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[Stroke in Adults, Stroke Types and Risk Factors: A case control study]

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ABSTRACT:

Objective: Globally, stroke is the second leading cause of death for old age people above 60 years, and the fifth leading cause in people aged 20 to 59 years old; and this is also the situation in Palestine. There are many risk factors know to be linked and related to stroke. This study aims to assess risk factors for the development of stroke among stroke survivors and their adult control.

Method: This study is a case-control study which consisted of 450 participants aged ≥45 years, (150 cases with first stroke and 300 controls with no history of stroke), was hold studied between Mar. 2015 to Sep. 2015 in Gaza strip, Palestine. For data collection, a self-designed questionnaire was used to interview the participants .

Results: We have directly interviewed 450 participants, 150 of them suffered first stroke (126 suffered ischemic stroke "84%"; 24 suffered hemorrhagic stroke "16 %") and 300 controls. Significant common risk factors for all strokes were: history of HTN (OR 2.22, 95% CI 1.44-3.47); DM (OR 2.25, 95% CI 1.51-3.36); Cardiac disorder (OR 1.67, 95% CI 1.09-2.55); obesity (OR 1.611, 95% C.I. 1.058–2.445) .

Recommends Proper nutritional counseling and nutritional recommendation should be integrated in the care of patients who are at risk of developing stroke especially obese patients with hypertension or diabetes in hospital and PHCC to increase and promote the patient's awareness about the stroke risk factors.

Keywords: risk factors, ischemic stroke, hemorrhagic stroke, and Gaza Strip.

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الملخص:
الجلطات الدماغية عالمياً هي السبب الرئيسي الثاني للوفاة بالنسبة للأشخاص فوق سن 60 عاماً، والسبب الرئيسي الخامس في الناس الذين تتراوح أعمارهم بين 20-59 سنة. وكذلك الوضع في فلسطين هناك العديد من العوامل التي ارتبطت بشكلٍ مباشرٍ في حدوث الجلطات الدماغية، ففي السنوات الخمسين الماضية كانت هناك تغيرات ملحوظة في سلوكيات الحياة وانماطها، هذه التغييرات في نمط الحياة أدت إلى زيادة الإصابة بالجلطة الدماغية. لذا هدفت الدراسة إلى معرفة عوامل الخطر التي أدت إلى حدوث الجلطات الدماغية بين الناجين من الجلطات الدماغية. واستخدم الباحث المنهج التحليلي حيث درست الحالات المرضية مقارنة بعينةٍ (مجموعة) ضابطة. تكونت عينة الدراسة من 450 مشارك موزعين إلى مجموعتين, **المجموعة الأولى** تكونت من 150 حالة مرضية ممن تزيد أعمارهم عن 45 سنة وقد شخّصهم أطباء الأعصاب بالإضافة إلى الصورة المقطعية للدماغ (CT Scan) بأنّهم مصابون بجلطةٍ دماغيةٍ حادةٍ لأول مرة, وأُدخلوا إلى أقسام الباطنة في المستشفيات الحكومية المركزية، أمّا **المجموعة الثانية** فتكونت من 300 فرد لم يعانوا من أي أمراض تتعلق بالجلطة الدماغية وتم اختيارهم بطريقةٍ عشوائيةٍ من مراكز الرعاية الصحية الأولية (المستوى الرابع)، وتم الأخذ بعَيْن الاعتبار تطابق الجنس والعمر والمنطقة السكنية حسب المجموعة المصابة. وتوصلت الدراسة أن الأمراض المزمنة كارتفاع ضغط الدم والسكري وأمراض القلب والسمنة ارتبطت ارتباطاً وثيقاً بالإصابة بالجلطات الدماغية. إضافة إلى أن إرتفاع ضغط الدم والعمر أقل من خمسين عاماً ارتبط بالنزيف الدماغي، بينما السكري والعمر أكثر من ستين عام والتدخين ارتبط بالجلطة الدماغية, وكانت علاقة الارتباط عالية وذو دلالة إحصائية بحدوث المرض.

الكلمات المفتاحية: عوامل الخطر، الجلطة الدماغية، الجلطة الدماغية النزيفية، قطاع غزة.

Introduction:

Stroke or Cerebrovascular Disease (CVD) is a clinical syndrome with rapid onset and focal neurological deficits that persists for at least 24 hours unless death occurs. It is mainly due to disruption of blood circuit to a portion of the brain, thereby depriving cells from oxygen and glucose leading to impairment and loss of cells. Stroke is a generic term referring to a group of disorders that include cerebral infarction, cerebral hemorrhage, and subarachnoid hemorrhage, and that describes the abrupt and sudden nature of onset (Strong et al, 2007).

