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Original Article

Low prevalence of atrial fibrillation in ischaemic stroke: Underestimating a modifiable risk factor

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ABSTRACT

Introduction: Cerebrovascular disease remains one of the leading causes of morbidity and mortality globally. In South Africa, it was the fourth leading cause of death in 2016, responsible for 5.1% of all deaths - the leading cause of death in individuals 65 years and older. Atrial fibrillation accounts for 15% of all strokes and 25% are diagnosed when patients present with a stroke. We set out to determine the prevalence of atrial fibrillation in patients with confirmed ischaemic strokes in a district level hospital in the Western Cape, South Africa.
Methods: This descriptive study was conducted at Mitchells Plain Hospital in Cape Town and data was collected over a one-year period. Patients diagnosed with a stroke were identified from an electronic patient register and relevant radiology and clinical data were sourced retrospectively. The diagnosis of ischaemic stroke was confirmed by a CT scan report and ECGs were independently screened by two Emergency Physicians. Ethical approval was granted by the University of Cape Town Human Research Ethics Committee [790/2018].
Results: The proportion of adult patients with a stroke diagnosis was 2%. Of the included cases, 80% had ischaemic strokes and 11% had haemorrhagic strokes. 11% of all patients with ischaemic strokes had atrial fibrillation, 67% of those presumed new. A total of 60 (15%) of all patients with ischaemic stroke were aged 45 years or younger. The inpatient mortality rate was statistically higher in patients who had atrial fibrillation (26% vs 7%, $p < 0.001$).
Conclusion: With the increasing population life expectancy, and prevalence of cardiovascular disease the prevalence of atrial fibrillation and its complications will increase. Since the risk of stroke related to atrial fibrillation can be reduced significantly by oral anticoagulation, further studies should aim to explore barriers and challenges to effective screening.

African relevance

- The 11% prevalence of atrial fibrillation (AF) in ischaemic stroke is an under-estimation of a modifiable risk factor.
- 67% of AF was newly diagnosed, reflecting ineffective primary and secondary screening practices.
- Patients with AF related stroke have worse outcomes with a 26% prevalence of inpatient mortality.
- With the increasing population life expectancy, the prevalence of AF and its complications is expected to increase.

Introduction

Cerebrovascular disease remains one of the leading causes of morbidity and mortality globally. It affects 15 million people annually and it is responsible for 5 million deaths per annum, contributing to the growing burden of non-communicable diseases worldwide [1,2]. In South Africa (SA), it was the fourth leading cause of death in 2016, responsible for 5.1% of all deaths - the leading cause of death in individuals 65 years and older [3]. Globally approximately 3% of the total health care resources are dedicated to stroke, indicating that cerebrovascular accidents (CVA) contribute to a significant economic burden on countries [4,5]. In 2008, Bertram et al. estimated that there are 75,000 strokes in SA each year, with 25,000 of these fatal within the first month [6].

Global estimates suggest that up to 80% of strokes are ischaemic, of which 20% are cardio-embolic in nature [7]. Internationally, atrial fibrillation (AF) accounts for 15% of all strokes and 25% are diagnosed

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only when a patient presents with a stroke [7]. Patients with AF have a fivefold increased risk for developing a stroke as well as a twofold increased risk of silent cerebral infarction [7–10]. AF, the most common cardiac arrhythmia worldwide, has an estimated prevalence of 0,5-2% in the general population within high-income countries (HICs), with a higher prevalence in males as compared to females [9–11]. Current data, albeit sparse, indicates that the prevalence of AF in low-to-middle income countries (LMICs) is slightly lower [11]. Despite this lower prevalence of AF in LMICs, the number of AF-related deaths increased by 196% from 1990 to 2013 in Sub-Saharan Africa, as did the number of deaths from strokes, particularly ischaemic strokes with a 102% increase [12]. This significant increase is believed to be as a result of population growth, ageing and epidemiological transition [12].

The presence of AF in patients with newly diagnosed strokes is associated with prolonged hospitalization, increased persistent disability, greater severity of disease, and elevated healthcare costs [13–15]. In addition to this, strokes that occur in the setting of AF have an increased risk of mortality compared to strokes of other aetiologies (30-day mortality OR, 1.84; 95% CI: 1.04 to 3.27) [9,16,17].

