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Diabetes and stroke in Qatar: results of a prospective stroke register

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Background: Stroke prevalence is on the increase within Qatar, both within the local indigenous population and the migrants coming into the country for work. There is a perception that diabetes is a major contributing factor in many of the stroke patients but there is a lack of evidence. People with diabetes have a higher risk of stroke disease and within Qatar there has been a rise in people having stroke of 26% per 100,000 head of population in the last decade
Aim: A population-based study, which describes the epidemiology of stroke in respect to presenting HbA1c level.
Methods: The HbA1c level was recorded in 919 patients admitted to hospital during 2014 with a primary diagnosis of ischaemic or haemorrhagic stroke. The patients were divided into three groups according to their HbA1c levels: HbA1c≥ 6.5% (a diagnosis of diabetes), HbA1c 5.7–6.4% (pre-diabetes) and HbA1c≤ 5.6% (normal range). Each group was compared by subtype of stroke, ethnic group, age and gender. Results. The results indicate that Qataris and Arabs are more at risk than other ethnic groups of lacunar infarcts. The average age varies from 49 years for the West Pacific population to 67 years for Qataris. In Qatari nationals, the gender is almost equally divided.
Conclusion: The prevalence of HbA1c≥ 5.7% in the stroke population is on average 77%, whereas in the Qatari stroke population this rises to 88%. The group of patients with HbA1c≥ 6.5% features more prominently in all subtypes of ischaemic strokes.

Key words: Diabetes, stroke register, HbA1c, Qatar, clinical practice

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Introduction and background

Diabetes is one of the most common non-communicable diseases, and is indisputably one of the most challenging global health problems. Type 2 diabetes accounts for 90% of diabetes worldwide.[1] Complications of diabetes are a major cause of morbidity and mortality. There is substantial evidence that it is reaching epidemic proportions particularly in many economically developing and newly industrialised countries. Qatar is in the top 10 countries globally for diabetes with a prevalence of approximately 19.8%.[2] The number of women with diabetes (53.2%) exceeds that of the male diabetic population (46.8%), and reaches a peak in the age group 40–49 years, 13.8% of Qataris have prediabetes.[3]

Stroke is now the second leading cause of death worldwide accounting for 9% of the deaths each year. It is also the No. 1 cause of adult disability. Every year, there is an estimated 16.9 million people having their first stroke, 33 million stroke survivors and 5.9 million who die from a stroke.[4] Within the Middle East, the incidence and prevalence of strokes are low when compared with the western countries; this could be because of the predominance of the younger age groups in this region.[5] The average stroke patient is 20 years younger than that of western countries. In Qatar, stroke incidence is on the increase, the population within the country is increasing at the rate of 30 000 per month, the majority are migrant males of working age from low-income countries. Hypertension is the single most important risk factor for stroke; however, diabetes is increasingly seen as an equally important risk factor. Both diabetes and stroke place an economic burden on the country in terms of the provision and delivery of health care and an emotional toll on patients and their carers.

The rapid urbanisation and lifestyle changes for the indigenous population over the past 30 years have increased the risk factors associated with diabetes and stroke which includes hypertension, hyperlipidaemia, obesity, lack of exercise and smoking. A national diabetes centre has been opened at Hamad General Hospital which is a model for diabetes care across Hamad Medical Corporation. The Supreme Council for Health has recognised stroke prevention and management as high priority, and the first medical specialty ward was developed in Hamad General Hospital for Stroke Care.