There are 15 million people worldwide who suffer a stroke each year. According to the World Health Organization (WHO, 2012). Globally, stroke is the second leading cause of death for people above the age of 60 years, and the fifth leading cause in people aged 15 to 59 years old (World Heart Federation, 2015). Each year, nearly six million people worldwide die from stroke. One in six people worldwide will have a stroke in their lifetime. Every six seconds, stroke kills someone (World Stroke Organization, 2012). Stroke is the leading cause of gait impairment in rehabilitation facilities (Mant & Walker, 2011), in the US; stroke is the number one cause of long-term disability (American Heart Association, 2015). Overall, in 2010, an estimated 16.9 million cases of incident stroke took place worldwide (69% in low-income and middle-income countries), 33 million prevalent stroke cases (52% in low-income and middle-income countries), 5.9 million stroke deaths (71% in low-income and middle-income countries) (Feigin et al., 2014).

According to the annual report of the Palestinian Ministry of Health (MoH, 2014A), it is stated stroke are the third leading cause of death in general population (8.8%), with a rate of 25.6/100,000. It was shown that it is the fifth leading cause of death in male (7.5%), and third leading cause of death in female .(%10.2)

Limited studies were conducted in Gaza Strip (GS) to investigate risk factors for stroke but no study has investigated yet the risk factor for stroke. So, this study is hoped to promote evidence-based prevention, diagnosis and management of stroke that is suitable for our local situation which will help primary & secondary health providers in the prevention and early detection of stroke risks.

Research Problem:

During recent years and based on many observations, hospitals records and annual report, stroke is a becoming serious problem in Palestine, and it needs a special and comprehensive care. According to the Palestinian Annual Report 2013, the mortality rate among CVD between (20-59) years old is high in comparison with other diseases, and it accounts for 5.1% of all deaths. Also, the mortality rate among CVD over 60 years old is higher in comparison with other diseases, it accounts 14.1% of total death (MoH, 2014A).

The status of health in Palestine in 2013 showed that the mortality rate among CVD in males is high in comparison with other diseases and it accounts 7.5%. The mortality rate in females also is high, and it accounts for 10.2% for all deaths. The mortality rate among cerebrovascular diseases in both males and females between (60-75) years old are high and they account 14.1% (MoH. 2014A). No previous studies have been located in the literature about risk factor and stroke diseases in GS, therefore, this study could answer important questions related to the impact on risk factors to develop stroke in GS. The study could provide valid and credible information about the stroke advices, and provide some awareness for stroke patients towards adopting healthy life style.

General objective:

To assess risk factors for development of stroke among stroke survivors and adult in Gaza Governorates.

Specific objectives:

- To assess the relationship between chronic diseases (Hypertension, Diabetes and Cardiac disease) and the development of stroke.
- To assess the relationship between obesity (BMI) and the development of stroke.
- To examine the association between certain personal and behavioral characteristics (Education level, Employment and smoking) and the occurrence of stroke.

Research questions:

- What is the relationship between chronic diseases and stroke?
- What is a significant relationship between stroke and BMI?
- Is there a relationship between socio-economic conditions and stroke?
- Is there any possible association of lifestyle (education level and smoking) and occurrence stroke?
- Is there a significant relationship between family history and stroke?

Study definition

This part will contain the definition of terms included in this study

Risk factors: A risk factor is any attribute, characteristic or exposure of an individual that increases the likelihood of developing a disease or injury, but is not necessarily causal factors. Some examples of the more important risk factors are underweight, gender, high blood pressure, tobacco and alcohol consumption, and unsafe water, sanitation and hygiene (WHO,2015).

Stroke: A clinical syndrome characterized by an acute loss of focal cerebral function with symptoms lasting more than 24 hours or leading to death, and which is thought to be due to either spontaneous hemorrhage into the brain substance (hemorrhagic stroke) or inadequate cerebral blood supply to a part of the brain (ischemic stroke) as a result of low blood flow, thrombosis or embolism associated with diseases of the blood vessels (arteries or veins), heart or blood (Warlow et al, 2008).

Body mass index: Is a number calculated from a person's weight and height. BMI is a fairly reliable indicator of body fatness for most people. Calculated by weight in Kilograms (Kg) divided by the square of height in meter (CDC, 2015).