There is a paucity of data available reporting on the prevalence of AF in LMICs. The prevalence of AF and its complications will likely increase due to increasing life expectancy and the increasing burden of other CVDs. This study aimed to determine the prevalence of AF in patients with confirmed ischaemic stroke, at a district level hospital in the Western Cape.

Methods

Study design

This is a descriptive study and data were collected retrospectively from existing databases.

Study setting

This study was conducted at Mitchells Plain Hospital (MPH) in Cape Town, South Africa. MPH is a district hospital in the Mitchells Plain Health District of the Metro Region, which is approximately 32 km from Cape Town's city centre. The hospital serves a population of approximately 800,000, which includes the population of Mitchells Plain and the greater part of Philippi, a large nearby township. Patients eligible for thrombolysis or endovascular procedures are transferred to a tertiary facility 25 km away. CT scans and reporting services are only available during office hours at MPH and patients requiring emergency after hour CT scans are also transferred to the nearby tertiary hospital.

Study population and sampling

Inclusion criteria: All adult patients (≥18 years of age) who presented to MPH Emergency Centre (EC) with a clinical diagnosis of a stroke were eligible for inclusion. A diagnosis of stroke, for the purpose of this study was defined as patients with an ICD-10 code (primary or secondary) of a stroke: ICD-10 chapter: "Diseases of the circulatory system" and the ICD-10 subgroup of "cerebrovascular diseases". Consecutive patients were included for the full study period from 1st April 2017 until 31st March 2018 (1 year).

Exclusion criteria: Ischaemic strokes secondary to causes other than thrombosis or an embolism were excluded, e.g. trauma or space-occupying lesions. Patients diagnosed with transient ischaemic attacks and other stroke mimics were excluded. Additionally, patients with ischaemic stroke referred from other departments were excluded because this would have complicated the data collection process. The incidence of patients referred from other departments was very low. Patients who died prior to reaching the hospital were also excluded.

Data collection and management

Data were collected in three phases: Phase 1 identified patients from the electronic patient register HECTIS. A search from within the database was conducted for keywords and ICD-10 codes with a clinical diagnosis of stroke. Demographic data was collated during this phase. Phase 2 involved scrutinizing the PACS (Picture archiving and communication system) database for CT brain reports (radiologist reported) performed on patients identified from phase 1. The absence of an intracranial bleed or CT scan features indicative of an infarct were used to diagnose an ischaemic stroke. Phase 3 involved the collection of clinical data for all patients identified from phase 2 by accessing the electronic database, Enterprise Content Management (ECM). Comorbid conditions were collated from prior diagnoses as documented in clinical notes. All patients with a confirmed CT scan diagnosis of an ischaemic stroke were included in this phase. Clinical notes were scrutinized for ECGs and each ECG was independently assessed (Cohen's Kappa) by two Emergency Physicians for the presence of AF (Atrial flutter and atrial tachycardia were not included). Clinical notes, as well as previous ECGs, of patients were assessed to help decide whether the AF is presumed new or existing. In those with existing AF, the anticoagulation plan was documented.

Ethical considerations

Existing data were collected retrospectively, and data were deidentified after the data collection process was completed. Folder numbers were used to track the data collection process through the different phases. This study received ethical clearance from the University of Cape Town Human Research Ethics Committee (HREC: 790/2018 and facility approval via The National Health Research Database (WC_201812_006).

Data analysis

This study was powered to analyze the primary outcome variable, prevalence of AF in confirmed ischaemic strokes. A sample size calculation suggested a minimum of 196 samples, with a precision of 5%, an expected prevalence of 15% and a population size of 800,000. Categorical data were described as proportions/percentages. A 95% confidence interval (CI) is provided when applicable and statistical significance is defined as a $p < 0.05$. Categorical data was compared using the Fisher's exact test or Chi^2 test, depending on the sample characteristics.

