Urban Versus Rural Egypt: Stroke Risk Factors and Clinical Profile: Cross-Sectional Observational Study

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Background: Egypt is a densely populated country with living habits and health care services that differ from urban to rural regions. We aimed to study how characteristics of stroke vary among these regions. *Methods:* This is a cross-sectional observational study of ischemic stroke, thus hemorrhagic and venous strokes were excluded. A total of 1475 ischemic stroke patients were recruited for analysis from a tertiary hospital in Cairo representing urban area and from a secondary care hospital in Suhag representing rural region. *Results:* Analysis was done for 1143 ischemic stroke patients from urban and 332 from rural area. Onset to door was shorter in urban. Urban patients showed an older age and higher prevalence of hypertension and diabetes (65.9%, 48.6% respectively), while rural patients were characterized by female preponderance (51.5%), more dyslipidemia, smoking 44.6%, stroke in young 20.5%, atrial fibrillation 23.8% % and recurrent stroke 44.3%. Rural cases showed a severer deficit at onset and poorer outcome. *Conclusion:* Vascular risk factors, stroke type, and presentation tend to differ in Egypt according to the geographic distribution whether urban or rural. Studying patterns of such difference may aid in planning specific targeted preventive and therapeutic strategies for stroke in urban and rural Egypt.
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Introduction

Egypt is the most populated country in the Middle East with over 98 million inhabitants. According to Central Agency of Public Mobilization and Statistics around 43% live in urban and 57% live in rural areas.[1] However, there are few demographic stroke studies, mostly obtained through door to door surveys in some governorates. They revealed an overall crude stroke prevalence of 613/10,0000 and crude incidence rate of 202/10,0000.[2] Thus there is a significant for further evaluation of stroke in Egypt regarding risk factors, and demographic differences between urban and rural regions.[3]

The term urban is defined on basis of population density with more than 1000 people per square mile and population of at least 5,0000 together with signs of modernization while rural areas are defined in term of exclusion.[4]

Taking into consideration different living habits and health care plans and services between rural and urbanized communities, studies comparing stroke clinical profile and outcome are needed for adapting suitable medical plans.[5]

The objective of the current study is to compare stroke profile in patients admitted into a tertiary hospital in Cairo the capital of Egypt, as a representative of urban

region to that of patients admitted with stroke in a secondary care hospital in Suhag, that lies about 400 km south to Cairo as a representative of rural region.

Method

Study Design

This is a cross-sectional (observational) study. Approval for conducting this study was obtained from local research ethics committee.

Study Population

A total of 1770 Egyptian patients with acute vascular insults were recruited over a 3-year period (January 2016 to December 2018), from 2 stroke units of Ain Shams University hospitals in Cairo as a representative of urban area, and 498 patients from central hospital of Suhag as a

representative of rural area. Patients enrollment in the study are shown in flow chart (Fig 1).