Interpreting the BMI:

Table 1.1 Combined recommendations of BMI cut-off points made for overweight or obesity, and association with disease risk

	Body mass index	
	Range	**Obesity class**
Underweight	<18.5	
Normal	18.5–24.9	
Overweight	25.0–29.9	
Obesity	30.0–34.9 35.0–39.9	I II
Extreme obesity	> 40.0	III

According to the CDC (2015), BMI < 18.5 kg/m² is considered underweight, from 18.5-24.9 kg/m² is considered normal weight, from 25-29.9 kg/m² is considered overweight (pre-obesity) and ≥ 30 kg/m² is considered obese (CDC, 2015).

Smoker: Anyone who smoked 100 cigarettes in their lifetime and currently smoke cigarettes every day or someday (CDC, 2015).

Current Smoker: Any person who smokes tobacco both daily and occasionally at the time of the study or the survey (CDC, 2015).

Literature review

Definition of stroke

A stroke is a sudden onset of neurological impairment that is caused by a disruption of the blood supply to the brain, which may be either ischemic or hemorrhagic in origin (Mant & Walker, 2011). The term "stroke" usually refers either to a cerebral infarction or to non-traumatic cerebral hemorrhage. Depending on the population you are seeing (ethnicity, age, comorbidities) the ratio of infarcts to hemorrhages is about 4:1 (Uchino et al, 2011).

Ischemic stroke is caused by obstruction of a blood vessel supplying the brain, either due to in-situ thrombus or embolus from a distant site (most commonly the carotid arteries or the heart). Hemorrhagic stroke is caused by bleeding of a blood vessel supplying the brain (Warlow et al, 2008).

As a result, the affected area of the brain cannot function, which might result in an inability to move one or more limbs on one side of the body, inability to understand or formulate speech, or an inability to see one side of the visual field (Donnan et al, 2008).

Stroke is defined by the WHO as a clinical syndrome consisting of rapidly developing clinical signs of focal (or global in case of coma) disturbance of cerebral function lasting more than 24 hours or leading to death with no apparent cause other than a vascular origin (Hatano, 1976).

Epidemiological background

Nearly 20 million people worldwide suffer a stroke each year; of these, 5 million will not survive. According to the WHO, stroke is the second leading cause of death for people above the age of 60 years, and the fifth leading cause in people aged 15 to 59 years old (World Stroke Organization, 2012). Each year, nearly six million people worldwide die from stroke. One in six people worldwide will have a stroke in their lifetime. Every six seconds, stroke kills some. In fact, stroke continues to be responsible for more deaths annually (World Heart Federation, 2015).

According WHO, estimated 17.5 million people died from CVD in 2012, representing 31% of all global deaths. Stroke is the fourth leading cause of death in low-income countries, approximately 52/100.000 population, second leading cause of death in lower-middle income countries, approximately 78/ 100,000 population, first leading cause of death in upper middle countries, approximately 126/ 100,000 population, and second leading cause of death in high income countries, approximately 95/ 100,000 population (WHO, 2012).

In Arab countries, incidence rates for all strokes ranged from 11.7 / 100,000 in Qatar to 63 / 100,000 in Libya. Incidence rates for hemorrhagic stroke were 2.7 / 100,000 in Qatar, 1.9 / 100,000 in Saudi Arabia and 10.4 / 100,000 in Iran (Tran et al, 2010).

Stroke mortality is affected by stroke incidence, the mortality rate of stroke subtypes and the level of stroke care. Cerebral hemorrhage have a much higher mortality rate than ischemic stroke, and therefore better control of HTN is likely to lead to decrease in its incidence, and result in a fall in stroke mortality (Mbbs et al, 2007).

In Palestine and according MOH, stroke is the second leading cause of death for people above the age of 60 years, approximately 14.1/100,000 population and the fifth leading cause in people aged 20 to 59 years old, approximately 5.1/100,000 population. Total stroke is the third leading cause of death with a rate 8.8% and approximately 25.6/100,000 population (MOH, 2014A).

Classification of stroke

There are different approaches to classification of acute stroke. International classification of diseases and problems made by the WHO regarding health (tenth audit- -ICD 10) includes diseases and signs, symptoms, abnormal test results, complaints, social circumstances and external causes of injuries and illnesses. This classification classifies stroke under codes from I 60 to I 69 into following subgroups: subarachnoid hemorrhage, intracerebral hemorrhage, other non-traumatic hemorrhages, cerebral infarct caused by extracerebral or intracerebral occlusion, as well as non-specific stroke (Kadoji et al, 2012).

Ischemic stroke

An ischemic stroke is death of brain tissue due to interruption of blood flow to a region of the brain, this deprives the brain cells of oxygen and nutrients, and cells may begin to die within minutes.

Cause by occlusion of a cerebral or cervical artery or less likely, a cerebral vein (Uchino et al, 2011). About 80–90% of strokes are ischemic in origin (Mant & Walker, 2011).