Results

During the study period of 12 months, 45,944 patients visited the EC of which 36,028 (78%) were adults. The proportion of adult patients with a stroke diagnosis was 2%. Of those, 80 (11%) met exclusion criteria (Fig. 1). Of the 645 that were included, 130 (20%) did not have CT scans. Of those that had a CT scan ($n = 515$), 412 (80%) had ischaemic strokes, 56 (11%) had haemorrhagic strokes and 47 (9%) had other CT pathology, including primary and secondary tumours, tuberculomas, abscesses or toxoplasmosis. Stroke mimics refers to patients who had an alternative discharge diagnosis without requiring a CT brain scan and included conditions like seizures, Todd's paresis, metabolic derangements and infections.

Table 1 describes the demographic details and clinical characteristics of all participants who met inclusion criteria ($n = 468$). Supplementary Table 1 summarises corresponding features of patients who did not have CT scans ($n = 130$) and those who had other CT diagnoses ($n = 47$). Hypertension (88% vs 59%, $p = 0.002$), diabetes (39% vs 11%, $p < 0.001$) and dyslipidaemia (22% vs 5%, $p = 0.004$) were statistically more prevalent in those who had an ischaemic stroke, compared to those who had a haemorrhagic stroke. The gender distribution, prevalence of

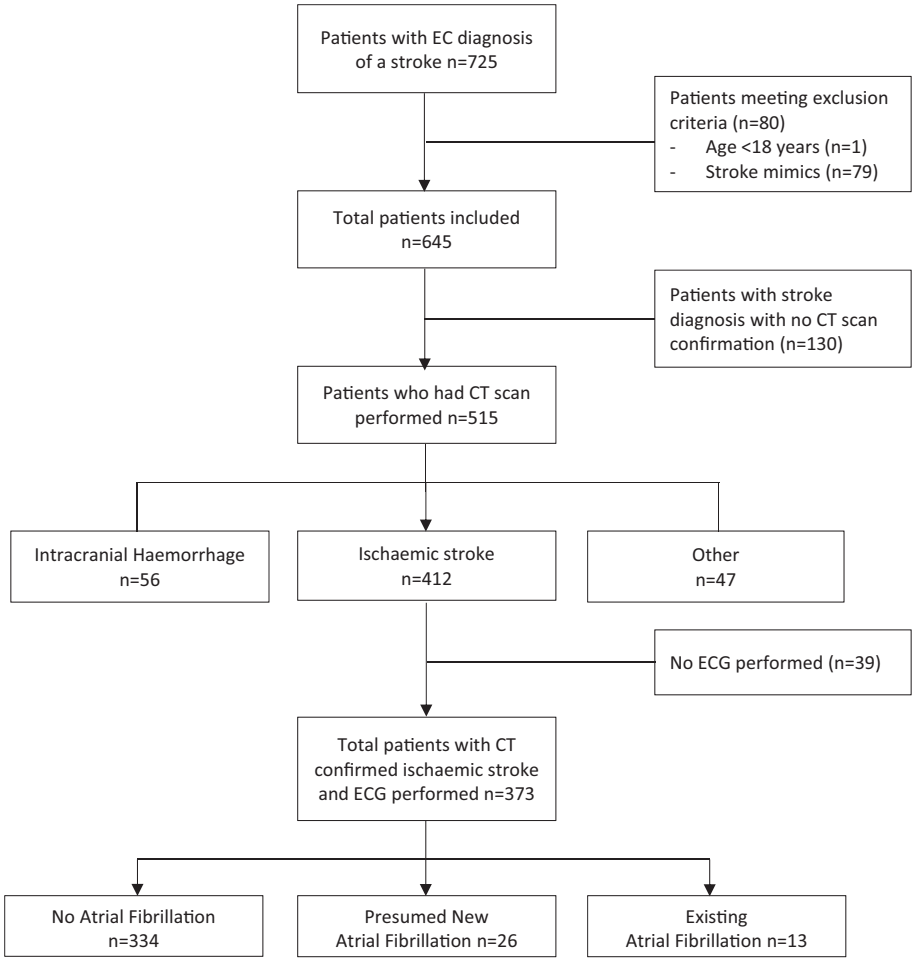

Fig. 1. Flow diagram of study participants.

smoking, HIV, excessive alcohol use, and prior valve replacement were not statistically different between the two groups. All patients with haemorrhagic strokes received CT scans within 8 h of presentation while 7% of those with ischaemic strokes waited ≥48 h. A total of 18% of patients with ischaemic strokes were discharged from the EC, significantly higher than in the haemorrhagic group ($p < 0.001$). The proportion of patients who survived to hospital discharge was not significantly different ($p = 0.648$).