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Diabetes and stroke

Poorly controlled diabetes damages the arteries increasing the risk of atherosclerosis, causing high blood pressure which is the single highest cause of stroke worldwide and also causes narrowing and occlusion of the arterial system causing embolic strokes. Diabetes has been found to be an independent risk factor for ischaemic stroke,[6–8] and increases the risk of stroke regardless of ethnicity.[6,7,9] The risk increases by 3% each year, in those with diabetes for 10 years or more there is three times the risk.[9] In the United Kingdom Prospective Diabetes Study (UKPDS 33), the 10-year risk of macrovascular complications was four times greater than the complications of microvascular disease.[10]

The Emerging Risk Factors Collaboration, a meta-analysis of 102 studies analysed 698 782 people without previous vascular disease. In 605 689 people with diabetes and after accounting for other risk factors, diabetes more than doubled the risk of ischaemic stroke.[11] In one follow-up study, the risk ratio for stroke varied with age with an overall 5–14-fold increase in those from 20 to 65 years of age.[12]

People with Type 2 diabetes are more likely to have a stroke at a younger age, the prognosis is poor, there is an increased risk of recurrent stroke and death.[6,8]

In a study of 3020 participants with a previous stroke, 37% had diabetes and 71% of those had haemoglobin greater than 7%,[8] the American Diabetes Association target for HbA1c is <7%.[13] The UKPDS 66 found that the higher the HbA1c the more likely a fatal stroke.[14] The UKPDS 35 found that although hypertension was a major contributing factor for stroke, 1% reduction in HbA1c reduced the risk of stroke by 12%.[15]

Prediabetes and stroke

Prediabetes describes people whose blood glucose levels are higher than the normal range but not high enough to be classified as diabetes. Prediabetes is used to describe people with impaired fasting glucose (IFG) and impaired glucose tolerance (IGT). The diagnosis of prediabetes can be made with HbA1c 5.7–6.4%.[13] Prediabetes is associated with both an increased risk of developing diabetes and an increased risk of cardiovascular disease (CVD).[2,13,16,17] There is evidence that there is an increased risk of stroke, particularly ischaemic stroke in people with prediabetes.[16–19]

The American Diabetes Association Standards of Clinical Care recommend those with prediabetes should be informed that they are at risk of developing Type 2 diabetes and CVD. They should receive advice on how to delay or prevent Type 2 diabetes.[13]

Stroke in Qatar

As Qatar continues to undergo change in both the urbanisation of the country and changes to lifestyle, this increases the risk of diabetes. The consequence of this explosion of diabetes in Qatar will potentially result in more complications, including stroke. Qatar is a country with a high population of migrants compared to Qatari nationals who represent about 35% of the overall population.[20] The risk of stroke in Qatar represents the demographics of the population, the occurrence is lower than that of other countries and occurs in a younger population.[21,22]

The first prospective hospital-based study of stroke in Qatar reported 270 strokes, 217 ischaemic and 53 haemorrhagic. Hypertension and diabetes were the biggest risk factors at 63% and 42%, respectively. The patient fatality rate for stroke at 30 days was 16%, indicating a major cause of mortality and morbity.[20] In 2014, this number has risen to 1065 strokes, 893 ischaemic and 172 haemorrhagic strokes. In terms of stroke patients per 100 000 head of population, the incidence of stroke has risen from 37.4 in 2004 to 46.9 in 2014. The tripling in population size over this period does not account for the increased strokes alone.

At the end of 2014, Qatar had a population of approximately 2 250 000.[23] There is a substantial migrant population from across the globe with a mixture of high-income and low-income countries. Many low-income migrants from the Western Pacific and the Indian subcontinent have had limited access to health care and education. Death from stroke is higher in China, Japan and Taiwan than other countries in the Western Pacific.[24,25] This is largely due to changes in the environment, lifestyle and genetic factors.

