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CHADS2 Stroke Risk Stratification in Atrial Fibrillation Patients; Community Based Comparison Study

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Authors' contributions

This work was carried out in collaboration between all authors. Authors MKAS, EAF and OIB designed the study, wrote the protocol. Authors MKAS and ZES wrote the first draft of the manuscript. Authors TME and MMG managed the literature searches and help in discussion writing. Author MKAS done the analyses of the study with help of statisticians. All authors read and approved the final manuscript.

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ABSTRACT

Atrial fibrillation (AF) is very common cardiovascular disorder and a major health problem in North Africa. AF associated with increase the risk of stroke and hospitalization.
Objectives: To compare stroke risk factors among community people who have atrial fibrillation and those who are not using both CHADS2 Score and Community Stroke Risk Classification (CSRC).
Methodology: This was community based descriptive cross-sectional comparison study.
Area: North Africa (north of Libya, the capital Tripoli).
Time: 2014, one year.
Population: Sampling was done from a large cohort of individuals living in the community. Two

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groups where selected, AF group, which consists of 519 patients who had AF, and control group (602 apparently healthy individuals) who does not have AF. The two groups were selected and matched having the same confounding characters. Both groups were interviewed and screened using CHADS2 Questionnaire as well a local Libyan classification of stroke risk factors called Community Stroke Risk Classification (CSRC).

Results: Among population screened (8016) over five years (from 2010 to 2014) the prevalence of AF was 7% (519 patients) and the main age of AF group was 61.2 years with range of 22->70 and SD±16.4. The main age of control group was younger than AF group with main age of 52 years (*P*<0.001). AF increased with age with more than 89.8% was over frothy years old with males domination over females (*P*<0.0001).

Comparison between AF group and control in stroke risk factors in CHADS2 score showed significant dominations of risk factors over AF group than control; CHF (46.4% versus 24.3% respectively) (*P*<0.0001). Hypertension (49% versus 34% respectively) (*P*<0.0001), DM (56% versus 38% respectively) (P<0.0001), TIA (43% versus 19.4% respectively) (*P*<0.0001) and finally stroke prevalence (Prior stroke) was significantly higher among AF group compared with control group (84% versus 0.9% respectively) (*P*<0.0001).

CHADS2 score was very high among AF group compared to control, with AF group 97.8% had risk points of stroke, where only 2.7% had no risk, where in control group; 66.8% had risk and 33.3% had no stroke risk. High CHADS2 score with ≥3 risk points were dominated with AF group compared with control (*P*<0.0001) (83.6% versus 66.8% respectively).

Community Stroke Risk Classification (CSRC) showed dominations of higher score of ≥3 risk factors among AF group compared with control (66.8% versus 23%) (*P*<0.0001). However in the intermediate score with 1-2 risk factors, control group was dominated (43.7%) over AF group (31.2%) (*P* <0.0001).

Conclusion: AF is a major risk factor of stroke among north African population (Libya). CHADS2 and CSRC classification scores are very useful tools to be used to evaluate the risk factors of stroke in community population having AF or not.

Keywords: Atrial fibrillation; stroke; prevalence; risk factors; risk points; classification; community; Africa; Libya.

ABBREVIATIONS

CHF: Congestive Heart Failure; CDC: Centers of Disease Control; CSRC: Community Stroke Risk Classification; HT: Hypertension; TIA: Transient Ischemic attack; RF: Risk Factor; WHO: World Health Organization.

1. INTRODUCTION

Stroke is the second leading cause of death above the age of 60 years. Every year, 15 million people worldwide suffer a stroke [1]. In the Middle East and North Africa stroke is increasingly becoming a major health problem, with projections that deaths from it will nearly double by 2030 [2].

Stroke risk factors are divided into those that are modifiable and those that are not, such as sex, Increasing age are a major un-modifiable risk factor for stroke. The modifiable risk factors of stroke include hypertension, diabetes, AF, obesity, smoking, and lack of exercise [3].

