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Original article

Access to acute stroke care: A retrospective descriptive analysis of stroke patients' journey to a district hospital

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A R T I C L E   I N F O

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A B S T R A C T

Introduction: The burden of stroke in Africa has increased in the last two decades, with the population undergoing a rapid epidemiological transition, with a rise in the incidence of stroke risk factors together with the gradual aging of the population. Evidence-based guidelines for acute stroke care are often not feasible in resource challenged settings but even when resources are available, considerable delays to definitive care exists. This study aims to describe the factors that influence time from symptom onset to hospital arrival in patients that present to a district level hospital Emergency Centre with confirmed ischaemic strokes.

Methods: A descriptive analysis was performed using a retrospective folder and database review. All adult patients with a confirmed ischaemic stroke, on Computed Tomography (CT) scan, presenting to Mitchells Plain Hospital Emergency Centre during the study period of 12 months (1st of January 2019 to 31st of December 2019), were eligible for inclusion. Data were collected from existing electronic patient databases and the time from onset of symptoms to hospital arrival was extracted from the clinical notes.

Results: A total of 730 (2%) patients presented with a diagnosis of stroke, of which 381 (52%) were included (CT confirmed ischaemic strokes). Only 48 (13%) presented within 4.5 h of symptom onset and the median time from onset of symptoms to presentation to the hospital was 24 h (IQR 12-72 h). The majority of patients (31%) arrived via a primary public emergency medical service (EMS) call, while 29% presented directly to the hospital as self-referrals with private transport. Primary public EMS calls had the shortest call-to-hospital-arrival time (1 hour and 31 minutes), even though the median time from symptom onset to hospital arrival was still 16 h.

Conclusion: The median time from symptom onset to hospital arrival for patients with stroke symptoms is much longer than what evidence-based guidelines suggest. The chain of survival for emergency stroke care is only as strong as its weakest link and the data from this study suggest that improvement campaigns should target stroke education and access to care.

Introduction

Stroke is the second leading cause of death globally, with estimates of 20 million annual stroke deaths and 70 million stroke survivors by 2030.[1,2] The burden of stroke in Africa has increased in the last two decades, with the population undergoing a rapid epidemiological transition with a rise in the incidence of stroke risk factors, together with the gradual aging of the population.[3–5] In South Africa, stroke is responsible for 25 000 deaths annually and 95 000 years lived with disability.[6] Since the year 2000 it is the third most common cause of death after HIV/AIDS and coronary artery disease.[6] Stroke is not only a leading cause of death but also results in long term disability and is associated with significant economic losses.[7] It is estimated that between 3-4% of the total health care expenditure in High-Income Countries (HIC) is spent on stroke care, with the mean lifetime cost of ischaemic stroke per person estimated at $140 048 in the United States.[8] There is a paucity of data describing the economic burden of stroke care in Low- and Middle-Income Countries (LMIC). A study in rural South Africa demonstrated a loss of disability adjusted life years (DALYs) of 1 552 per 100 000 person years due to stroke, twice as high as estimates for HIC during the same time period with the estimated costs of stroke care being between 1.6-3% of the total health expenditure.[1,8,9] The costs of stroke reach far beyond those incurred by health services, with informal care and productivity loss both contributing greatly to the overall financial burden.[10]

Several evidence-based guidelines provide recommendations for acute stroke care. A focus on the role of emergency medical services' early recognition and transport to dedicated stroke units, early imaging and neurologist review, and early intervention through lysis and/or endovascular treatment are common themes.[11,12] Rapid assessment and stabilisation by EMS with transport to dedicated stroke units and

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stroke education to health care personnel, dispatchers, EMS personnel and the general public have demonstrated significantly improved outcomes.[13,14] Even though intravenous thrombolysis for acute ischaemic strokes has been incorporated in the South African Stroke Guideline, controversy regarding its use still remains.[15,16] The benefits of early revascularisation and early admission to a dedicated stroke unit has however been shown to decrease mortality as well as costs, even in a LMIC.[17,18] These guidelines are however developed in HIC and are not feasible for resource challenged LMIC, where the severely ill and injured are still unable to access good quality prehospital and acute care.[15,19,20] Chunga et al. (2019) demonstrated that prehospital services and national emergency numbers were lacking in LMIC, along with significantly less access to specialist neurology and radiology services.[20]

