eNeurologicalSci 2 (2016) 3–7

Contents lists available at ScienceDirect

eNeurologicalSci

journal homepage: http://ees.elsevier.com/ensci/

Computed tomography scanning and stroke mortality in an urban medical unit in Cameroon

Alain Lekoubou [a], Clovis Nkoke [b], Anastase Dudzie [c,d], Andre Pascal Kengne [d,e,*]

[a] Department of Neurology, Medical University of SC, Charleston, USA
[b] Faculty of Medicine and Biomedical Sciences, Department of Internal Medicine, Yaoundé, Cameroon
[c] Douala General Hospital and Buea Faculty of Medicine, Department of Internal Medicine, Douala, Cameroon
[d] Department of Medicine, University of Cape Town, Cape Town, South Africa
[e] South African Medical Research Council of South Africa, Cape Town, South Africa

ARTICLE INFO

Article history:
Received 10 November 2015
Received in revised form 25 December 2015
Accepted 25 January 2016
Available online 26 January 2016

Keywords:
Sub-Saharan Africa
Cameroon
Stroke
Computerized tomography
Mortality

ABSTRACT

Background: Despite the increasing availability of head computerized tomography (CT) in resource-limited settings, it is unclear if brain-imaging-based diagnosis of stroke affects the outcomes in the absence of dedicated structures for acute stroke management.
Objectives: In a major referral hospital in the capital city of Cameroon, we compared in-hospital mortality rates in patients with a WHO-based diagnosis of stroke between participants with and without brain imaging on admission.
Methods: Stroke patients with and without admission brain imaging were compared for demographic characteristics, risk factors, clinical and laboratory characteristic, and in-hospital mortality. Heterogeneities in mortality rates (CT vs. No CT) across major subgroups were investigated via interaction tests, and logistic regressions used to adjust for extraneous factors such as age, sex, year of study, residency, history of diabetes and hypertension, history of stroke, Glasgow coma scale, and delay between stroke symptoms onset and hospital admission.
Results: Of the 1688 participants included in the final analysis, 1048 (62.1%) had brain imaging. The median age of the non-CT vs. CT groups was 65 vs. 62 years (p-value < 0.0001%). The death rate of non-CT vs. CT groups was 27.5% vs. 16.4% ($p < 0.0001$). This difference was mostly similar across major subgroups, and robust to the adjustments for confounders (in spite of substantial attenuation), with excess deaths in those with CT ranging from 65% to 149%.
Conclusion: In this resource-limited environment, the absence of brain imaging on admission was associated with high in-hospital death from stroke, which was only partially explained by delayed hospitalization with severe disease. These results stressed the importance of scaling up acute stroke management in low- and middle-income countries.

1. Introduction

Stroke is a major health issue, representing the second cause of disability and mortality worldwide [1]. The burden of stroke is however unevenly distributed with more than 80% of deaths occurring in low- and middle-income countries [2]. In an effort to align with international standards of stroke care, low- and middle-income countries have been striving to implement pre-hospital care, stroke units, and post-stroke rehabilitation and follow-up, with however limited successes [3]. Acute stroke care seems to be the less developed aspect of stroke care in these settings. Obtaining brain imaging is the next step after a clinical assessment of suspected cases of stroke. In the struggle to align with acute stroke care standards as set up in developed countries, the number of patients initially screened with brain imaging has increased over recent years with CT being the most widely available and affordable imaging modality. While the current trends may herald better care to come, it is unclear if obtaining a head CT in the specific context of limited access and availability of dedicated stroke unit would translate into a better outcome and more specifically a lower mortality. Using data from the largest hospital of the capital city of Cameroon in central Africa over a period of 14 years, we hypothesized that

* Corresponding author at: Medical Research Council of South Africa, P.O. Box 19070, Tygerberg, 7505 Cape Town, South Africa.
E-mail address: andre.kengne@mrc.ac.za (A.P. Kengne).

http://dx.doi.org/10.1016/j.ensci.2016.01.003

among patient with a clinical diagnosis of stroke, mortality is lower in participants who obtained a CT head on admission than in those who did not.

2. Methods

2.1. Study setting

The Yaoundé Central Hospital is the largest hospital in the capital city of Cameroon, with a catchment population of about two million individuals. At the end of the year 2012, the department of medicine of this hospital was staffed with 29 specialist physicians (including three neurologists), working in collaboration with four emergency physicians, two intensivists, three neuro-radiologists and two neurosurgeons, twelve general practitioners, and junior specialist physicians in training. Patients admitted to the units were referred from the emergency department, other departments, outpatients clinics, and other hospitals. For each patient, upon discharge or in the event of in-hospital death, both the initial diagnosis and the final diagnosis were recorded in the registers. Recorded diagnoses were usually expanded to include serious comorbidities. The study was approved by the administrative authorities of the hospital acting as the local ethic committee.