In the South Asian population, there is a high prevalence of prediabetes, and the progression of prediabetes to diabetes is high. In comparison with the Caucasian population that has a 2–5% risk of developing diabetes, people from South Asia have a 15–20% risk and diabetes occurs at a younger age.[26,27] The increased prevalence not only occurs in their home country with variations in both urban and rural areas but the prevalence of diabetes is also high in the migrant population.[26–28] Studies have shown a high frequency of ischaemic stroke in South Asians with a higher mortality than white Europeans.[26,29] A study in Qatar reported ischaemic stroke as the more common type of stroke occurring in Arabs and South Asians.[30]

Research design and method

In recognition of the growing prevalence of diabetes and stroke in both the Qatari and non-Qatari population, the government and providers of health care, Hamad Medical Corporation, made the commitment to develop national strategies and public awareness campaigns for both specialities. For the first time in Qatar, a ward was designated specifically for stroke care in the main tertiary hospital at Hamad General Hospital. A prospective stroke register of over 204 data points was commenced to track the patient journey, pathway, outcomes and epidemiology of the stroke. In 2014, 1065 patients were hospitalised with confirmed stroke

disease. This register was searched for all patients with a recorded HbA1c on admission with their stroke event; this provided a population base of 919 patients. The patients were divided into three groups: those with an HbA1c $\geq$ 6.5% (a diagnosis of diabetes), HbA1c 5.7–6.4% (prediabetes) and HbA1c $\leq$ 5.6% (normal range). Patients were entered into those groups even if they had unknown diabetes or prediabetes. The decision to use HbA1c as the indicator rather than a reported history of diabetes was because of the 393 patients who presented with a known history of diabetes and 74% had a recorded HbA1c of greater than 7.0%. Each group was compared for ethnicity, age, metabolic syndrome and outcome being the subtype of stroke suffered using the Bamford classification.[31]

To review the subtypes of stroke, each stroke was categorised into intracranial haemorrhage, transient ischaemic attack or ischaemic infarcts using the Oxford (Bamford) classification (Fig. 1).

The Oxford Community Stroke Project classification, also known as the Bamford classification, is based on the initial presenting clinical symptoms. Using the symptom criteria, the stroke episode is classified as total anterior circulation infarct (TACI), partial anterior circulation infarct, LACunar Infarct or POsterior Circulation Infarct (POCI). These four categories predict the extent of the stroke, the area of the brain that is affected, the underlying cause and the prognosis.[32]

The ethnicity of the patients was grouped into six categories: Qatari Nationals, South Asians (Indian, Pakistani, Bangladesh, Sri Lanka, Nepal), Western Pacific (Philippines, Korea, China, Japan), African (Sudan, Kenya, Morocco, Tanzania), Arabs (Saudi, Oman, Lebanon, Egypt, Yemen, UAE) and Caucasian (UK, America, Europe, Canada, Australian).

Results

Of the 1065 patients who presented with confirmed stroke disease, 919 people had a recorded HbA1c on admission.

Gender

The gender population distribution in Qatar is skewed by the extensive working age migrant population, 75% of country's residences are male. This is reflected in the stroke population, only 22% are female and 61% of the females had a recorded HbA1c greater than 6.5% compared with 50% of the males. Twenty-five percent of both genders had prediabetes. However, in the Qatari nationals, the gender divide is almost equal, 49% female and 51% male, and there was no significant difference between the genders with regard to which HbA1c category the patients were in.

Ethnicity

Across the stroke population, the largest ethnic group seen in the hospital with a stroke is of South Asian origin, this leads to the perception that it is an expatriate issue. However, the figures for per 100 000 head of population, it is the Arabs and Qataris that are more at risk of stroke than the other four ethnic groups. The average age for a stroke in Qatar for a male is 53 years old and 63 for

Classification	Symptoms	Mortality	Recurrence
Total Anterior Circulation Stroke (TACS)	Higher Cerebral Dysfunction & Homonymous Visual Field Defect & Ipsilateral Motor +/- Sensory Deficit	39% at 1 month 60% at 1 year,	Low Risk
Partial Anterior circulation stroke (PACS)	2 out of 3 of TACS Symptoms OR Higher Cerebral Dysfunction Alone OR Monoparesis	4% at 1 month 16% at 1 year	Very High Risk
Lacunar stroke (LACS)	Motor Stroke OR Sensory Stroke OR Sensorimotor Stroke OR Ataxic Hemiparesis	2% at 1 month 11% at 1 year	Low Risk
Posterior circulation stroke (POCS)	Ipsilateral Cranial Nerve Palsy with Contralateral Motor Deficit OR Bilateral Deficit OR Disorder of Conjugate Eye Movement OR Cerebellar Dysfunction OR Isolated Homonymous Hemianopia	7% at 1 month 19% at 1 year	High Risk

Figure 1 Bamford classification.

	per 100,000	Average Age
African	32	58
Caucasian	32	61
S. Asian	34	50
W Pacific	32	49
Arabs	51	62
Qatari	67	67

Figure 2 Ethnic groups, age.