Fig. 2 illustrates the age distribution of patients with ischaemic strokes (n = 412). The distribution is skewed to the left (Shapiro-Wilk: p = 0.008) and distributed around a median of 61 with 50% of all strokes occurred between 52 and 68 years of age. The youngest patient was 27 years old and the eldest, 99.

A total of 60 (15%) of all patients with ischaemic stroke were ≤45 years of age, commonly referred to as a *young stroke* [18]. No statistically significant differences were found when gender and in-hospital mortality were compared between those that are ≤45 years old or older. The prevalence of HIV (38% vs 5%, $p < 0.001$) and valve replacement (7% vs 1%, $p = 0.001$) were statistically higher in the ≤45-year-old group, as well as those with TB meningitis (14.5% vs 0.3%, $p < 0.001$). Univariate analysis of HIV in young strokes reveals an OR of 11.4 (CI 5.6-23.4, $p < 0.001$). Multivariate regression analysis of all comorbidities with age ≤ 45 years found that the odds of someone with a young stroke having HIV is 3 times higher than in those who are >45 years old (OR 2.9, CI 1.8-7.9, $p = 0.035$).

Of the CT confirmed ischaemic strokes ($n = 412$), 39 did not have and ECG performed during their hospital stay. 11% of all patients with CT confirmed ischaemic strokes had AF, 67% of those presumed new. The presence of AF was confirmed by two emergency physicians, who individually evaluated all ECGs ($n = 373$). Agreement was achieved in 98.66% of observations with a Cohen's Kappa of 0.931 (95% CI 0.871 to 0.991). The five ECG's that were not initially agreed upon were discussed and consensus was achieved on all of them, without the need for external validation.

The proportion of patients with ischaemic stroke who had AF ($n = 39$) increased significantly from 70 years upwards, as illustrated in Fig. 3. From 70 to 80 years the prevalence of AF was 27% and from 80 to 90 years, 35%. In patients <70 years old, the prevalence was 6%.

Table 2 describes the demographic details and clinical characteristics of patients with ischemic strokes of those who had AF. Age was stratified into <70 and ≥ 70 years old based on the findings in Fig. 3.

Smoking was statistically more prevalent in those without AF (15% vs 31%, $p = 041$), while a prior valve replacement was statistically more prevalent in those participants with AF (10% vs <1%, $p < 0.001$). Inpatient mortality was statistically higher in patients with AF (26% vs 7%, $p < 0.001$) and much more prevalent in those 70 years or older (51% vs 18%, $p < 0.001$). Univariate analysis of AF in patients ≥70 years revealed an OR of 4.8 (CI 2.4-9.6 $p < 0.001$). Multivariate regression analysis of all comorbidities and demographics with the presence of AF in those with an ischaemic stroke, found that the odds of having AF is 7 times higher in those ≥70 years old, in comparison to those who are younger (OR 7.0, CI 1.4-34.2, $p = 0.016$).

Of the 13 participants with existing AF, none were therapeutically anticoagulated (Fig. 4). From those who had existing AF, all the deaths occurred in those without any anticoagulation. Even though a non-random difference in mortality exists ($p = 0.010$) between those on

Table 1
Demographic details and clinical characteristics of participants with ischaemic and haemorrhagic strokes (n=468)