Statistical Analysis

Statistical analysis was done on a personal commuter using SPSS version 16th version Statistics (SPSS Inc., Chicago). The Kolmogorov-Smirnov goodness of fit test was performed to test the normality of continuous data distribution. Continuous data were presented as mean and SD if normally distributed and as median and range for skewed data, whereas categorical data were presented as frequencies. Regarding bivariate analysis, Student t test was used to compare normally distributed continuous variable with nominal independent variable. Mann-Whitney U test used to compare not normally distributed continuous variable with nominal independent variable and to correlate ordinal dependent variable versus nominal independent variable. The chi-square test was used for
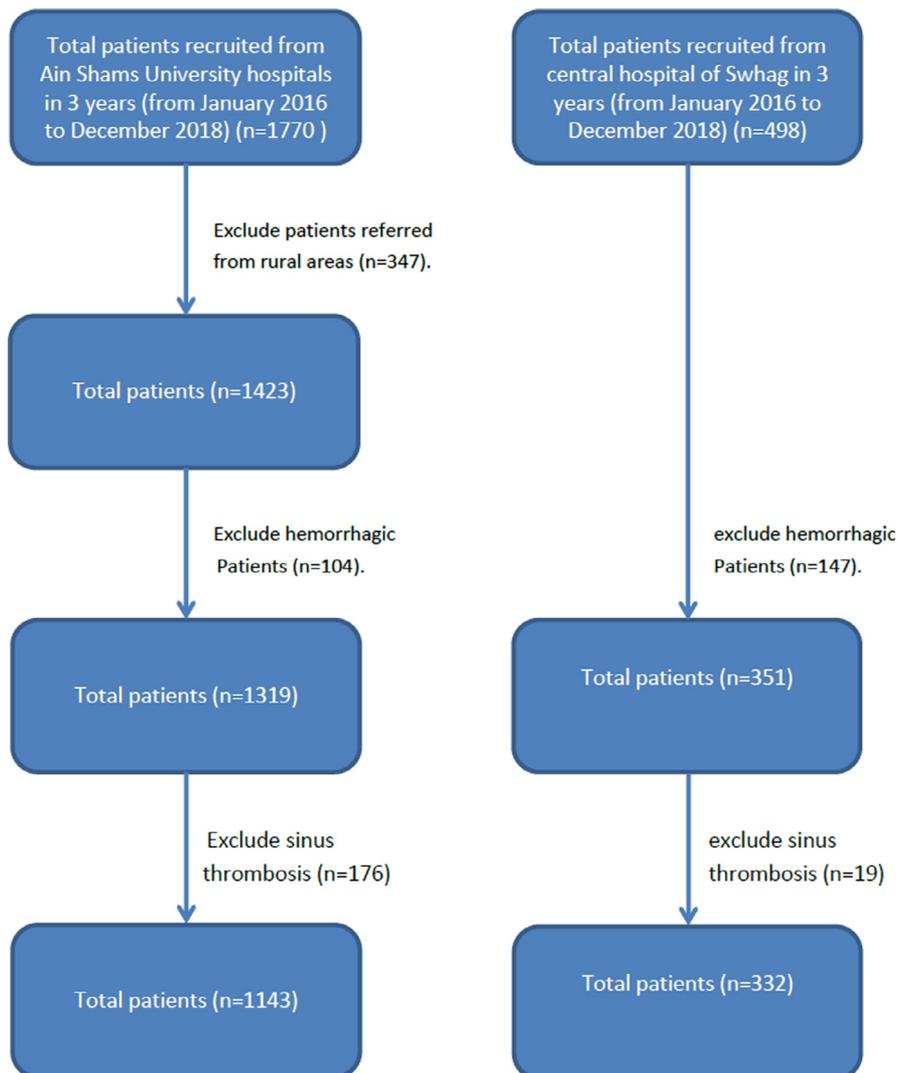

Figure 1. *Recruitment algorithm.*

comparison of nominal data. Fisher's exact test was used if more than 20% of the cells in any crosstabulation had an expected count of less than or equal to 5. *P* value less than .05 was considered statistically significant.

Results

A total of 1475 patients with ischemic stroke were enrolled, 1143 (77.5%) were from urban and 332 patients (22.5%) were from the rural areas.

Comparison of Demographic Data of the 2 Groups

The mean age in urban patients was significantly older than that of rural patients (62 [±11.8] and 58.7 [±15.5] respectively) (*P* value ≤.01). There were gender differences between both regions; where rural patients showed female preponderance (51.5%) (*P* value ≤.01). A higher proportion of stroke in young (<46 years) was seen among the rural patients (20.5%) as compared to urban (7.5%), *P* value less than or equal to .01 (Table 1).

Comparison of Risk Factors Between the 2 Groups

There were significant differences in risk factor prevalence; diabetes, and hypertension were more common in urban, while higher serum cholesterol and statin intake, smoking, atrial fibrillation (AF), and previous stroke were detected in rural cases (Table 2 and Fig 2).

Comparison of Clinical Profile and Type of Stroke Between the 2 Groups

Onset to door was significantly shorter in urban. NIHSS scale on admission, mRS, and mortality rate after 3 months were higher in rural region denoting more severe deficit on presentation and worse outcome. According to TOAST classification, large and small vessel disease showed a higher prevalence in urban than rural, while cardioembolic and undetermined etiology were higher in rural population. Carotid stenosis more than or equal to 50% was recorded to be more frequent in urban region (Table 3 and Fig 3).

Discussion

Arab countries have similar lifestyle and dietary habits that may influence stroke risk, type, and post stroke survival compared to Western and Oriental populations.[3] Also, lifestyle and health care services differ between different regions within each country.