Transient Ischemic Attack (TIA)

A transient ischemic attack (TIA) is traditionally defined as an acute loss of focal cerebral or ocular function with symptoms lasting less than 24 hours, which is caused by embolic or thrombotic vascular disease. The distinction between TIA and stroke is one of duration of symptoms, with 24 hours representing a watershed between the two (Easton et al, 2009). This distinction is arbitrary–some patients with symptoms lasting less than 24 hours have evidence of infarction on brain imaging, and others with more protracted symptoms have no such evidence. Clinically, the distinction does not matter since the management of TIA and minor stroke is essentially the same. The incidence of TIA and minor stroke that presents like a TIA is of the order of 1/ 1000 people/ year (Mant & Walker, 2011).

About a quarter of patients with ischemic stroke have a TIA first, and over 40% of these occur in the week preceding the stroke. In the past, the risks of stroke following TIA were under-estimated. The true risk of stroke following an untreated TIA is around 8% after 7 days and 17% after 90 days, with the risks following a minor stroke a little higher. The individual risk following a TIA varies considerably, depending on simple clinical features (how long the TIA lasts, and whether or not it leads to unilateral weakness or speech disturbance) and age, Blood Pressure (BP) and diabetes mellitus (Uchino et al, 2011). These risk factors have been operationalized into a simple clinical score, the ABCD2 score, whereby people with TIA are assigned a score varying between 0 and 7, depending on the presence or absence of these features. The higher the ABCD2 score, the higher the risk of stroke. About two-thirds of patients with TIA would be expected to have an ABCD2 score ≥4, and over 90% of strokes that occur in the week following a TIA occur in patients with an ABCD2 score ≥4 (Johnston et al, 2007).

Hemorrhagic strokes

Hemorrhagic stroke represents 15% of all strokes, but they are responsible for about 40 % of all stroke deaths. It occurs when a blood vessel in the brain leaks or ruptures. Hemorrhages can result from a number of conditions that affect blood vessels, including uncontrolled high BP (hypertension) and weak spots in blood vessel walls (aneurysms). A less common cause of hemorrhage is the rupture of an arteriovenous malformation, blood dyscrasias/ bleeding disorders, anticoagulants, bleeding into tumors, angiopathies (Goldstein, 2009).

Risk factor of stroke

Given the devastating deficits often associated with a stroke, the need for prevention is obvious. Many of the risk factors for stroke can be treated or modified. Doing so may prevent an initial stroke or recurrent strokes, as well as decrease the risk of premature death, which is most often the result of coronary disease. A number of stroke risk factors are the same as those for heart disease, although their relative importance varies.

Obesity

Obesity has become one of the most prevalent conditions making a significant impact on public health worldwide (Winter et al, 2008). Obesity is associated with an increased risk of stroke, whether measured by BMI, WC, or WHR (Bodenant et al, 2011). The association between obesity and stroke remains controversial, with published studies showing positive or negative association. While systematic differences in the risk factors for stroke subtypes and the proposed biological mediators

influencing the causal pathway between obesity and stroke may occur, previous studies have seldom characterized stroke subtypes or adequately examined the influence of such biological mediators. Most studies have been too small to adequately describe the nature of any BMI and stroke relationship (Song et al, 2004).

Individuals with a BMI of 30 kg/m^2 or more have double the incidence of ischemic and hemorrhagic stroke compared with individuals with a BMI of less than 23 kg/m^2. Each unit increase in BMI is associated with an increase in the adjusted risk of stroke by about 6% (Kurth et al, 2002). Among adults who are overweight or obese (BMI 25–50 kg/m^2), each 5 kg/m^2 increase in BMI is associated with about 40% higher mortality from stroke. Individuals with a waist-to-hip ratio in the highest tertile (>0.96 in men and >0.93 in women) have a 65% increased risk of stroke compared with individuals in the lowest tertile (<0.91 in men and <0.86 in women). The population attributable risk of stroke associated with an increased WHR is 26.5% (O'Donnell et al, 2010).

There are other studies showing that increasing BMI is associated with a graded elevated risk of stroke (Rexrode et al, 1997; Kurth et al, 2002; Abu-Odah et al, 2014). In other studies, however, no relation was found between BMI and stroke risk (Lu et al, 2006). Possibly, BMI is not an appropriate indicator to assess the risk of stroke (Suk et al, 2003). Markers of abdominal obesity have rarely been studied in cerebrovascular disease. In 2 of those studies, WHR was more strongly associated with the risk of ischemic stroke than BMI, but the strength of this association was attenuated after adjustment for cardiovascular risk factors (Hu et al, 2007; Winter et al, 2008). Zhang X et al (2009) demonstrated that increasing levels of general or abdominal adiposity consistently predict risk of stroke in predominantly non-obese Chinese women. In other large-scale studies showed that BMI is not a good indicator of stroke. So, we've chosen abdominal obesity and to find out its relation with ischemic stroke (Tanne et al, 2005; Warlow et al, 2003). Abdominal or visceral obesity emerging as a risk factor for stroke according to various large-scale studies worldwide but not the BMI (Winter et al, 2008).