n (column%)	CT Diagnosis		P
	Ischaemic n=412 (88%)	Haemorrhagic n=56 (12%)	
Gender			
Male (n=243)	209 (51%)	34 (61%)	.161
Female (n=225)	203 (49%)	22 (39%)	
Age			
18-25 (n=0)	0	0	.323
26-35 (n=20)	18 (4%)	2 (4%)	
36-45 (n=51)	42 (10%)	9 (16%)	
46-55 (n=96)	82 (20%)	14 (25%)	
56-65 (n=151)	133 (32%)	18 (32%)	
66-75 (n=100)	94 (23%)B	6 (11%)	
>75 (n=50)	43 (10%)	7(13%)	
≤45 years (n=71)	60 (15%)	11 (20%)	.320
>45 years (n=397)	352 (85%)	45 (80%)	
Comorbidity			
Hypertension (n=353)	320 (78%)B	33 (59%)	.002
Diabetes (n=165)	159 (39%)B	6 (11%)	.000
Smoking (n=130)	118 (29%)	12 (21%)	.258
HIV (n=44)	39 (10%)	5 (9%)	.897
Dyslipidaemia (n=92)	89 (22%)B	3 (5%)	.004
Valve replacement (n=8)	7 (2%)	1 (2%)	.963
Chronic kidney disease (n=2)	2 (1%)	0	.601
TB meningitis (n=10)	10 (2%)	0	.239
Ischaemic heart disease (n=37)	36 (9%)	1 (2%)	.070
EC Disposition			
Discharge (n=77)	74 (18%)B	3 (5%)	.000
Admit (n=289)	268 (65%)B	21 (38%)	
Transfer to tertiary hospital (n=96)	68 (17%)	28 (50%)A	
Death (n=6)	2 (1%)	4 (7%)A	
Time to CT scan			
< 8 hours (n=412)	356 (86%)	56 (100%)	.013
8 hours-2 days (n=29)	29 (7%)	0	
2 days-1 week (n=27)	27 (7%)	0	
Hospital outcome			
Inpatient death (n=41)	37 (9%)	4 (7%)	.648
Survived to discharge (n=427)	375 (91%)	52 (93%)	

A Statistically significantly higher proportion than the corresponding Ischaemic category ($p<0.05$)
B Statistically significantly higher proportion than the corresponding Haemorrhagic category ($p<0.05$)
Percentages may not add up to 100% because of rounding

anticoagulation and those without, the sample does not meet all prerequisites for a Chi^2 comparison.

There was no statistically significant difference between the demographics, comorbidities and other characteristics between those with presumed new and existing AF (Supplementary Table 2). The average age for those with existing AF was 70 years and for those who had presumed new AF, 66 years.

Discussion

The proportion of CT confirmed ischaemic strokes of 80% is in agreement with international statistics [7,14]. Limited data from SA suggests that the number is potentially closer to 71% [4]. This difference could however be explained by the fact that 20% of patients with a clinical diagnosis of an ischaemic stroke did not receive a CT scan – not an uncommon practice in resource challenged settings. Chunga et al. reports that with regards to emergency access to imaging of the brain, 81% of LMICs had access to CT scans, with 84% of them having 24-h access to radiology services, compared to HICs with 83% and 98% respectively [19]. Global data on the availability of medical devices in 2014 estimated that the number of CT scan machines per 1 million population is only 0.32 in low-income centres compared with 42 in HIC and neuro-diagnostic tests are often inaccessible or unaffordable to many patients in LMIC settings [20].

HIV, a known risk factor for ischaemic stroke, was present in 10% of cases, close to double seen in HICs, where the prevalence is between 1 and 5% [21]. This study found no difference in the prevalence of HIV between ischaemic and haemorrhagic strokes. HIV was however more prevalent in ischaemic strokes in a hospital-based series from SSA, where it is reported in over 90% of HIV-associated strokes [21–23]. Combination antiretroviral therapies are beneficial but can be atherogenic and could increase the risk of stroke, especially during the initiation phase of therapy [21].

The prevalence of AF in patients with ischaemic strokes is 11%, lower than the 15-20% reported by the United States, [13,16] and significantly lower than other HICs, where it is reported as being close to 30% [24,25]. This could possibly be due to the fact that this study only included CT confirmed strokes – excluding the 20% who did not have radiological confirmation (20%). Of the 39 patients with confirmed ischaemic stroke without ECGs, 62% were admitted (6 discharged and 9 transferred to tertiary care – Supplementary Table 1). It is not understood why no ECGs were performed despite institutional guidelines. In addition, the majority of patients with no AF had only one ECG done on admission, without any further ECG monitoring. Continuous ECG monitoring for periods of 24-h can approximately double the number of