We found urban stroke patients to be significantly older than rural ones. In a study done in northern Portugal there was no age difference between urban and rural,[6] the same was reported in Indian studies[7,8] and in another study from Poland.[9] The overall mean age of our patients (58.7-62 years) was lower than that reported by studies from northern Portugal[6]; Nigeria,[10] and Turkey[11] where the mean age ranged from 64 to 74 years.

A higher proportion of stroke in young was seen among our patients reaching 20.5% the rural cases. The Trivandrum Stroke Registry conducted in South Indian community reported stroke in the young, in only (3.8%) of patients in a population-based study.[7] While in rural area in Istanbul it comprised only .6% and was not reported below 30 years of age.[11]

Unlike most studies where stroke is commoner in male gender,[6,10,12] we found that males were less than females in rural area. Since the current study is hospital based,

Table 1. *Demographic data of the 2 groups*

Risk factor	Urban (Cairo)	Rural (Swhag)	*P* value
Age (y)[†]	62 (±11.8)	58.7 (±15.5)	≤.01**
Male gender[††]	727 (63.6%)	161(48.5%)	≤.01**
Young age (<46y)[††]	85 (7.5%)	68 (20.5%)	≤.01**

[†]Mean ± standard deviation.
[††]Number (percentage).
**Highly statistically significant.

Table 2. *Risk factors of the 2 groups*

Risk factor	Urban (Cairo)	Rural (Swhag)	*P* value
Smoking habit[††]	134 (11.7%)	148 (44.6%)	≤.01**
History of hypertension[††]	753 (65.9%)	194 (58.4%)	≤.01**
History of diabetes[††]	555 (48.6%)	87 (26.2%)	≤.01**
Serum cholesterol (mg/dl)[†]	191 (±48.9)	238 (±74)	≤.01**
AF[††]	99 (8.7%)	79 (23.8%)	≤.01**
Previous CVS[††]	121 (10.6%)	147 (44.3%)	≤.01**

[†]Mean ± standard deviation.
[††]Number (percentage).
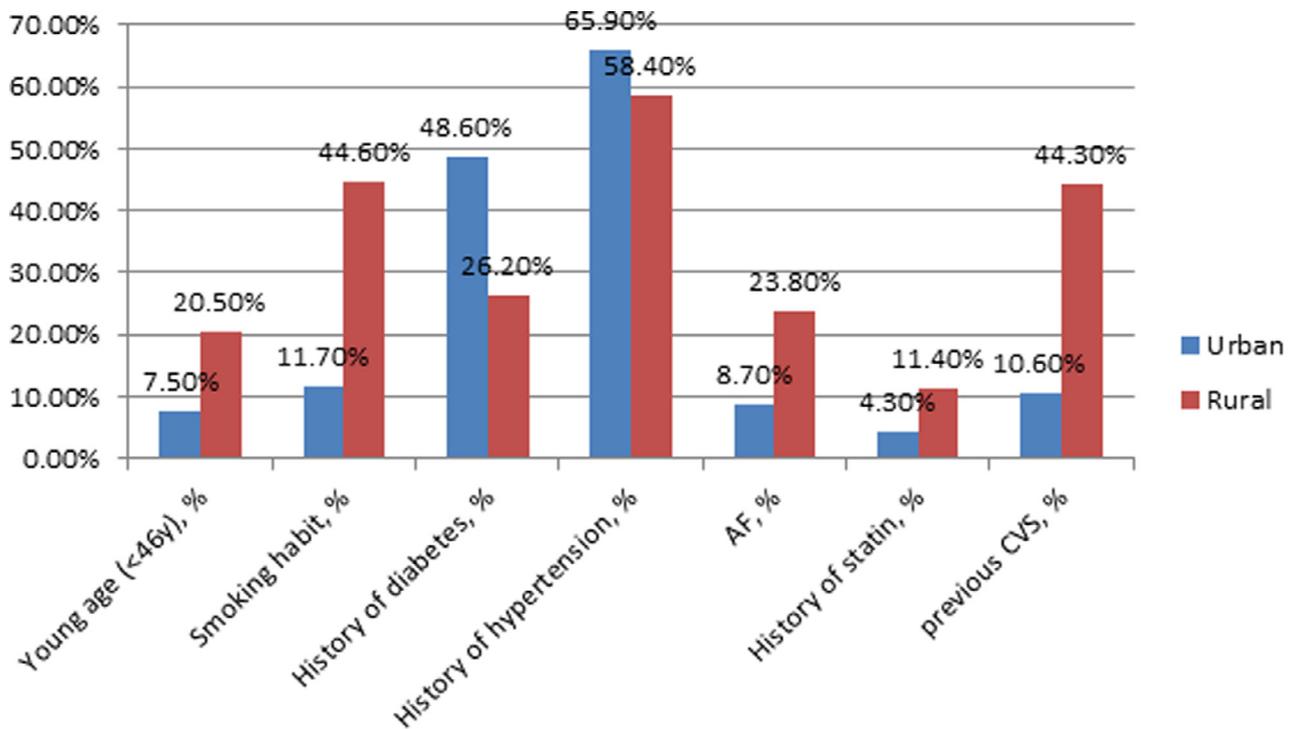**Highly statistically significant.