2.2. Recruitments and data collection

Hospital registers were surveyed for the period from January 1999 through December 2012 to identify patients with stroke. The standardized medical record has the advantage of reducing the likelihood of missing data and improving standardization of medical information. Briefly, the standardized medical record includes a section filled by the emergency department nurse and physician that summarize patient's demographic, chief complaints, vital signs, arrival time, brief clinical exam, and disposition. The second section of the standardize medical record which is filled by the resident under the supervision of an attending physician while the patient is on the floor includes a detailed history of the chief complaint, physical examination, summary of significant laboratory, and imaging investigations as well initial and final diagnoses. Final diagnosis as reported in chart is made by the attending physician. Medical records of all patients with a diagnosis of stroke were reviewed. The diagnosis of stroke was retained if patients met the World Health Organization (WHO) definition of stroke and both recurrent and first-in-lifetime strokes were included, supplemented where available by a brain computerized tomography (CT). For each eligible patients, data were recorded on the age, sex, length of stay, place of residency (urban vs. rural), history of stroke, hypertension, current smoking, diabetes mellitus, admission systolic and diastolic blood pressure (BP), level of consciousness, stroke subtype (ischemic vs. hemorrhagic stroke), and vital status upon discharge. Vital status (deceased or alive) is part of the disposition section of the standardized medical records. This information is systematically entered in the medical records at the time of discharge or death by the medical staff and double-checked by the attending physician on service.

We applied the WHO definition of stroke as a rapidly developing clinical sign of focal (or global) disturbance of cerebral function lasting more than 24 h (unless interrupted by death) [4]. When a CT scan was not available, stroke was judged unlikely in the presence of at least two of the following: 1) preceding fever (suggestive of abscess), 2) recent weight loss (suggestive of malignancy or chronic infection), neck rigidity, or blood in the CSF (suggestive of subarachnoid hemorrhage). Hypertension or diabetes was based on documented history, ongoing drug treatments, or a documented previous systolic (and/or diastolic) BP ≥ 140 mm Hg (90 mm Hg) for hypertension or fasting blood glucose > 126 mg/dL. Alcohol consumption and status for smoking were based on recorded history. Length of stay was estimated as the time from admission to the medical department to discharge (death or alive).

2.3. Statistical analysis

Data were analyzed with the use of SAS/STAT® v 9.1 for Windows (SAS Institute Inc., Cary, NC, USA). We have presented the results as counts and percentages, mean and standard deviation (SD), or median and 25th–75th percentiles (Q1–Q3). Differences between participants in the CT group and those in the non-CT group were analyzed via chi-square tests and equivalents (Fisher exact test and likelihood ratio chi-square test) for qualitative variables and via the Student t-test or non-parametric equivalent for quantitative variables. Mortality was compared between CT-group participants and non-CT group of participants overall, and heterogeneities across major subgroups were assessed via interaction tests. Interaction tests are appealing when considering the relationship between an outcome of interest (mortality in our case) and two or more predictors and serve to assess if the simultaneous effect of two or more predictors (status for CT scan and any of the other grouping variables in our case) on the outcome is not additive. Interactions were tested in the current study by constructing logistic regressions models to predict mortality during hospitalization and by having as predictors the main effect of 'status for CT scan,' each of our grouping variable of interest, as well as the cross-product of the later with 'status for CT scan' variable, and the p-value for the effect of this cross-product variable served to indicate whether there was a significant interaction or not. The effects of extraneous factors on the difference in death rates between the non-CT group vs. the CT group was accounted for in logistic regression analyses. Logistic regression does not account for the effect of follow-up time on the outcome occurrence, which in turn can affect the investigation of the outcome–predictor relationship. To confirm the robustness of our findings from logistic regressions, the effect of extraneous factors on the relationship of status for CT scan and mortality was also assessed using accelerated failure time regression models. A p-value of <0.05 was used to characterize statistical significance.

3. Results

3.1. General characteristics

Out of a total of 1688 participants who fulfilled the clinical diagnosis of stroke, 1048 (62.1%) had a CT of the head while 640 (37.9) did not. The overall sample, the CT group, and the non-CT group comprised 49.8%, 51.0%, and 47.8% of female, respectively (p-value = 0.210). Those who did not receive a brain CT were in generally older (median age 65 years vs. 62 years, p-value < 0.0001), had a more prolonged admission (13 days vs. 10 days, p-value < 0.0001), a shorter time from stroke onset to admission (24 h vs. 48 h, p-value < 0.0001), a higher Glasgow coma scale (p-value < 0.0001), and a lower mortality rate in the CT group compared to the non-CT group (Table 1).

3.2. Mortality in participants without CT compared to those with a CT

Of the total 348 deaths (20.6%) recorded during the hospitalization, 172 (cumulative incidence rate 16.4%) occurred in participants who had a brain CT and 176 (cumulative incidence rate 27.5%) in those who did not (p-value < 0.0001). This difference in mortality persisted within pre-specified subgroups except among participants with a history of smoking (p-value = 0.187), those with recurrent stroke (p-value = 0.465), rural participants (p-value = 0.557), and those with a shorter delay from stroke onset to admission (p-value = 0.130). However, compared with mortality pattern (CT vs. No CT) within complementary subgroups, there was no evidence of statistical interaction, with the exception of length of stay (interaction p = 0.03) for which mortality rate (CT vs. No CT) was similar at and above median length of stay (10.9% vs. 12.8%, p = 0.429), but excessively higher below median of stay for the non-CT group (23.0% vs. 39.5%, p < 0.0001) (Table 2).