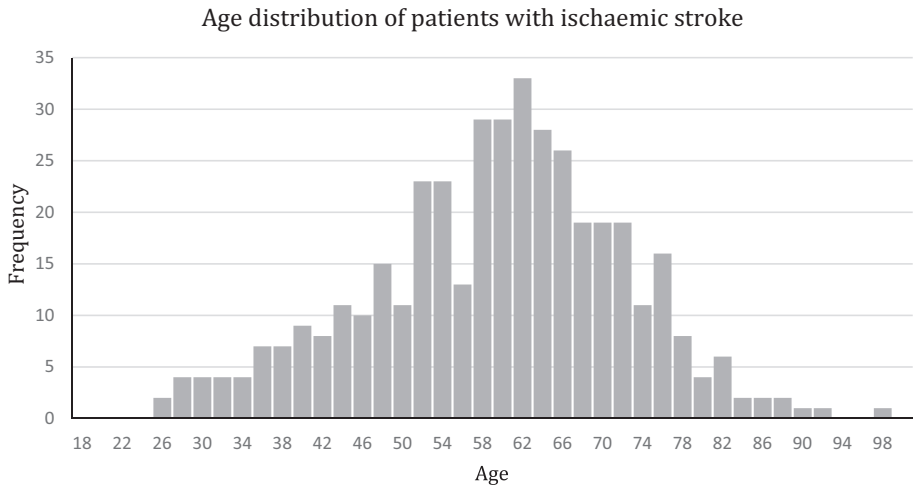

Fig. 2. Histogram of age distribution of patients with ischaemic stroke (n = 412).

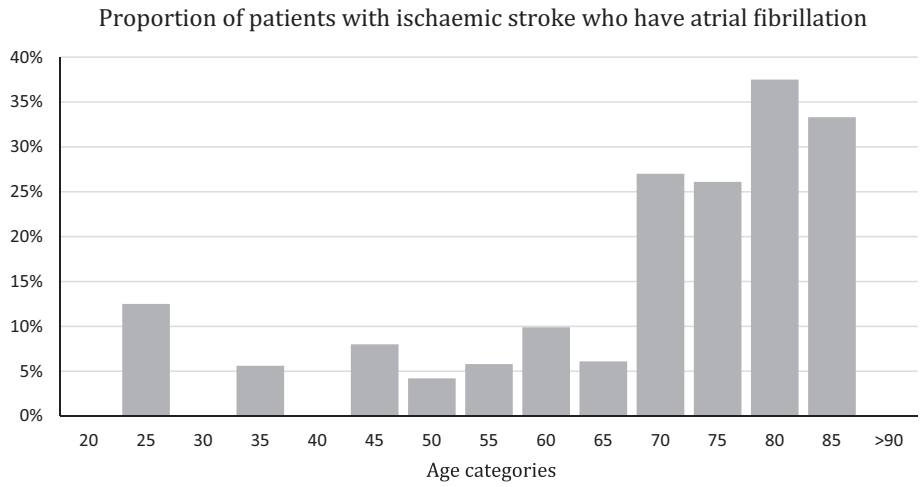

Fig. 3. Proportion of patients with ischaemic stroke who have atrial fibrillation per age category (n = 39).

Table 2
Demographic details and clinical characteristics of patients with ischaemic strokes (n=373).

n (column%)	Atrial Fibrillation		P
	Present n=39 (11%)	Not Present n=334 (89%)	
Gender			
Male (n=189)	18 (46%)	171 (51%)	.551
Female (n=184)	21 (54%)	163 (49%)	
Age			
18-25 (n=0)	0	0	.002
26-35 (n=16)	1 (3%)	15 (5%)	
36-45 (n=39)	1 (3%)	38 (11%)	
46-55 (n=73)	4 (10%)	69 (21%)	
56-65 (n=123)	10 (26%)	113 (34%)	
66-75 (n=86)	13 (33%)	73 (22%)	
>75 (n=36)	10 (26%)B	26 (8%)	
<70 years (n=293)	19 (49%)	274 (82%)A	.000
≥70 years (n=80)	20 (51%)B	60 (18%)	
Comorbidity			
Hypertension (n=295)	35 (90%)	260 (78%)	.084
Diabetes (n=148)	12(31%)	136 (41%)	.229
Smoking (n=110)	6 (15%)	104 (31%)A	.041
HIV (n=36)	1 (3%)	35 (11%)	.113
Dyslipidaemia (n=86)	5 (13%)	81 (24%)	.109
Valve replacement (n=7)	4 (10%)B	3 (1%)	.000
Chronic kidney disease (n=2)	1 (3%)	1 (0.3%)	.067
TB meningitis (n=9)	1 (3%)	8 (2%)	.948
Ischaemic heart disease (n=34)	4 (10%)	30 (9%)	.794
EC Disposition			
Discharge (n=68)	3 (8%)	65 (20%)	.170
Admit (n=246)	26 (67%)	220 (66%)	
Transfer to tertiary hospital (n=57)	10 (26%)	47 (14%)	
Death (n=2)	0	2 (1%)	
Time to CT scan			
< 8 hours (n=319)	35 (90%)	284 (85%)	.548
8 hours-2 days (n=29)	3 (8%)	26 (8%)	
2 days-1 week (n=25)	1 (3%)	24 (8%)	
Hospital outcome			
Inpatient death (n=34)	10 (26%)B	24 (7%)	.000
Survived to discharge (n=339)	29 (74%)	310 (93%)A	