Hypertension (HTN)

A major risk factor to stroke, high blood pressure is present in 50 to 70 % of stroke cases, depending primarily on the type of stroke (Abu-Odah et al, 2014). The long-term effects of the increased pressure damage the walls of the arteries, making them more vulnerable to thickening or narrowing (atherosclerosis) or rupture (Lawrence & Brass, 2002).

There is no specific BP reading that is considered normal, but rather a range. Most experts agree, however, that a reading greater than 140/90 mmHg is abnormal, and anyone with such a reading should see a physician. But even mild elevations in BP are associated with an increased risk for stroke. Sometimes mildly elevated blood pressure can be controlled by life-style modification, but medication is often needed. Although the patient may feel no different, control of blood pressure is associated with a marked decrease in the occurrence of stroke (Cuccurullo, 2004). Control of high BP contributes towards the reduction of stroke. A dose response relationship with a 10-mmHg reduction in systolic BP is associated with a 31% reduction in stroke risk (Mbbs et al, 2007).

Recent data from the study as inter heart and inter stroke studies conducted in 22 countries by O'Donnell et al. (2010) identified major risk factors for stroke that contribute to 90% of stroke in these countries. The research found HTN was the strongest risk factor for stroke, and was stronger for intracerebral hemorrhagic stroke than for ischemic stroke. HTN was more strongly associated with stroke in individuals younger than 45 years than in those aged 45 years or older.

Diabetes mellitus (DM)

A fasting plasma glucose level over 100 mg/dl is strongly linked with ischemic stroke events in patients with preexisting atherothrombotic disease and stress hyperglycemia following a primary stroke increases the probability of a poor outcome (Tanne et al, 2004). Chronic hyperglycemia, as indicated by elevated HbA1c levels, is associated with a 17% increase in the risk of stroke with each 1% rise of HbA1c. More recently, post-challenge glucose levels in non-diabetic individuals have been found to have a significant association with stroke mortality during 38 years of follow-up (Capes et al, 2001). Studies on glucose lowering using oral antidiabetic agents are often confounded by other factors such as duration of diabetes, age of patient and diabetes severity (Selvin et al, 2004). In the UKPDS, however, the use of metformin as first-line therapy in obese patients with type 2 diabetes reduced stroke risk by 42% compared with the conventionally treated group. Sulphonylurea treatment over 10 years was found to reduce the development of microvascular complications in subjects with diabetes, but the risk of stroke was raised (Sander et al, 2008). Other study by Abu-Odah et al. (2014) found risk of stroke associated with diabetes mellitus was high and significant.

Heart disease

Just as strokes area strong risk factor for heart disease, heart disease is a strong risk factor for stroke, although only for one type of stroke, ischemic strokes. Heart disease is associated with stroke in two ways. First, damage to the heart may make it more likely that clots will form within the heart. These clots can break loose and travel to the brain, causing a cardio embolic stroke. Heart disease and stroke are also associated because they are both manifestations of atherosclerotic disease in the blood vessels. If the blood vessels feeding the heart (the coronary arteries) are diseased, it is likely that arteries to the brain are also affected (lawrence & brass, 2002).

Patients with evidence of coronary artery disease, congestive heart failure, left ventricular hypertrophy (enlargement of the left side of the heart), disease of the heart valves, or arrhythmias (irregular heart rhythms) have a several-fold increase in the risk of stroke (Uchino et al, 2011).

Several recent studies suggest that people with atrial fibrillation who take daily doses of either aspirin or warfarin (Coumadin) have a reduction of up to 80 % in their risk of stroke. These findings suggest that an estimated 20,000 to 50,000 strokes might be prevented each year if all people with this condition had prophylactic drug treatment (Goldstein, 2009).

Heredity and family history

There are several rare familial conditions that may be complicated by ischemic stroke and TIA. There is also increasing interest in complex genetic disorders thought to be caused by multiple gene interactions, presumably influenced by environmental factors (Flossmann & Rothwell, 2004). However, family history of stroke is only a modest risk factor for ischemic stroke. Moreover, much of the association appears to be secondary to hereditability of risk factors for stroke such as HTN and diabetes (Schulz et al, 2004).