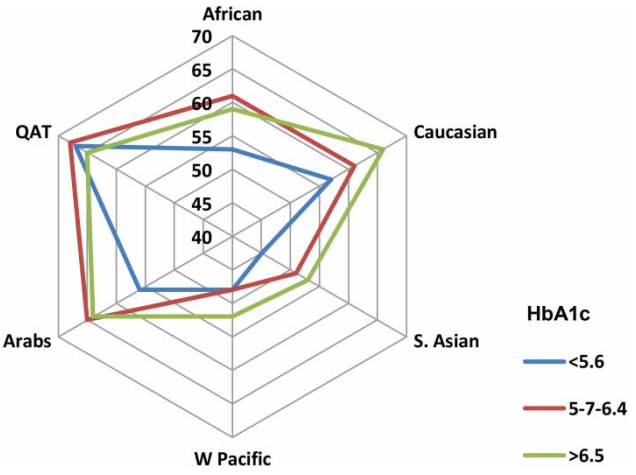

Figure 3 Mean average age compared with ethnicity for each HbA1c group.

females. By ethnicity, the age varies from an average age of 49 years for the Western Pacific population to 67 years for Qataris (Fig. 2).

Cross reference the three HbA1c groups with ethnicity and age, and the results indicate that the younger strokes are occurring in the non-diabetic group. Prediabetes and increasing age appear to be linked in the Africans, Arabs and Qataris (Fig. 3).

In the Qatari population, 19.8% are estimated to be diabetic, and a further 13.8% prediabetic; however, in the stroke caseload 70% of Qataris are diabetic with a further 18% prediabetic. This figure is far higher than in the other ethnic groups. The other Arabs and the South Asian group show a very similar picture with 50% already in the diabetic group and a further 25% in the prediabetic group. The Western Pacific stroke patients are equally distributed across the groups with the highest number of prediabetics at 34%. In the Caucasian stroke population, the picture is almost the reverse of the Qatari with diabetes or prediabetes as a relative reduction factor for their strokes (Fig. 4).

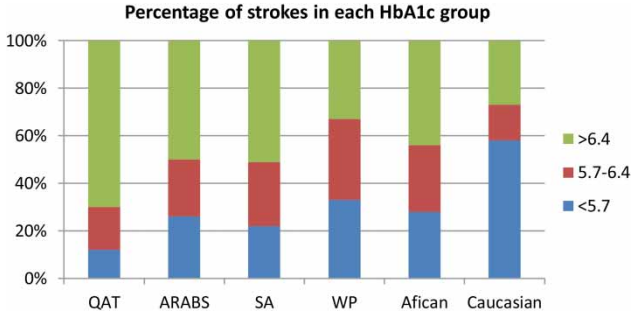

Figure 4 Percentage of stroke in each of the HbA1c categories by ethnicity.

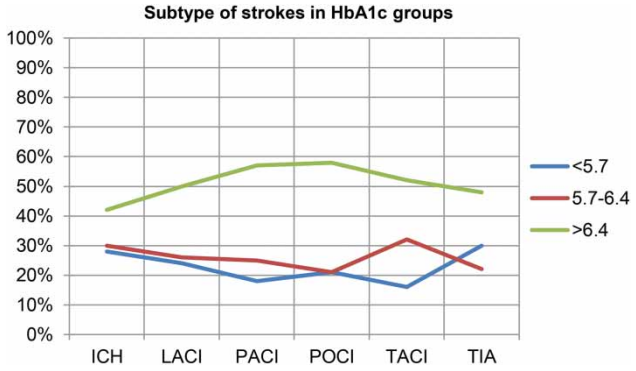

Figure 5 Percentage of subtypes of stroke.

