedicated to the management of TBI is not achieved.¹⁰ Neurosurgical intensive care has not emerged because of lack of financial or human resources. Therefore, the means of prevention of secondary systemic insults to the brain are limited. Indeed, economic issues may make performing an emergent HCTS uneasy. Burkina Faso is one of the numerous countries with an out of the pocket payment model of health care.^{11,12} Patients or their relatives have to pay for care, including imaging testing. The cost of a HCTS without contrast is close to the mean monthly income in some countries. Performing a nonuseful HCTS may preclude further useful treatments and seriously impact the financial stability of families.¹¹ Nevertheless, improving the management of TBI aims to limit the social and economic impact of the trauma, by improving the functional outcome and accelerating return to work.¹³ Decreasing the level of dependence is a challenging issue, especially in LICs where young male adults are most often involved in motor vehicle accidents, and may switch from a source of income to a burden on family finances.¹⁴

Therefore, understanding the medical impact and the usefulness of HCTSs for the decision-making in TBI is of utmost importance. The main objective of the study was to investigate the impact on medical management induced by HCTS findings in patients suffering from isolated TBI, with specific attention to patients with no or low income and patients with only mild TBI. Secondary objectives were to describe the neuroimaging strategy, the economic implications of performing HCTS, the impact of TBI on autonomy scale, and the rate of return to work.

MATERIALS AND METHODS

Study Design and Population

This is an observational prospective study conducted in a tertiary university hospital in Ouagadougou, Burkina Faso. All patients admitted in the emergency department (ED) for isolated TBI with an indication for HCTS are included. Patients or relatives are informed of data collection. The study was approved by the local ethics committee, *Comité d'Ethique pour la Recherche en Santé* (no. 2015-10-05).

Protocol Management of TBI

All patients are first managed in the ED by ED physicians. The first clinical assessment allows an early triage and the prescription of HCTS after protocol, in accordance with the guidelines of the American College of Emergency Physicians and the Centers for Disease Control and Prevention.^{2,15}

Neuroimaging is performed as soon as patients or relatives can afford it. CT scan is interpreted by a neurosurgeon and a radiologist. Findings on HCTSs help decision-making in the following areas: neurosurgery; specific medical therapy: osmotherapy or antiepileptic therapy or antibiotics; patient orientation: admission

to intensive care unit, admission to wards, supervision in ED, or discharge to home according to guidelines for management of mild TBI; and functional prognosis.^{1,2,7}

HCTS findings are classified according the severity of lesions. Indications for surgery are decided by the attending neurosurgeon in case of open wound, open skull fracture, hematoma with mass effect, subdural hematoma, or epidural hematoma.¹⁶

Indications for medical supervision comprise all severe or moderate TBI, and mild TBI without criteria required for discharge to home.

Indications for direct discharge home are mild TBI without neurologic worsening and normal CT scan.²

Indications for medical therapy (osmotherapy, antiepileptics, or antibiotics) include neurologic focal signs, including anisocoria, clinical or CT scan signs of cranial hypertension, seizures, pneumocephalus, or open skull fracture.¹ Pain killers are prescribed according to clinical evaluation of analgesia.

Patients with indications for neurosurgery are operated on if surgery can be funded. Patients with indications for medical treatment or supervision without indications for surgery are hospitalized in wards, where medical treatment is prescribed, and neurologic status is assessed every 2 hours. An HCTS is repeated only on demand by the neurosurgeon or in case of clinical worsening.

Discharge from the hospital is considered in stable patients, without evolving condition, with no disability, and with Glasgow Outcome Scale (GOS) score >4.¹⁷ In case of disability (GOS score ≤3), relatives are informed to allow organization of return to home.

All patients have at least 1 posttrauma consultation scheduled at 1 month postdischarge to assess the absence of surgical complications, neurologic status, disability assessment, and return to work. If required, for specific medical reasons, patients are asked to come to the postdischarge visit before the end of the first month.

Technique

In our institution, all trauma HCTSs are performed without contrast, using a 64 multidetector CT scanner with a section thickness of 0.625 mm.

Collection of Data

After informed consent, patients are included in the study. All data are completed and recorded in a dedicated database by an investigator not involved in the management of patients. All recorded data are already routinely collected in the usual TBI assessment form. Patients with low income comprised patients with low and no income, and are defined from occupation and level of income declared by patients or relatives. Similarly, the ability to afford the CT scan is assessed from declarations. In an emergency situation, we do not attempt to confirm or verify this information.

Collected Data. We collected the following information: general characteristics of patients (age, sex, occupation, and level of income), characteristics and mechanism of TBI, neurologic status at admission in ED (amnesia of episode, focal neurologic deficit, anisocoria, Glasgow Coma Scale score, clinical signs of cranial hypertension, and seizures), data related to neuroimaging

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