Just how easy it will be to separate out shared genes from shared environment in a disease as common as stroke remains to be seen. Disentangling the interactions and working out the pathway from genotype to phenotype will be a monumental task. Whatever the mechanism, one can at least reassure patients with TIA or stroke that a family history of stroke is associated with little or no increase in the risk of a future stroke (Flossmann & Rothwell, 2004).

Smoking habits

The tobacco epidemic is one of the biggest public health threats the world has ever faced, killing around 6 million people a year. More than 5 million of those deaths are the result of direct tobacco use while more than 600 000 are the result of non-smokers being exposed to second-hand smoke. Nearly 80% of the more than 1 billion smokers worldwide live in low- and middle-income countries, where the burden of tobacco-related illness and death is heaviest (WHO, 2012).

Smoking is known to promote atherosclerosis and a procoagulant state. It has been established in older adults that the stroke risk associated with cigarette smoking falls to the lowest levels within 5 years of smoking cessation, (Wannamethee et al, 2005) suggesting that induction of a procoagulant state is the primary mechanism. Cigarette smoking causes vascular endothelial dysfunction with associated alteration in hemostatic and inflammatory markers. Smoking also increases fibrinogen concentration, reduces fibrinolytic activity, increases platelet agreeability, and causes polycythemia (Arquizan et al, 2005).

The evidence linking smoking to stroke is extremely convincing. The results of numerous globally based studies evaluating the association between stroke and cigarette smoking. In short, these studies performed across various ethnicities and populations demonstrate a strong association between smoking and stroke risk, with current smokers having at least a two- to fourfold increased risk of stroke compared with lifelong nonsmokers or individuals who had quit smoking more than 10 years prior. In one study, the risk increased to sixfold when this population was compared with nonsmokers who had never been exposed to environmental tobacco smoke (i.e, second-hand smoke) (Shah& Cole, 2010). In a separate study, this sixfold increase in risk persisted when cigarette-smoking women with smoking spouses were compared with smoking women with nonsmoking spouses, further demonstrating the effect of second-hand smoke on stroke risk (Qureshi et al, 2005).

Materials and Method

Study design

The design used study is quantitative retrospective case-control study, this design gives the researcher the opportunity to compare the history of past exposure to risk factor or the presence of certain a characteristic among cases and controls. The investigator is looking backward from the disease to a possible case. A case control study has the advantage of being relatively inexpensive and enables the researcher to meet the study objectives in a short time and in the same it studies several risk factors for a single disease.

Setting of the study

This study was conducted at the five main governmental hospitals in GS for cases selection, selected case from medical department in Kamal Odwan Hospital, Shifa hospital, Shohda Al-Aqsa hospital, European Gaza hospital and Nasser hospital in each different geographical area to reflect representative result.

Twice the numbers of control matched from attendees of the primary health care centers (PHCC) are (Shohda Jabalia, Shohda El-Rimal, Sorane, Deir-El-balah, El-Magazie, Shohda khan-younis, and Shohda Rafah health centers). They are follow up for any illnesses other than metabolic diseases, they also have same characteristics as cases except that they free from metabolic disease and any past history of stroke.

Study population

The study population according to statistics hospitals of ministry of health (2014) consisted to 1,500 stroke patients (MOH, 2014). A study sample include of adults from both genders whose ages were 40 years and more, cases should be newly diagnosed as having stroke by physician or computed tomography (CT) scan, and selected based on a non-probability purposive sample from inpatient medical dependent governmental hospital in Gaza governorates. Additionally, twice these numbers were selected from governmental PHCC in same geographical areas of the cases, will serve as our control sample, controls matched for age, gender, and place of residency.

3.4 Sampling

3.4.1 Sample calculation

The researcher used Epidemiological information program (Epi-info, Ver. 7), statistical calculator for case control study to calculate the sample size at 95% CI with power 80%, with percentage of error ±5% and based on 2 controls for every one case. Based on local study by Abu-Odah et al., (2014) prevalence of obesity among over 45 years 50%, and among stroke patients 70%. So, the total number of the proportion sample is composed of 450 participants, divided into 150 cases and 300 controls from different location to keep 1:2, case control ratio. The cases sample represents 10% of stroke patients according to MOH statistics hospitals (MOH, 2014).

3.4.2 Sampling process

According to MOH, hospitals are either small or major hospitals (depending on the capacity), the major hospitals with capacity of 101 or more bed, as there is in the GS, five large government hospitals offering adult health service (MOH_C, 2014). GS is divided into five governmental as follow: North Gaza, Gaza city, Mid-Zone, Khanyounis and Rafah. The researcher selected all large governmental hospital to cases, while we selected 7 PHCC from 54 centres to select control (This clinic considered central clinic "Level four" in every province).