Stroke subtypes

As expected from the wealth of research available, the group of patients with HbA1c ≥ 6.5% features more prominently in all subtypes of stroke. In the United States and other western nations, lacunar infarcts (small vessel disease) account for 15–25% of all ischaemic strokes. In Qatar small vessel disease is more common, leading to 60% of strokes due to small vessel disease (hypertension and diabetes being the main risk factors) as per stroke registry in Qatar.[33,34] But HbA1c ≥ 6.5% occurs more consistently in all the ischemic strokes, there is a high correlation in the POCI and partial anterior circulation stroke subtype. Around 20–30% in all subtypes has an HbA1c 5.7–6.4% and features more strongly in the TACI (Fig. 5).

Conclusion and changes in practice

There has been a collaborative working between the diabetes CNS and the stroke CNS with the rest of the multidisciplinary stroke team in order to amend the stroke guidelines. It is now policy for all stroke admissions to have an HbA1c test at the time of admission. Patients are informed of their HbA1c level, if this is ≥6.5%, then a diagnosis of diabetes is made, or if it is a known diabetic, then the diagnosis of poorly controlled diabetes is made. The patient will be seen either as an inpatient or as an urgent outpatient by the diabetic educators, and followed up on a regular basis. If the HbA1c is 5.7–6.4%, the

diagnosis of prediabetes is given, and the patient is referred and seen by the dietician while an inpatient for lifestyle advice and followed up in the stroke clinic. Extensive education sessions and stroke/diabetes competencies have increased the awareness of the problem among the ward stroke nurses, and empowered them to refer direct to the dietician and to reinforce the advice from the dietician and diabetes educator. The ward stroke nurses take time to sit and explain about lifestyle and modifiable risk factors to educate the patient and family to reduce the risk of a second stroke. They explain to the patients about their diet, taking medication, stopping smoking, exercise and the importance of attending appointments even if they feel well. The POCI and partial anterior circulation strokes group of patients have a high correlation with the diabetes group, both have a high risk of reoccurrence and therefore secondary prevention is essential. Diabetes education to understand the relationship between diabetes and stroke is extremely important, one of the main benefits of a dedicated stroke unit has been in having a cohort of nurses that can be trained to specialise in holistic stroke care. The prediabetic group features more strongly in the TACI, given the extremely poor prognosis for this group of patients, the identification and treatment of prediabetes is important in stroke prevention.

Given the migrant population, the ability to follow up patients or compare groups is problematic. Therefore, to measure if the changes within the stroke service have achieved their goals, the HbA1c will be repeated in the stroke prevention clinic at 6 months for all stroke patients still within Qatar.

The prevalence of diabetes is increasing worldwide not least in the Middle East and North Africa region. The rapid urbanisation in Qatar brings with it an increasing population and lifestyle changes leading to metabolic syndrome and the macrovascular complications of diabetes including stroke. Hamad Medical Corporation has addressed the need to provide a stroke and diabetes service which continues to expand to meet the needs of the population.

The authors recognise the necessity to raise public awareness and education as a primary prevention of stroke. There is a public awareness diabetes campaign in Qatar, and this has been followed by a stroke campaign. By targeting the known patients with diabetes and taking the opportunity for screening and treating prediabetes at an earlier stage, the aim is to reduce the stroke prevalence per 100 000 head of population. The changes within the stroke service will be monitored and adjusted as required, and a further analysis will be conducted next year to see if the rate of second strokes within the Qatar population has decreased.

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Disclaimer statements

Contributors Both JB & PB developed the idea. JB screened citations, screened full text papers and developed the manuscript. PB screened citations, extracted data and undertook analysis.

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Ethics approval None.

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