Even when resources are available for reperfusion therapy, most patients in LMIC remain ineligible, due to delays in seeking help after symptom onset, or a lack of access to acute stroke care.[21] Intravenous thrombolysis can be considered for patients who presents within 4.5 h of onset of symptoms, with specific considerations for those who awoke with stroke symptoms.[11,12] Mechanical thrombectomy is recommended up to 6 h post onset of symptoms for large vessel occlusions, but can be extended to 12 and even 24 h if perfusion studies are available.[11,12,22] A paucity of data that explores the barriers of access to acute stroke care in LMIC exists and this impedes the development of locally applicable guidelines. This study aimed to describe the factors that influence time from symptom onset to hospital arrival in patients that present to a district level hospital Emergency Centre (EC) with confirmed ischaemic strokes.

Methods

A descriptive analysis was performed, using a retrospective folder and database review as data collection method.

The study was conducted at Mitchells Plain Hospital (MPH), a district level hospital in the Mitchells Plain Health District of the Metro Region, which is approximately 32km from Cape Town's city centre. The hospital serves a low- to middle-income population of approximately 600 000, which includes the population of Mitchells Plain and the greater part of Philippi, a low-income community in a large nearby township. Mitchells Plain EC attends to an average of 4 000 patients per month with a high burden of non-communicable diseases as well as HIV/TB and trauma. Mitchells Plain Hospital does not have an onsite stroke centre, or neurology services and only have access to CT scans during office hours (08:00-16:00 on Mondays to Fridays). Patients with confirmed or suspected ischaemic strokes who are eligible for revascularisation therapy are promptly transferred to a tertiary hospital 22 km away.

All adult patients with a confirmed ischaemic stroke presenting to Mitchells Plain Hospital EC during the study period of 12 months (1st of January 2019 to 31st of December 2019), were eligible for inclusion. Data from consecutive adult patients (>18 years old) with confirmed ischaemic strokes as confirmed on CT of the brain, were collected. Patients with stroke mimics, those who did not have a CT brain, those transferred from private ECs with missing data and patients who developed ischaemic strokes as an inpatient, were excluded.

Data were collected in four stages. During the first stage, the electronic registry Hospital and Emergency Centre Tracking and Information System (HECTIS) was searched for patients with a clinical diagnosis of a stroke using the International Classification of Diseases 10th revision (ICD-10) codes, namely I63.x. HECTIS is an official provincial application used across the Western Cape to help track patients' throughput in the EC. HECTIS database managers were requested to export required variables of all patients within the ICD-10 I63.x group during the study period onto a spreadsheet. The investigators validated this database by cross-checking the information from a duplicate extraction. Presentations, as documented by nurses during the triage process was also assessed to include all cases with stroke presentations, even if the ICD-10 were inaccurate. Stage two assessed the Picture Archiving and Communication System (PACS) for patients identified in stage one for their CT Brain scan reports. PACS is the official provincial digital application where radiological images can be reviewed, and reports accessed. Confirmation of ischaemic stroke was sought through the presence of signs of an ischaemic stroke or the absence of alternate pathology in an otherwise normal scan. Stage three entailed a manual extraction of information from the clinical notes stored on the Enterprise Content Management (ECM) registry. ECM is an official provincial application used for electronic storage of clinical notes and other documentation. During the final stage, the ETriage database was utilised to obtain information for patients who were transported via EMS. ETriage is an official electronic database used by the Western Cape EMS to document clinical assessment and transfer details with process times. Data were collected by the study investigators. Folder numbers were used to track patients through phases and patients were deidentified as soon as the data collection process was completed. Cases were excluded if patients' clinical data or information were missing or inaccessible. Incomplete data were included and described up to the point where it could no longer be analysed. Cases where time of symptom onset to hospital arrival is missing were excluded from time calculations (Table 1) but demographics were presented for both missing and incomplete data. The time from symptom onset to hospital arrival was obtained from all clinical notes via ECM. If the specific time of onset was not documented or unclear, the closest possible time category, as adopted from Khalema et al. (2018) was used, with up-rounding of estimates.[19] Evidence recommends thrombolysis within 3 h of onset of symptoms, with an extension to 4.5 h in certain cohorts.[12] Mechanical thrombectomy is recommended up to 6 h post onset of symptoms for large vessel occlusions, but can be extended to 12 and even 24 h if perfusion studies are available.[12]