Of all cardiac arrhythmias, atrial fibrillation is the most common. It affects approximately 1-2% of the population [4]. The prevalence is higher in men compared to women [4]. The occurrence is suspected to rise due to an ageing population and the progressive nature of the arrhythmia [5]. It is one of the most common causes of ischemic stroke and is related to increased cardiovascular morbidity and mortality [6]. The Framingham study and other studies have demonstrated a fivefold increase in overall stroke risk associated with AF [7]. The proportion of stroke associated with AF increases progressively with age, ranging from 6.7% in individuals aged 50–59 years to 36.2% in those aged 80–89 years [7].

The CHADS2 Stroke score have been established to guide antithrombotic therapy in individuals with known AF. However, AF is often not diagnosed until patients present with thromboembolic complications [8].

In up to 25% of patients, AF is suspected to be the cause of a cryptogenic stroke [9] and

associated with a higher in-hospital mortality, not just in ischemic stroke patients population as a whole, but also in cardioembolic stroke subtype patients [10]. Therefore, early identification of individuals with AF seems to be warranted in order to prevent associated complications [11]. Many efforts have been undertaken to create models for the identification of patients at risk of AF before complications become apparent. So far, risk stratification has been limited to small cohorts or restricted age groups. Finally, risk stratification was not easily adopted in daily practice [12].

The CHADS2 score are well-established tools to estimate the risk of thromboembolic events in individuals with known AF [13]. Some features of these scores are not only used to predict the risk of thromboembolic complications, but also to predict the occurrence of AF [14]. In this study in Libya, we hypothesized that the CHADS2-CSRC scores may predict the prevalence of AF with highlighting the most risk factors contributing to their development and may be used in future to guide cardiac monitoring and help in preventing more complication related to AF and stroke.

1.1 Objectives

To compare stroke risk factors among community people who have atrial fibrillation and those who are not using both CHADS2 Score and Community Stroke Risk Classification (CSRC).

2. METHODOLOGY

The study is community based descriptive, cross-sectional comparison study.

2.1 Populations

Individuals who are 16 years old or above.

2.2 Population Sample

519 having AF which was selected from **8016** Individuals in study done in Libya (Shambesh et al. [15]).

2.3 Comparison Group

602 individuals who do not have AF were selected from the same general population sample and their characters were similar to the AF group (e.g. age, sex, social class).

2.4 Area

North Africa, Mediterranean area of Libya (Tripoli the capital).

2.5 Time

Done in 2014 for one year.

2.6 CHADS2

Questionnaire used to assess stroke risk in patients with atrial fibrillation [16], and also was adapted in this study to be used among population without AF as it had been used in other studies elsewhere [17].

2.7 Method of survey

Individuals were interviewed using CHADS2 Score Questionnaire and as well a local Libyan classification of stroke risk factors was used (called Community Stroke Risk Classification-CSRC which created to be used for the first time in Libya by Shambesh et al. [15]). CHADS2 score is derived from the sum of point values of individual stroke risk factors {congestive heart failure (CHF), hypertension (HT), age≥ 70, diabetes (DM) (1 point each), and prior stroke or transient ischemic attack (2 points) (Table 1). The CHADS2 scoring table which shown below adding together the points that correspond to the condition represents the results in CHADS2 score which used to estimate stroke risk as follows:

Score Zero points = No risk = Low Risk Score
Score 1,2 points = Intermediate Risk Score
Score ≥3 points = High Risk Score

Table 1. Showing CHADS2 score questionnaire used in the study

Condition		Points
C:	Congestive heart failure	1
H:	Hypertension	1
A:	Age ≥70 and sex	1
D:	DM	1
S:	Prior Stroke or TIA	2

2.8 Community Stroke Risk Classification-CSRC

This classification depend on calculation of numbers of risk factors (RF), each risk factor used in the study (age ≥ 70, DM, Hypertension, CHF, TIA and prior stroke) were given one number for each condition among each

individual participated and the score is a result of summation of those risk factors as shown in Table 2.

