PRIMARY CARE DIABETES XXX (2016) XXX–XXX

Contents lists available at ScienceDirect

Primary Care Diabetes

journal homepage: http://www.elsevier.com/locate/pcd

Original research

Diagnosed diabetes mellitus and in-hospital stroke mortality in a major sub-Saharan African urban medical unit

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ARTICLE INFO

Article history:
Received 8 January 2016
Received in revised form
26 May 2016
Accepted 16 July 2016
Available online xxx

Keywords:
Sub-Saharan Africa
Cameroon
stroke
Diabetes mellitus
Mortality

ABSTRACT

Background: Estimates from developed countries show that early mortality after stroke is unaffected by diabetes status. Despite the high burden of both conditions in sub-Saharan Africa, data on the association between diabetes status and early mortality are lacking.
Objective: In a major referral hospital in the Capital city of Cameroon, among acute stroke patients diagnosed using the World Health Organization criteria, we compared mortality rates in patents with and without *known* diabetes.
Methods: Stroke patients with and without *known* diabetes were compared for demographic characteristics, risk factors, clinical, radiological, laboratory characteristic, and in-hospital mortality. Heterogeneities in mortality rates across major subgroups were investigated via interaction tests, and logistic regression accelerated failure-time models used to adjust for *confounders*.
Results: Of the 1667 acute stroke patients included, 213 (12.8%) had diabetes mellitus. In general diabetic patients were older (median age 64.0 vs. 62.0 years, $p = 0.0006$), and were more likely to have other stroke risk factors including a higher triglyceride levels on admission (106 vs. 97 mg/dL, $p = 0.044$), a history of stroke (19.7% vs. 13.6%, $p = 0.022$), and a history of hypertension (89.7% vs. 64.8%, $p < 0.0001$). The death rates of diabetic patients and that of non-diabetic patients were similar (22.1% vs. 20.1%. $p = 0.524$). This finding was similar across all pre-specified groups, with no evidence of interaction. Diabetes was unrelated with mortality in adjusted regression models.
Conclusion: Diabetes is frequent among stroke patients in this setting, and often co-exists with other stroke risk factors. In-hospital mortality rate is equally high in diabetic and non-diabetic patients.

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http://dx.doi.org/10.1016/j.pcd.2016.07.008
1751-9918/

Please cite this article in press as: A. Lekoubou, et al., *Diagnosed* diabetes mellitus and in-hospital stroke mortality in a major sub-Saharan African urban medical unit, Prim. Care Diab. (2016), http://dx.doi.org/10.1016/j.pcd.2016.07.008

1. Introduction

Stroke and diabetes are common disorders affecting 33 million and 415 million individuals worldwide respectively [1,2]. Mortality associated with both conditions is high [1,3]. Globally, 6% of deaths are caused by high blood glucose, and stroke accounts for 11.1% of deaths worldwide [1,3]. Stroke is one of the leading complications of diabetes. It is estimated that 12% of strokes are attributable to diabetes [4]. People with diabetes mellitus have more than double the risk of ischemic stroke after correcting for other factors. In a meta-analysis of prospective studies involving 530,083 participants, the reported hazard ratio for ischemic stroke was 2.3 (95% CI 2.0–2.7) in people with vs. those without diabetes [5]. This excess risk is supported by a strong biological plausibility. Patients with diabetes have accelerated atherosclerosis of both small and large vessels [6]. Furthermore, the risk of atrial fibrillation is increased by 40% among diabetic patients [7]. The impact of hyperglycemia on stroke also translates into higher mortality as approximately 20% of diabetics will die from stroke making it one of the leading causes of death in this population [8]. Long term death rate is higher in diabetic patients compared to non-diabetic patients after a stroke [9,10]. However, during the first three months following a stroke event, there are indications that mortality is not affected by diabetes status [10,11]. Despite being one the epicenters of the growing burden of both stroke and diabetes mellitus, little is known on the impact of diabetes on early stroke mortality in sub-Saharan Africa. Using data from the largest academic medical center in Cameroon spanning a 14-year period, we have tested the hypothesis that just as observed in developed countries, diabetes mellitus is not associated with an excess early mortality in stroke patients.

2. Methods

2.1. Study setting

The study setting has been previously described [12]. Briefly, the study was carried out at the Yaoundé Central Hospital in the Capital city of Cameroon; a hospital with a catchment population of about two million individuals. The medical unit of this hospital is the largest nationwide and comprises 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 working under close supervision of senior physicians.

2.2. Recruitments and data collection

Hospital registers were surveyed for the period from January 1999 through December 2012 to identify patients with stroke. January 1999 coincided with the implementation of the standardized medical record in the study setting. Briefly, the standardized medical record includes a section filled by the Emergency department nurse and physician that summarizes patient's demographic, chief complaints, vital signs, arrival time, brief clinical exam and disposition. The second section, 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-ever strokes were included; supplemented where available by a brain computerized tomography (CT). For each eligible patient, 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, hemorrhagic stroke, unclassified) and vital status upon discharge. All patients with stroke for whom diabetes status was known were included in the present analysis.

2.3. Definitions

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) [13]. 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).

Diabetes mellitus status was based on documented history of ongoing drug treatment, Hypertension was based on documented history, ongoing drug treatments, or a documented previous systolic (and/or diastolic) BP $\geq$140 mm Hg (90 mm Hg). Hyperlipidemia was based on documented history, ongoing treatments, or total cholesterol $\geq$200 mg/dL, LDL cholesterol $\geq$100 mg/dL, or HDL-cholesterol <40 for men and <50 for women, and/or triglyceride $\geq$150 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). Mortality data was based on all-cause mortality, in the absence of existing processes to adjudicate the causes of death in the study unit. Death ascertainment was done based on Physician on duty note and death certificate in the medical record

2.4. 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, and median and 25th–75th percentiles. Differences between participants with diabetes and those without diabetes were analyzed via Fisher exact test for qualitative variables and Kruskal–Wallis test for quantitative variables. Mortality was compared between diabetic and non-diabetic subjects overall, and heterogeneities across major subgroups assessed via interaction tests. The effects of *confounders* on the difference in death rates between

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