A convenience sample size of approximately 350 over the 12 month data-collection period was anticipated based on the findings of Mayet et al. (2021).[23] Descriptive statistics were used to describe demographics and categorical variables were described and tabulated as proportions and percentages. Categorical variables were analysed for non-random associations by using the Chi^2 test, and continuous variables with the help of the Mann-Whitney U test as all numerical variables did not meet requirements for a normal distribution (Shapiro-Wil's test $p<0.05$). Medians and interquartile ranges (IQR) were used to describe the middle and distribution of numerical data respectively. Statistical significance was defined as a $p<0.05$. Microsoft Excel was used to manage data initially and SPSS Version 28 was used to perform the analysis.

Ethical approval was obtained from the University of Cape Town's Health Research Ethics Committee (HREC 610/2020) and facility approval through the National Health Research Database website (WC_202010_023).

Results

A total of 49 577 patients presented to the EC during the one-year study period of which 38 126 (77%) were adults. Of the 730 (2%) identified with a clinical diagnosis of a stroke, 381 (52%) were included in the final sample. Fig. 1 details the exclusions.

Of the 381 patients, 195 (51%) were females and 186 (49%) males. The age distribution was skewed to the left around a median of 62 years (IQR 51-70), with the youngest and oldest participant being 21 and 90 years old respectively. The largest proportion of patients were in the >65 years old category (n = 141, 37%), and 53 (14%) of patients were under 45 years old (young stroke). Most patients were either unemployed (n = 101, 27%) or earning less than R8 333 per month per family unit (n = 268, 70%). Of all patient that developed symptoms at home (n = 370), 100 (27%) were unemployed. A total of 48 (13%) patients presented within 4.5 h of symptom onset and the median time from onset of symptoms to presentation to the hospital, was 24 h (IQR 12-72). Most of the patients arrived via a primary public EMS call (n = 119, 31%) while 112 (29%) patients presenting directly to the hospital as