2.9 Field Survey

Doctors who work in community and family medicine department were trained by professions to collect data using CHADS2 Questionnaire and CSRC score; interviewing individuals by taking detailed history (present, past, medical, hospital admission), checking of any available investigations, discharge letters and medical reports and doing medical examinations. Known cases of hypertension, DM, CHF, AF, TIA and prior strokes had been established by previous medical diagnosis by hospital specialists.

2.10 Statistical Analysis

This step was done by Statistician who were scoring CHADS2 and CSRC grades by SPSS package version 19- USA. Data was calculated and described by using mean, mode, standard deviation, cross tabulations and graphical presentations. T student test for independent samples for numerical data was used with Chi-square for categorized data.

3. RESULTS

Using SPSS software independence sample t-test applied on age distribution of individuals having AF screened for the study (519 individuals) and 602 controls have no AF.

The age of participants was divided into seven age groups (10 years interval within each group except for last group which include those who are ≥70 year old). The prevalence of AF among whole population (8016 individuals) in study done by Shambesh et al. [15] was 7%.

3.1 Age Comparison between AF Group versus Control

The mean age of AF group was 61.2 years with SD±16.4, it ranges from 22 to >70. Where control group was much younger with mean of age of 52.0 years with SD±18.6 and range from 16 to >70 (P<0.0001).AF increase with age , with more than 89.6% of patients over 40 years old and 57.2% over 60 years (10.1% in 0-39 of age, 31.4% in 40-59 of age and 57.2% in 60-≥70) while in control only 37.7% were over 60 years (28.7% in 0-39 of age, 33.5% in 40-59 of age and 37.7% in 60-≥70) (Table 3, Fig. 1).

3.2 Sex Comparison between AF Group versus Control

Sex in both groups was almost similar, in AF group (Males constitute 50.3% and females were 49.7%) and control group (Males constitute 51.8% and females were 48.2%).

Table 2. Showing CSRC score used in the study

Level	Score	No. of risks
Low risk score	score of zero	No risk factor
Intermediate risk score	score of one	One risk factor
Intermediate risk score	score of two	Two risk factors
High risk with a score ≧3. Subdivided to:		
High risk score-3	score three	Three risk factors
High risk score-4	score four	Four risk factors
High risk score-5	score five	Five risk factors
High risk score-6	score six	Six risk factors

Table 3. Showing age structure of both AF and control groups

Age group	AF group		Control	
	No.	%	No.	%
10-19	0	0	9	1.5
20-29	17	3.3	85	14.1
30-39	37	7.1	79	13.1
40-49	73	14.1	78	13
50-59	95	18.3	124	20.6
60-69	111	21.4	99	16.4
>70	186	35.8	128	21.3

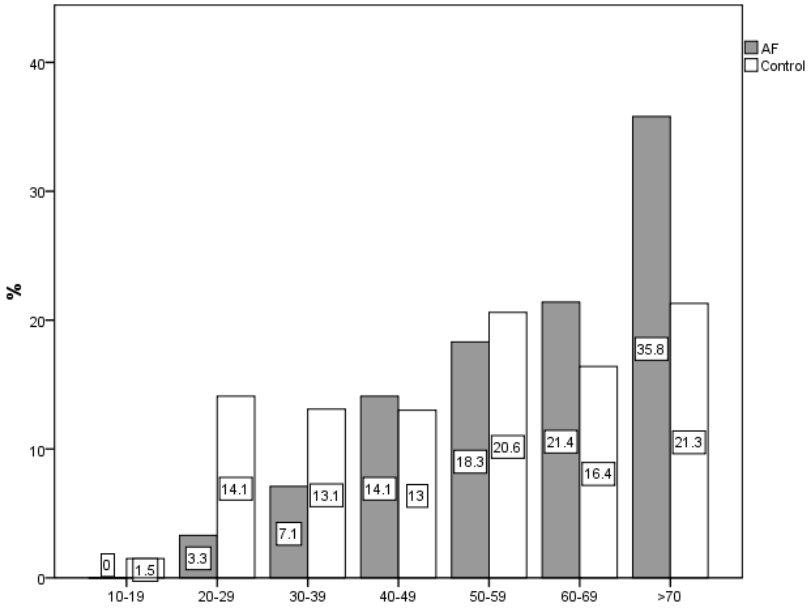

Fig. 1. Showing age structure of AF and control groups

3.3 Congestive Heart Failure (CHF) as Risk Factor Comparison between AF Group versus Control

CHF was more prevalent among AF group than the control group (46.4% versus 24.3%) respectively (*P*<0.0001). Males were dominated in both groups of CHF (M:F, 51.7%, 49.2% for AF group versus 56.8%, 43.2% for control).