A Statistically significantly higher proportion than the corresponding Atrial Fibrillation category (p<0.05)
B Statistically significantly higher proportion than the corresponding No Atrial Fibrillation category (p<0.05)
Percentages may not add up to 100% because of rounding

AF cases diagnosed when compared to a single short ECG recording [26]. The use of ultrasound signs of left atrial straining, as well as p-wave dispersion on ECG were proven to successfully increase the yield significantly to predict paroxysmal AF in cryptogenic strokes [26–28]. These are cost-effective and quick interventions that could potentially improve secondary AF screening following cryptogenic strokes.

Two thirds of those with AF were newly diagnosed on presentation which may suggest that primary screening practices are lacking [16]. AF satisfies most of the WHO's criteria for a disease suitable for screening [29]. Current European Society of Cardiology guidelines recommend opportunistic screening for AF by pulse taking or ECG rhythm strip instead of a systematic approach in people >65 years [29,30]. This single timepoint opportunistic pulse palpation with confirmatory ECG in elderly adults is potentially feasible and beneficial for primary stroke prevention [31]. In a Canadian study screening for AF, in seniors >65 years during routine appointments with their family physicians, with single lead-ECG is a highly cost effective strategy with an incremental cost per quality-adjusted life-year gained of CAD$ 4788 [32]. which equates to R51 200. Although the risk of stroke related to AF can be reduced by 64–70% with oral anticoagulation, underutilization of this effective treatment and delayed diagnosis remain major obstacles, thus screening at primary care level is of utmost importance [27,31]. Despite increasing data on community-based AF screening becoming available in recent years, questions remain regarding the most appropriate setting and tools. Large-scale systematic AF screening in the community (>4000 individuals) have been conducted in different countries and regions with AF detection (new diagnosis of AF) rates ranging from 0.5 to 5.6% [29].

AF is seen more commonly in males, and male gender being an independent risk factor of AF [9,11]. This sample did not show a difference in gender distribution which could be due to the small sample size (n = 39). Advancing age is a significant risk factor for the development of AF, and with the increase in life expectancy in HICs the prevalence of AF will be higher compared to this population where the median age of ischaemic strokes were 61 years.

The prevalence of young patients with stroke *(≤45 years old)* [18] is significantly higher (15%) compared to HICs, with a prevalence of 18,1/100000 in a French population, obtained from the French Stroke Registry, 10,8/100000 in a Finnish based study and 12,1/100000 in young Italians. Bejot et al., reported the incidence of young patients with stroke had increased by 40% between 1994 and 2012, coupled with an increase in hospitalization [33]. A rise in the non-communicable disease burden, as well as cigarette smoking and alcohol abuse is most likely a contributory factor. HIV has contributed to 38% of all young strokes and has been labelled the leading risk in young Africans [34]. Benjamin et al. found the prevalence of HIV in young stroke in Malawi to be 42% and