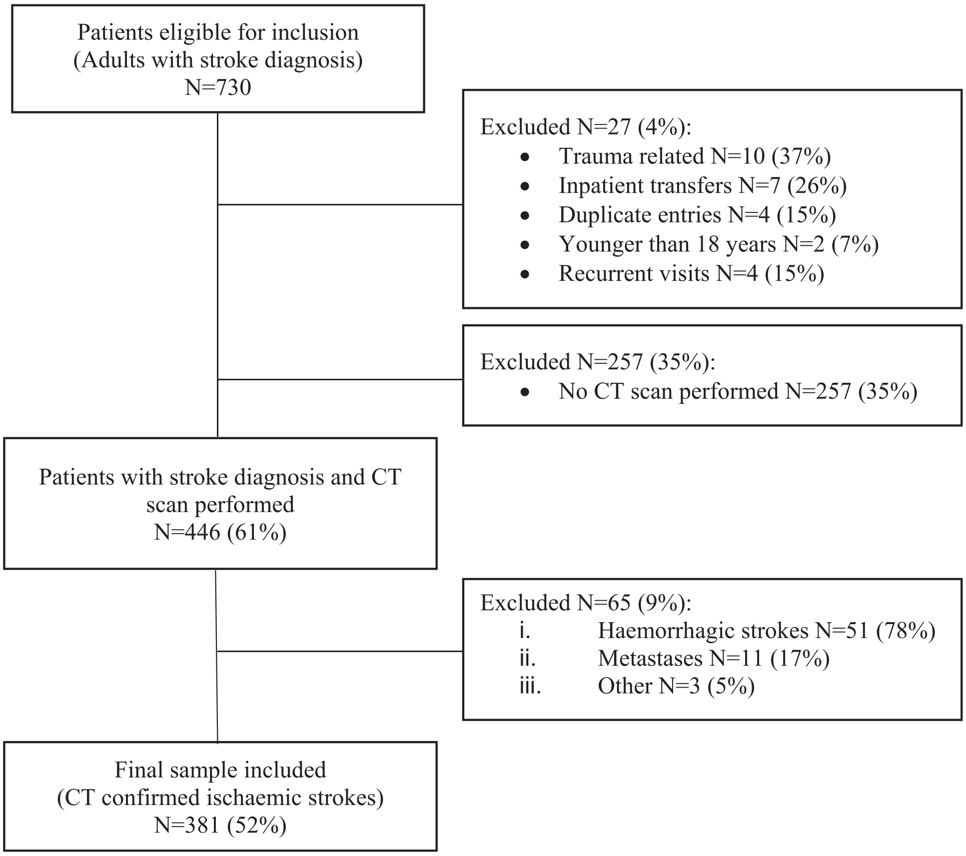

Fig. 1. Flow diagram of study participants.

self-referrals with private transport. Of the patients who arrived via a primary public EMS call, 27 (23%) presented within 4.5 h of onset of symptoms, with a median time of 18 h (IQR 6.5-48) from symptom onset to hospital arrival. Even though they only make up a small subset of patients, those patients within the highest income category had the shortest delay from symptom onset to hospital arrival (12 h). The biggest proportion (60%) arrived within 12 h from the onset of symptoms, with 80% using private transport. Table 1 depicts demographical and clinical characteristics of all patients for each presenting time category. In total, 160 (42%) patients had the time of onset documented clearly, with a specific time documented. A total of 197 (52%) were documented as days and/or weeks e.g., symptoms started 2 days ago. In this instance the time frame was categorised to the closest applicable. For 24 (6%) patients the time of onset of symptoms was not documented in any of the medical notes.

Time from symptom onset to hospital arrival did not differ significantly during weekdays, with a median of 24 h across the days of the week. On weekends, the median reduced to 18 (IQR 11-72) and 14 h (IQR 7-25) on Saturday and Sunday respectively. More patients arrived within 12 h of onset of symptoms outside of office h (29% vs 36%), even though the median time from symptom onset to hospital arrival were similar (25 vs 24 h). A large proportion of patients (n = 293, 77%) were admitted and almost all of the patients, 370 (97%), developed symptoms at home. Patients who required admission presented sooner than those who were discharged from the EC (median: 24 h vs 48 h after onset of symptoms), as well as those who woke with symptoms of a stroke (median: 21 h vs 24 h).

Fig. 2 categorises the time from symptom onset to hospital arrival with more than 60% of patients arriving after 12 h of symptoms onset, and more than 30% arriving after 24 h of symptom onset. Nearly 5% of patients presented after more than a week of symptoms.

Fig. 3 represents the timeline from symptom onset to hospital arrival for each type of presentation. Patients either presented directly or via the general practitioner (GP) with their own private transport, or with EMS directly from scene or via the clinic. The shortest time from symptom onset to hospital arrival occurred with clinic referrals that were transported by public EMS (16 h), with a mean EMS call-to-hospital-arrival time of 2 h and 27 minutes. Primary public EMS calls had the shortest call-to-hospital-arrival time (1 hour and 31 minutes), even though the median time from symptom onset to hospital arrival was still 16 h (IQR 10-48).

Table 2 provides a breakdown of the time from symptom onset to hospital arrival for patients who arrived via primary public EMS calls. Of the 119 patients that arrived via primary public EMS calls, 101 (85%) had a documented EMS presentation on the EMS electronic records. A total of 81 (80%) EMS presentations correlated with a stroke or stroke like symptoms including, *CVA/Stroke* (44%), *TIA* (4%), and *unilateral weakness* (32%). When grouped together, no significant difference was noted when compared to the rest of the documented presentations (scene time p=0.118, EMS call to arrival on scene p=0.099 and EMS call to hospital arrival p=0.376). The median time from symptom onset to hospital arrival, however, was associated with a significant shortening in those with documented EMS presentations of stroke (18 vs 24 h, p=0.005). The overall time from symptom onset to hospital arrival is similar to those who presented via the clinic, (17 vs 17 h) but shorter than the self-referrals (17 vs 24 h).