3.4 Hypertension as Risk Factor Comparison between AF Group versus Control

Hypertension was dominated among AF group compared to control (49% versus 34%) respectively (*P*<0.0001). Also males were dominated in both groups (M:F, 56.3%, 43.7% for AF group versus 58.6%, 41.4% for control).

3.5 Diabetes Miletus (DM) as Risk Factor Comparison between AF Group versus Control

DM was Higher among AF group compared to control (56% versus 38%) respectively (*P*<0.0001). Females were higher in AF groups while males was higher in Control group (M:F, 49%, 51% for AF group versus 51.5%, 48.5% for control).

3.6 Transient Ischemic Attack (TIA) as Risk Factor Comparison between AF Group versus Control

TIA was Higher among AF group compared to control (43% versus 19.4%) respectively (*P*<0.0001). Males dominated in both groups (M:F, 53.3%, 46.7% for AF group versus 65.8%, 34.2% for control).

3.7 Prior Stroke (PS) (Embolic or Hemorrhagic Stroke) as Risk Factor Comparison between AF Group versus Control

PS was Higher among AF group compared to control (84% versus 0.9%) respectively (*P*<0.0001). Males and females were similarly affected in both groups (M:F, 50.3%, 49.7% for AF group versus 50%, 49% for control).

3.8 CHADS2 Score Comparison between AF Group versus Control

CHADS2 score works with points, higher the points (P) higher the risk (R) score for stroke. AF group patients showed that 97.3% had risk points of stroke (2.7% had no risk points), from that 14.1% had intermediate score (1-2RP) and 83.6% had ≥3 risk points, where the control group showed that 66.8% had risk points (33.3% had no risk points) and from that 40.7% had

intermediate score (1-2RP) and only 26.2% had ≥3 risk points (*P*<0.0001) (Table 4, Fig. 2).

This results found that AF group had very high risk score in CHADS2 which mainly concentrated in ≥3 risk points (*P*<0.0001) compared to control group where the score was concentrated in low and intermediate scores.

3.9 CSRC Score Comparison between AF Group versus Control

CSRC works with number of risk factors (RF), higher the number of risk factors higher the stroke risk. AF group patients showed that 97.3% had risk factors of stroke (2.7% had no risk factors), from that 31.2% had intermediate score (1-2RF) and 66% had ≥3 risk factors, where the control group showed that 66.8% had risk factors (33.3% had no risk factors) and from that 43.7% had intermediate score (1-2RF) and only 23% had ≥3 risk factors (*P*<0.0001) (Table 4% Fig. 3).

This result found almost all AF patients had risk factors of stroke and concentrated in high score compared to control group where only 66.8% had risk factors which concentrated in intermediate score and to lesser extent in high CSRC score.

4. DISCUSSION

This is the first time such comparison study assessing stroke risk factors among community population (having AF) done in North Africa; it shows that stroke is a very common and important public health problem among Libyan citizens. It also shows that AF is a major risk factor for stroke beside other factors such as hypertension and DM.

Atrial fibrillation is a frequent arrhythmia with an estimated prevalence of 1.5–2% in developed countries [18]. This study in North Africa (Libya) showed higher AF prevalence of 7%.