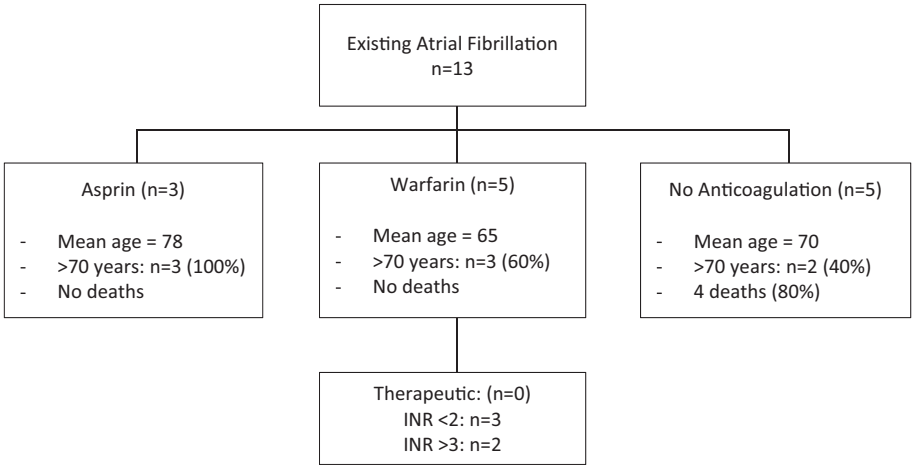

Fig. 4. Clinical characteristics of patients with ischaemic stroke and existing atrial fibrillation ($n = 13$).

that the risk increases during the initiation phase of therapy [35]. Preventive measures are key in this young population as the societal impact is high due to the greater number of years of life lost and the resulting loss in productivity [36]. In addition to HIV as an independent risk factor for developing a stroke in this cohort, it also increases the risk of developing TB meningitis, which in turn, can cause a vasculitis and a resultant stroke. In South Africa, as well as other LMICs, Rheumatic fever is still prevalent and results in valvular heart disease, which once again increases the risk of stroke in the younger population.

A limitation of this study is that it may not represent the true prevalence of AF in patients with ischaemic CVAs due to the following factors: (i) sampling did not include patients discharged from a primary health care facility, those who presented directly to a tertiary facility and those who died before reaching the hospital; (ii) patients who have paroxysmal AF may have been missed by routine screening practices (iii) the data collection process was retrospective and dependent on clinical notes and accurate record keeping, and lastly (iv) the prevalence of AF in patients with ischaemic CVA may be somewhat misleading as 10% of patients with an ischaemic CVA did not have an ECG. Selection bias may further influence the results because only 80% of included patients had a CT scan and ECG's were not analysed in the remaining 20%. This could have led to an underestimation of the prevalence of AF in ischaemic CVA's. Anticoagulation and screening practices may not represent the greater Western Cape community and may reflect district or institution specific practices.

Future research should attempt to calculate the true prevalence of AF in patients with ischaemic strokes, practically involving a multicentre data collection model across different levels of care. Barriers to primary and secondary screening for AF should be investigated and addressed. The alarmingly high rate of young CVAs should warrant an in-depth analysis, especially in our population with a high burden of HIV.

Conclusions

AF is a major risk factor for developing ischaemic strokes. With the increasing population life expectancy, and other CVDs, the prevalence of AF and its complications will increase. Although the risk of stroke related to AF can be reduced significantly by oral anticoagulation, delayed diagnosis and ineffective screening practices remain major obstacles. This study confirms that a significant proportion of patients with an ischaemic stroke have undiagnosed AF and that secondary screening of those with an ischaemic stroke is challenging. ECs should emphasize the importance of a secondary screening ECG, especially in resourced-challenged settings were CT scans are not always available. Since AF is a modifiable risk factor, further studies should aim to explore barriers and challenges to effective screening.

Dissemination of results

Results from this study were shared with staff members at the data collection site through an informal presentation, as well as submitted to the National Health Research Database. The results were also shared with the Division of Emergency Medicine, University of Cape Town.

Author contributions

Authors contributed as follow to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content: MM contributed 50%; CH 40% and KV 10%. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Declaration of competing interest

Dr Clint Hendrikse is an editor of the African Journal of Emergency Medicine. Dr Hendrikse was not involved in the editorial workflow for this manuscript. The African Journal of Emergency Medicine applies a double blinded process for all manuscript peer reviews. The authors declared no further conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.afjem.2020.10.013.

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