A non-probability purposive sample of adult patients was used to select cases diagnosis with stroke was selected from governmental hospital from each different geographical area in Gaza governorates and their aged was 45 years and more. Number of controls who is attended the PHCC for illness other than past history of stroke and metabolic disease. Their age range ±5 years old compare to case. After choose the sample interviews were performing with pretest and validate questionnaire, which contain issue about socio-demographic factor, health profile and nutritional factors.

Study Period

The study was conducted at the beginning of year 2015. After obtaining approval for the study proposal from Al-Quds University at the School of Public Health, an administrative letter was sent to the department of human resource development at MoH in July, 2015 to offer facilitation for conducting the study in MOH hospitals and PHCC.

Data collection started in Jul. 2015 till Sep. 2015. Data analysis and discussion were completed at Oct. 2015. Writing the final research report was completed at the mid of Nov. 2015.

Results and Discussion

In this chapter, the researcher presents the main results of the study variables that were attained the study objectives. The study was conducted to identify the common stroke risk factors and the most common nutritional risk factors among Palestinian adult patients. The identification of risk factors was done using comparative method by comparing a case sample with control samples using a statistical tools measurement such as bivariate analyses of matching pairs, Odds Ratio, their 95% (CI), Chi square test as well as Mann–Whitney test was also calculated for all risk factors, and continuous data (age, duration of chronic disease and BMI).

Participate in the study was personally interviewed convening a wide range of nutritional issues related to stroke, variables of socio-economic-demographic, health and nutritional habits.

In this chapter, the researcher highlights the findings of this study compared with other global and regional studies and attempt to interpret the results and its implication. The results could help in developing preventive health education and health promotion programs.

Socio-demographic characteristics of the study population

A Socio-demographic characteristic of the study participants has shown in Table 4.1. It compares the 150 cases with the 300 controls matched by gender, age and place of residency. The table shows that characteristics were one-third of the two-thirds because of matching, so there is no difference between them.

Table 4.1 Summary table of Socio-demographic characteristics of study population

Variable		Type of Participant				χ^2	P-Value
		Case (150)		Control (300)			
		No	%	No	%		
Gender	**Male**	84	56	168	56	0.00	1.00
	Female	66	44	132	44		
Age	**≤ 50 years**	20	13	39	13	2.621	0.623
	50 to 59	33	22	82	27.3		
	60 to 69	50	33.3	90	30		
	70 to 79	27	18	59	19.7		
	≥ 80 years	20	13	30	10		
Family size	**≤ 3 person**	32	21.3	60	20	0.368	0.941
	4 to 6	44	29.4	96	32		
	7 to 9	41	27.3	81	27		
	≥ 10 person	33	22	63	21		
Education	**Not Educated**	11	32	79	26.3	4.973	0.174
	Primary Educated	31	20.7	51	17		
	Secondary Educated	52	34.7	111	37		
	University Educated	19	12.7	59	19.7		
Employment	**Working**	18	12	73	24.3	9.429	0.002 *

	Not Working	132	88	227	75.7		

Likelihood ratio was used ***statistically significant (P-value < 0.05)**

Table 4.1 shows the distribution of both cases and controls regarding the socio-demographic variables. Among cases and controls 56% of participants were males and 44% were females. Gender was one of the matching variables. The ratio of male to female in the study was 1.2:1.

According to age, the samples were distributed into multiple groups; the most prominent age group was the age group between 60 to 69 years. The test showed no relationship between the age of the individual and the incidence of the stroke [$\chi 2$=2.621, P-value = 0.623]. This result shows discrepancy with another study, Greenberg et al (2010) that reported high incidence of stroke in the 50–65 year age group among all patients in Israel. In other study in Saudi Arabia by Al-Eithan and Amin (2010) the researcher found stroke occurrence was the highest among the 61-70 age group, and lowest in the 30-40 age group. A study in Cuba, Llibre et al (2010) found Stroke prevalence increased with age, with the exception of the group aged 75–79 years, which was slightly lower than the group aged 70–74 years. Prevalence was greater in men (9.5%) than in women (7.0%); the overall male/female prevalence ratio was 1.36 and was much higher in the group aged ≥80 years.

Regarding housing conditions, the table clarifies the number of family members living in the house. The results showed that (21.3%) of the cases and (20%) of the controls were living in houses with ≤ 3 persons, while (29.4%) of the cases and (32%) of controls were living in houses with 4 to 6 persons, while (27.3%) of cases and (27%) of control living in houses with 7 to 9 persons as well as (22%) of samples and (21%) of cases living in houses with ≥ 10 person persons. The results showed no relationship between age and the incidence of stroke [$\chi 2$=0.368, P-value = 0.941].