Discussion

The stroke burden of 2% of all patients that presented to the EC is significant, considering the long-term disability and economic impact a stroke has on the individual, family structures and the community at

Table 1
Demographical and clinical details of all patients per presenting time category, $n = 357$.

N (proportion)	Total	<3 h	<4.5 h	<12 h	Symptom onset to hospital arrival (hours) Median (IQR)	Missing data*
Overall	381	36 (10%)	48 (13%)	128 (36%)	24 (12–72)	24
Age categories						
18–25	2	1 (50%)	1 (50%)	1 (50%)	13.5 (3–24)	0
26–35	16	1 (6%)	1 (6%)	3 (19%)	36 (16–96)	2
36–45	35	4 (11%)	4 (11%)	11 (31%)	24 (12–48)	2
46–55	81	6 (8%)	7 (9%)	21 (26%)	25 (14–96)	4
56–65	106	8 (8%)	10 (10%)	35 (33%)	24 (12–72)	6
>65	141	16 (12%)	25 (18%)	57 (40%)	23 (8–48)	10
Gender						
Male	186	14 (8%)	19 (10%)	62 (33%)	24 (12–72)	8
Female	195	22 (12%)	29 (15%)	66 (34%)	24 (11–72)	16
Income category**						
Unemployed	101	12 (12%)	14 (14%)	43 (43%)	18 (9–72)	6
< R8 333 per month	268	22 (8%)	32 (12%)	80 (30%)	24 (12–72)	18
R8 333 ≤ R29 166 per month	7	1 (14%)	1 (14%)	2 (29%)	72 (9–168)	0
> R29 16 per month	5	1 (20%)	1 (20%)	3 (60%)	12 (6–24)	0
Type of presentation						
Clinic referral	71	1 (1%)	1 (1%)	24 (34%)	17 (11–48)	1
Self-referral	112	13 (12%)	16 (14%)	39 (35%)	24 (12–72)	10
Primary EMS	119	18 (15%)	27 (23%)	50 (42%)	18 (6.5–48)	7
GP referral	76	4 (6%)	4 (6%)	15 (20%)	48 (18–120)	6
Other	3	0 (0%)	0 (0%)	0 (0%)	80 (48–96)	0
Mode of transport						
Public EMS	183	19 (11%)	28 (16%)	73 (40%)	17 (8.5–48)	7
Private	197	17 (9%)	20 (10%)	55 (28%)	24 (12–96)	17
Private EMS	1	0 (0%)	0 (0%)	0 (0%)	96 (96–96)	0
Day of the week						
Monday	57	10 (18%)	10 (18%)	23 (40%)	24 (12–48)	3
Tuesday	63	6 (10%)	7 (11%)	16 (25%)	24 (12–48)	6
Wednesday	61	3 (5%)	6 (10%)	24 (39%)	24 (12–72)	1
Thursday	60	7 (12%)	9 (16%)	20 (33%)	24 (11–75)	7
Friday	63	3 (5%)	5 (8%)	17 (27%)	24 (12–96)	2
Saturday	38	3 (8%)	6 (16%)	12 (32%)	18 (11–72)	3
Sunday	39	4 (10%)	5 (13%)	16 (41%)	14 (7–25)	2
Weekend						
Yes	77	7 (9%)	11 (15%)	28 (36%)	17 (9–48)	5
No	304	29 (10%)	37 (12%)	100 (33%)	24 (12–72)	19
***Office hours						
Yes	153	13 (9%)	16 (11%)	45 (29%)	25 (12–72)	10
No	228	23 (10%)	32 (14%)	83 (36%)	24 (10–48)	14
EC Disposition						
Discharged	80	4 (5%)	5 (6%)	22 (28%)	48 (12–96)	2
Admitted	293	29 (10%)	40 (14%)	103 (35%)	24 (11–48)	20
Transfer up	5	3 (75%)	3 (75%)	3 (60%)	25 (1–62)	1
Deceased in the EC	1	0 (0%)	0 (0%)	0 (0%)		1
Other	2	0 (0%)	0 (0%)	0 (0%)	20 (16–24)	0
Stroke location						
Home	370	33 (9%)	45 (12%)	124 (34%)	24 (12–72)	24
Recreational	3	1 (33%)	1 (33%)	1 (33%)	24 (2–48)	0
Work	4	1 (25%)	1 (25%)	2 (50%)	87 (4–168)	0
Other	3	1 (100%)	1 (100%)	1 (100%)	75 (48–80)	0
Awoke with stroke						
Yes	50	0 (0%)	1 (2%)	21 (42%)	21 (12–24)	0
No	325	36 (11%)	47 (15%)	107 (33%)	24 (10–72)	18