Table 4. Showing score grades for both AF versus control groups

Score	CHADS2 score		CSRC score	
	AF group	Control group	AF group	Control group
Low-no risk	2.7%	33.3%	2.7%	33.3%
Intermediate-1	3.5%	22.8%	10.8%	26.8%
Intermediate-2	10.5%	17.7%	20.4%	17%
High-3	16.4%	10.7%	24.9%	14%
High-4	19.5%	7.8%	23.4%	8%
High-5	17.9%	6.2%	13.5%	1%
High-6	29.9%	1.2%	4.2%	0.0%

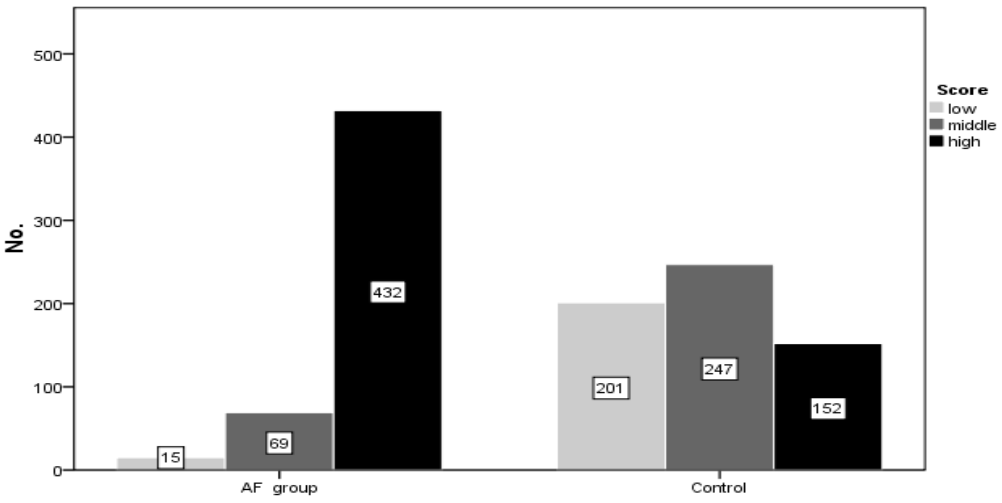

Fig. 2. Showing CHADS2- score among AF and control group

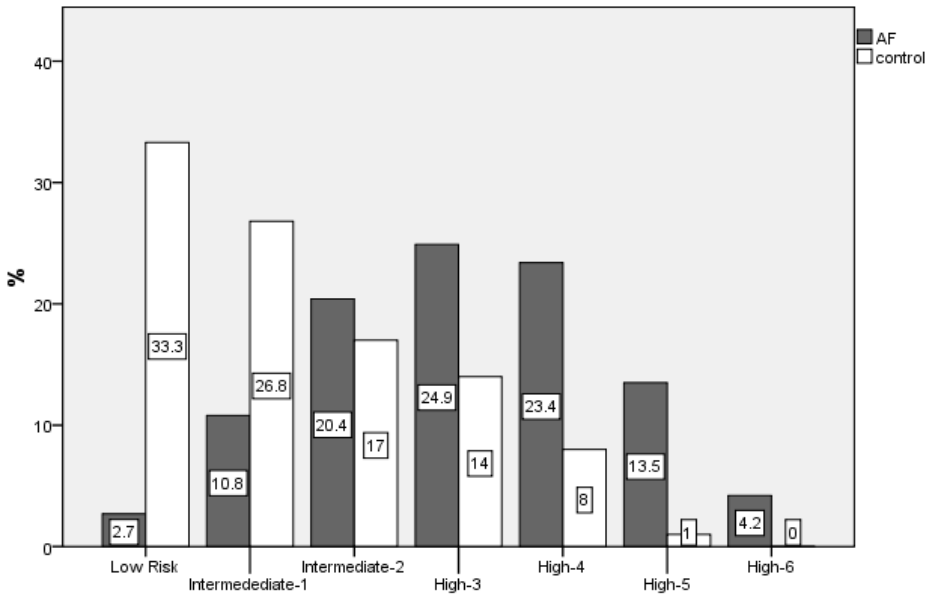

Fig. 3. Showing CSRC score among AF and control group

Hypertension, ischemic heart disease, diabetes mellitus, smoking and hypercholesterolemia are well-known risk factors for stroke. Oxford shire community stroke project study showed that the risk factors for cerebral infarction were present in 80% of cases, hypertension in 52%, ischemic heart disease in 38%, peripheral vascular disease in 25%; cardiac lesions were a major potential source of emboli to the brain in 20% and diabetes mellitus in 10% [19]. Similar to other studies done in Arab countries [5]; Mortel et al. [20] reported that diabetes is second to hypertension as a risk factor for stroke, followed by heart disease and smoking. Likewise, this study revealed AF is a significant risk factor that leads to stroke. The study also revealed that the AF group had higher prevalence of stroke more than the control group