Figure 2. *Risk factors of the 2 groups.*

this gender difference might be due to traditions of Upper Egypt where males refrain from asking for medical attention. This explanation is supported by a door to door prevalence study done in upper Egypt showing male preponderance (1.7:1).[13] Rural patients in Portuguese and Nigerian studies had a higher female percentage (51.8% and 52.5%; respectively).[6,10] Other studies found no gender difference between urban and rural.[8,14]

Our results showed prevalence of smoking in rural group (44.6%) to be much higher than urban and also higher than other studies. The prevalence of smoking in rural areas is variable among different studies reaching as high as 32% and 39%[7,11] and as low as 3%.[8]

The predominance of hypertension and diabetes in the urban group might be attributed to higher tendency for stress and fast food in urban population. However, the overall prevalence of hypertension in either group was lower than previously reported.[7,8,10,11,14] On the contrary, hypertension was reported as the commonest risk factor in rural group (78%-89%) in different studies including Indian, Nigerian, and Turkish.[7,8,10,11] Other studies detected no difference in diabetes according to residential areas.[7,8,14]

Serum cholesterol level was higher in rural group similar to most studies.[8,11] However, other literature showed great variation in results.[7,10,14] AF was higher in rural

Table 3. *Clinical profile and outcome between the 2 groups.*

	Urban (Cairo)	Rural (Sohag)	*P* value
Onset till door (min)[†]	480 (30-13695)	720 (120-4320)	≤.01**
NIHSS scale on admission[†]	7 (0-25)	13 (0-42)	≤.01**
mRS after 3 months more than 2[††] (375 missed cases)	283 (33.3%)	120 (48%)	≤.01**
Mortality rate after 3 months[††]	99 (11.6%)	59 (23.6%)	≤.01**
TOAST classification[††] (20 missed cases)			≤.01**
Small vessel disease	388 (34.5%)	64 (19.4%)	
Large vessel disease	405 (36%)	98 (29.7%)	
Cardioembolic	156 (13.9%)	91 (27.6%)	
Undetermined	176 (15.6%)	77 (23.3%)	
More than 50% stenosis[††] (20 missed cases)	277 (24.6%)	45 (13.6%)	≤.01**