*24 cases with missing data not included in calculations **Income per family unit – as defined by provincial department of health (routinely captured information) ***Office hours 08:00-16:00.
EMS Emergency Medical Services, GP General Practitioner, EC Emergency Centre.

large. This is much higher than reported previously in other provinces of South Africa (0.47 and 0.39 per annum), but similar to a recent study in the Western Cape that assessed the prevalence of atrial fibrillation in patients with ischaemic strokes and found the prevalence of ischaemic stroke to be 2%.[19,23,24] The proportion of ischaemic and haemorrhagic stroke was in keeping with local data and what is reported in the United States of America and Europe (85% and 11% respectively) but in contrast to data from other LMIC where the proportion of haemorrhagic stroke is reported as much higher ranging from 29-57%.[6,10,23,25,26] The median age of 62 years, is congruent with local stroke data, but much lower than the median age of 73 in HIC.[19,23,25,27–29]

The overall time to hospital arrival following onset of symptoms suggestive of a stroke was much longer (median of 24 h) as compared to HIC where it has been reported to be between 3-6 h.[4] Very few patients (13%) presented within 4.5 h of symptom onset. A recent study from South Africa reported the median time from symptom onset to hospital arrival to be 33 h (IQR 8-111 h), with 19% of patients arriving within 4.5 h of symptom onset.[19] These findings are comparable to the findings from our study, perhaps suggesting generalisability of the data to the public health setting in South Africa.[29]

Factors that were associated with earlier presentation included age >65 years (18%), female gender (15%), patients admitted to hospital

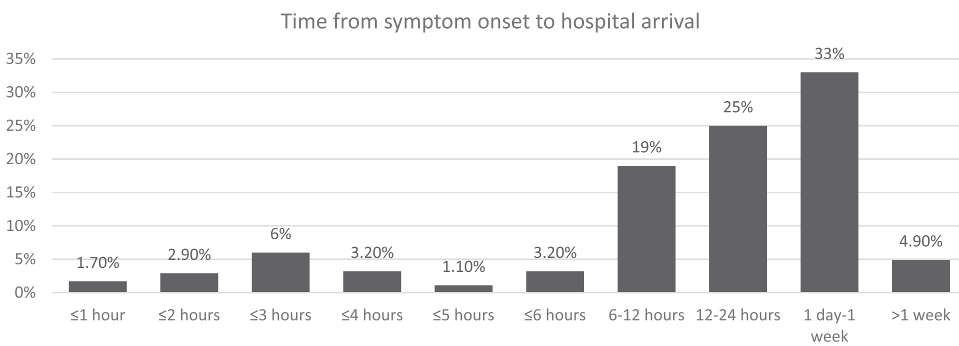

Fig. 2. Proportional breakdown of time from symptom onset to hospital arrival (median).