This study found AF prevalence rate as stroke contributing risk factor is high (7%); similar results found by other Libyan and Arab countries studies showed increasing rate of obesity, smoking, lack of exercise and eating of unhealthy diet among Libyan, and all of them are risk factors of cardiac disease including AF [21,22].

The prevalence of AF was 7% in our study population (mean age of 61.2±16.4 years). In developed countries, in general population aged over 65 years, the prevalence of AF is up to 30–34% and it has been described in patients with intensified monitoring with implanted devices during a follow up of 1.1–2.5 years [23,24], which much higher than the prevalence of 7% found among general population in this study.

In line with our data Engdahl et al. reported a prevalence of 14% in a population of 75 years and 76 years of age using a special screening program [25].

In patients with known AF risk factors for stroke which have been investigated and widely accepted CHADS2 score to identify patients who may benefit from oral anticoagulation [11]. But little is known about the occurrence of AF in patients with stroke risk factors [26]. That's why this Libyan study was done to identify the prevalence of AF among stroke patients which is found to be very high (84%) while in other studies in developed countries like Spain the prevalence was lower (27%) [27].

We could demonstrate that the prevalence of AF and risk of stroke rises significantly with every CHADS2 and CSRC score points raise, independent of the attending medical department and the underlying disease that lead to hospitalization. We conformed that 83.6% of patients with a CHADS2-score had ≥3 risk points while in control group only 26.2% had ≥3 risk points. Also 66% of patients with a CSRC score had ≥3 risk factors while only 23% in control had ≥3 risk factors. This finding confirms that the higher the scores of CHADS2-CSRC the higher

the risk of developing strokes. This goes in line with Zuo et al. who demonstrated that in patients without documented AF but arrhythmic symptoms, a high CHADS2 and CHA2DS2-VASc-score was associated with a high risk of a new onset of AF and at higher risk of developing strokes [28].

In individuals with intermediate CHADS2-CSRC scores, stroke still even in the control group was high and independent of AF. This confirms that other risk factors of stroke like hypertension, DM, TIA, CHF and prior stroke are plying very important role in developing stroke among north African Libyan population and this is also found among populations living in developed countries like Spain [27].

We, therefore, conclude that using the CHADS2 and CSRC scores are effective methods to detect patients with a high risk of AF and thromboembolic complications if AF is present with very high scores. Also at the end, this study confirms that the uses of such scores (CHADS2-CSRC) can help early detection of stroke among community population and hence early treatment and reduce stroke complications.

5. CONCLUSION

This study concluded that stroke is a major important public health problem in North Africa. AF is a major risk factor associated with stroke. Moreover, stroke risk factors as DM, HT and CHF and previous history of stroke or transient ischemic attack are increased among AF group compared with individuals having no AF. This might be related to sedentary life, obesity, bad eating habits, lack of exercise, epidemic of smoking, and sever stress from multiple civil wars inside the country.

Additionally, both CHADS2 and CSRC classification scores are very useful, easy to use and simple tools which used to estimate the risk factors of stroke in community population based studies having AF or not.

6. STRENGTHS AND LIMITATIONS OF THE STUDY

It is the first Libyan comparison community based study that use CHADS2 and CSRC questionnaires to assess stroke risk factors among those who have and do not have atrial fibrillation. Moreover, it uses enough sample size, thus, the result produced from this study reflect the real situation in the Libyan community. Finally, because, this study is cross-sectional study; therefore it explores associations, not causation.

7. RECOMMENDATION

To do another studies to measures stroke risk factors by using laboratory investigations, and other medical diagnostic procedures, consequently, to estimate the most accurate and true rates.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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