[†]Median (range).
[††]Number (percentage).
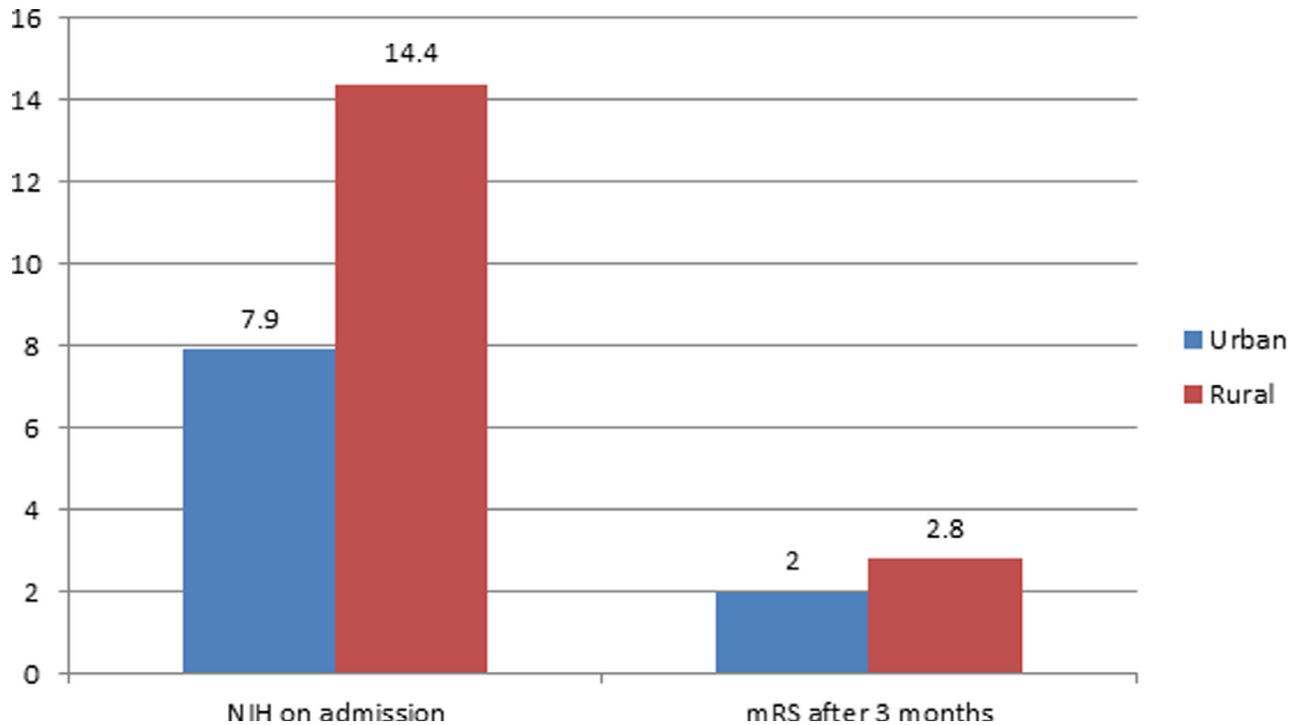**Highly statistically significant.

Figure 3. *Outcome of the 2 groups.*

group than urban and also higher than that reported by other groups that ranged from 4.9 to 11%.[7,8,10]

Prevalence of previous stroke was higher in rural than urban area, and more than rural areas of other countries.[8,10,15] This might reflect poorer control of risk factors in rural areas.

Overall this study showed that hypertension was the commonest risk factor in urban region followed by diabetes then smoking. Regarding rural area hypertension was the commonest risk factor followed by smoking then previous stroke.

Onset to door time was longer and NIHSS was worse in rural, possibly due to lack of awareness and higher illiteracy rate in rural Egypt (32.2%) versus urban (17.7%). This is similar to an Iranian syudy,[14] but different from western population study.[9]

Three months disability assessed by mRS was better in urban than rural, which matches results come from northern Iran.[14] This can reflect better health care in urbanized areas. However others noticed no difference between residential status regarding later disability.[7,8] Regarding mortality rate, it was higher in rural area compared to urban, similar results were reported from Saudi Arabia and Qatar.[15,16] Mortality rate, as most of the reviewed literature, was higher in rural areas than in urban ones.[7,9,14,17]

As for the type of stroke, rural patients showed more prevalence of cardioembolic and undetermined stroke. Cardioembolic stroke can be due to higher prevalence of AF among rural, while undetermined type might refer to the lack of detailed investigations in rural region.

The Trivandrum Stroke Registry from India also showed that undetermined type was more in the rural population due to unavailability of brain imaging.[7] On the contrary, a study from northern Iran showed that thrombotic stroke was significantly higher in the rural population and the incidence of embolic stroke was higher in urban populations.[14] Our results showed higher incidence of carotid stenosis in both rural and urban areas than other studies.[8,10]

Conclusion

There are significant differences in stroke demographics, risk factors, and clinical profile between urban and rural areas in this sample of Egyptian patients.

Recommendations

Studying differences in risk factors and stroke profile between urban and rural is needed to aid in depicting primary and secondary preventive plans tailored to the actual needs of each region. This may further lead to decline in morbidity and mortality inflicted by stroke.

Declaration of Competing Interest

The authors have no conflict of interest to declare.

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