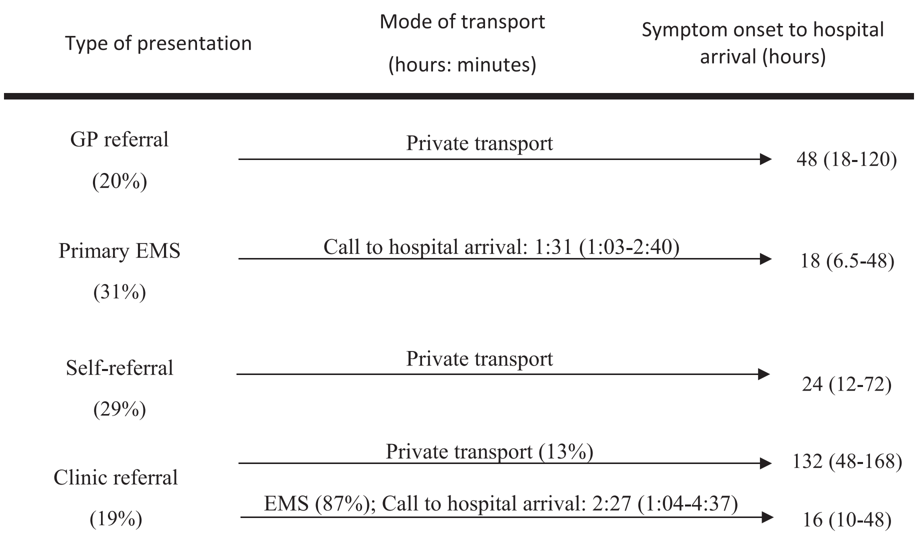

Fig. 3. Breakdown of the timeline of symptom onset to hospital arrival by type of presentation and mode of transport (median (IQR)).

Table 2
Documented EMS presentations and breakdown of time from symptom onset to hospital arrival (median (IQR))* (*n* = 363).

	Total (column%)	EMS call to arrival on scene (hours:minutes)	Scene time (hours:minutes)	EMS call to hospital arrival (hours:minutes)	Symptom onset to hospital arrival (hours)
Overall	101	0:50 (0:21-1:52)	0:18 (0:12-0:25)	1:33 (1:03-2:41)	17 (6-25)
Collapse / syncope	4 (4%)	1:17 (0:48-6:47)	0:16 (0:07-0:38)	2:19 (1:20-8:12)	14 (8-32)
Hyperglycaemia/DKA	3 (3%)	0:57 (0:50-2:55)	0:18 (0:16-0:20)	1:53 (1:29-3:25)	24 (4-72)
Unresponsive	5 (5%)	0:41 (0:40-0:46)	0:16 (0:11-0:28)	1:26 (1:23-1:48)	18 (8-30)
CVA / Stroke	45 (44%)	1:02 (0:20-2:17)	0:18 (0:10-0:23)	1:37 (0:59-3:13)	24 (10-48)
Weakness / Body weakness	4 (4%)	1:02 (0:12-4:30)	0:22 (0:16-0:41)	2:05 (0:50-5:29)	24 (18-24)
TIA	4 (4%)	2:17 (0:43-4:03)	0:16 (0:07-0:24)	2:47 (1:40-4:48)	31 (11-48)
Dizziness	1 (1%)	1:23 (1:23-1:23)	0:25 (0:25-0:25)	1:59 (1:59-1:59)	4 (4-4)
Body pain / Stiff body	2 (2%)	1:02 (0:29- 1:36)	0:31 (0:26-0:36)	1:49 (1:11-2:27)	169 (3-336)
Unilateral weakness	32 (32%)	0:36 (0:18-1:27)	0:17 (0:12-0:25)	1:19 (0:56-2:19)	12 (4-24)
Other	1 (1%)	0:17 (0:17-0:17)	0:21 (0:21-0:21)	1:00 (1:00-1:00)	4 (4-4)

* 18 patients excluded with missing and/or incomplete EMS data.

(14%) and patients arriving with public EMS (23%). Studies from Asia demonstrated that patients >65 years old presented sooner, with the postulation that they are more aware of stroke symptoms, hence the earlier presentation.[28,29] In contrast, data from HIC demonstrated no impact of age on time to hospital arrival in patients with acute ischaemic strokes.[30,31] Factors associated with a delay in presentation included younger patients, under 45 years, (11%), those arriving via GP (6%) and the clinic (1%) and those who awoke with a stroke (2%). This was also demonstrated in numerous international studies where referrals from other medical facilities as well as awakening with symptoms lead to longer delays to hospital presentation.[28,31,32] Patients who arrived at the hospital via primary EMS calls had the shortest delays from symptom onset to hospital arrival, congruent with international data.[4,13,14,27] Considering the relatively quick median EMS call-to-hospital-arrival time of 1 hour and 31 minutes, it is evident that the longest delays occurred before EMS was activated. This could either signify a lack of symptom recognition or a delay in the decision to access health care. Time from symptom onset to hospital arrival was much shorter for patients who presented during the weekend. This is in contrast to other studies in HIC where time of symptom onset and weekday presentation are associated with shorter delays.[27,32,33] Anecdotally, this could be due to better access to transport or improved stroke symptom recognition with the rest of the family or support structure at home, rather than at work. Our study also demonstrated shorter symptom onset-to-hospital-arrival times in patients in the highest income category, where 80% using private transport. Patients who required admission presented sooner than those who were discharged, probably because they had more severe symptoms and it was more obvious or apparent.

A total of 31% patients arrived with EMS of which 65% were via primary EMS calls. Even though there is a paucity of evidence evaluating EMS utilisation as primary access to acute stroke care in Africa, two studies reported very low rates (0% and 7% respectively).[19,34] LMIC often have ineffective or immature prehospital services as well as a lack of a national emergency number, potentially contributing to a lower EMS utilisation rate.[20] The proportion of patients with symptoms of a stroke that are transported to hospital with EMS in HIC, however, are reported to be as high as 60%.[29] The median EMS call-to-hospital-arrival time in our study was 1 hour and 31 minutes, as opposed to 44 minutes reported in North West of England.[35] Patients transferred by EMS from surrounding clinics had a longer time to hospital arrival with a median call-to-hospital-arrival time of 2 hours and 27 minutes. In the United States, scene time for EMS for stroke patients ranges from 13-20 minutes, with guidelines recommending a scene time of 15 minutes for 90% of calls for suspected stroke cases.[36] Our study found the median scene time for all calls to be 18 minutes and when stroke symptoms correlated with EMS presentations, 17 minutes. A study in the United States found EMS sensitivity for stroke recognition to be 74%, with a meta-analysis of the Cincinnati Prehospital Stroke Scale demonstrating sensitivities ranging from 79-95%.[37] We found that of the 101 patients in whom a presentation was documented, 81% correlated with a stroke or stroke-like symptoms. This is in keeping with findings from a study in the United States, where only after implementation of a stroke educational programme, EMS stroke recognition improved from 61% to 79%.[13] Commonality was found in the missed cases, with generalised weakness and dizziness also described in other international studies.[37]

This is the first study of its kind in the Western Cape that describes how patients with a stroke access health care and the delays that are associated with various prehospital factors. The information gained from this study will help understand the barriers to timeous access to stroke care and help inform future research priorities and health policies. This study however only described data from a single centre and inferences may therefore not be generalisable. However, the results do mimic the only other study like this from South Africa who had similar results.[19] By including only CT confirmed ischaemic strokes, a number of patients were excluded and this could potentially have led to selection and misclassification bias – especially in the group who did not receive a CT scan but had stroke symptoms. The decision to exclude stroke mimics, haemorrhagic strokes and unconfirmed ischaemic strokes was based on the potential bias that could have been introduced in the journey of a stroke patient to the hospital, because of confounders, including severity and differing/fluctuating symptoms. Extracting the exact time from onset of symptoms to hospital arrival is not always possible or accurate with retrospective data and a prospective approach could present more accurate data. Another limitation is the fact that disease severity as a confounder was not investigated and the affect is therefore not known. This may have impacted time from symptom onset to arrival, as well as mode of transport. Future studies should investigate different geographical areas and consider a prospective data collection method. A prospective regional stroke-registry could provide valuable answers and should be considered. The reasons for delays to access care should be qualitatively explored by interviewing patients and families in the community, and the association of delays and outcomes should be assessed in future studies.

Conclusion

Even though EMS response times were reasonably swift and comparable to high-income settings, long delays prior to activating EMS resulted in very long symptom onset-to-hospital-arrival times. This may suggest significant barriers with symptom recognition, accessing stroke care or with (a lack of) healthcare seeking behaviour, and should be qualitatively explored. The chain of survival for emergency stroke care is only as strong as its weakest link and the data from this study suggest that improvement campaigns should be focused on the delays prior to accessing health services, including stroke education and access to care.

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Dissemination of Results

The findings of this study have been disseminated to the Emergency Centre and Hospital managers, as well as to the Faculty of Emergency Medicine Cape Town.

Authors' 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: ROM contributed 50%; CH 40%; and UG 10%. All authors approved the manuscript to be published and agreed to be accountable for all aspects of the work.

Declaration of Competing Interests

Dr Clint Hendrikse is an associate 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.

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