According to educational level, the table shows that the majority (34.7%) of cases, (37%) of controls had a secondary education, (12%) of cases and (19.7%) of controls had a university degree. while (52.7%) of cases and (43.3%) of controls had primary educational level and less. The test showed no relationship between education and the incidence of stroke [$\chi 2$= 4.973, P-value = 0.174].

Regarding employment status, the table explain that the majority (88%) among cases and (75.7%) among controls have not working and participants who are working represent 12% of cases and 24.3% of the controls. We found that non employed people high risk with stroke ($\chi 2$= 9.429, P-value=0.02). We can explain this results that work gives the employed people with activity opportunity. In addition, the person who works has better economic situation comparing with the unemployed and can regulate his/her diet & can maintain health for the better.

Health profile:

Given the devastating deficits often associated with a stroke, the need for prevention is essential. Many of the risk factors for stroke can be treated or modified. Doing so may prevent an initial stroke or recurrent strokes, as well as decrease the risk of premature death. The health profile of an individual is directly linked to the occurrence of stroke and this has been confirmed by this study and by other previous studies. Therefore, patients who suffer from a turbulent health status, they must continue following-up to protect themselves from the occurrence of stroke.

Hypertension (HTN)

Previous studies have shown that HTN is a significant and independent risk factor for stroke. Treatment of HTN has been demonstrated to be the most important factor in reducing the incidence of stroke (Haverbusch et al, 2004). This study confirmed that HTN is a risk factor for stroke, here as it appears in the table (4.2) that HTN among cases 68.7% and 49.4% among control, the difference was statistically significant (P<0.001). So, HTN was found to be significantly associated with stroke (OR= 2.22, 95% C.I. [1.44 – 3.47]). This result was consistent with the results of a study by Sweileh et al (2008) that showed that the HTN was the most common risk factor of the stroke. Our results are also consistent with a study showed that the people who have a history of HTN develop stroke four times than people without HTN (Abedelaal, 2015). As well as agreed with the results of another study by (Abu-Odah et al, 2014) at which HTN was found to be significantly associated with stroke.

Table 4.2 Distribution of study participant according to their history of HTN

Variable		Type of Participant				OR 95% CI	P-Value
		Case (150)		Control (300)			
		No	%	No	%		
HTN	Present	103	68.7	149	49.4	2.22 (1.44–3.47)	0.001*
	Absent	47	31.3	151	50.3		
HTN Management	Controlled	59	57.3	113	75.8	0.43 (0.25–0.74)	0.001*
	Uncontrolled	44	42.7	36	24.2		

Regarding HTN Management, the table clarifies that there is a significant relationship between controlled and uncontrolled HTN. The difference between cases and controls is statistically significant (P-value=0.001), which means that the subject who has uncontrolled HTN has the chance of getting stroke more than the controlled BP, which is compatible with many other studies, for example, a study (Sweileh et al. 2008) found BP is poorly controlled among individuals who have experienced a previous stroke.

Diabetes Mellitus (DM)

DM has been independently associated with some forms of large artery disease and with small artery infarctions detected by neuroimaging studies (Antonios & Silliman, 2005). DM significantly increases the risk of stroke, but it is not clear how DM affects the clinical and functional outcomes. In some studies, stroke patients with DM were reported to be associated with reduced survival after stroke, worse clinical and functional outcomes, and more healthcare utilization (Sun et al, 2009).

Table 4.3 Distribution of study participant according to their history of DM

Variables		Type of Participant				Odds Ratio 95% CI	P-Value
		Case (150)		Control (300)			
		No	%	No	%		
DM	Present	80	53.3	101	33.4	2.25 (1.51–3.36)	0.000 *
	Absent	70	46.7	199	66.3		

DM Medication	**Tablet**	41	51.3	57	56.4	0.81 (0.45–1.47)	0.612
	Insulin	28	35	30	29.7	1.58 (0.83–3.00)	
	Tablet & Insulin	11	13.7	14	13.9	1.22 (0.51–2.86)	
DM Management	**Controlled**	53	66.3	71	70.2	0.83 (0.44–1.57)	0.338
	Uncontrolled	27	33.8	30	29.8		

Table 4.3 illustrates the relationship between the study population and history of DM, it was noted that the prevalence of DM among cases 53.3% and controls 33.4%. The difference was found statistically significant (P-value= 0.001). The risk of stroke associated with DM was high and significant (OR= 2.52, 95% C.I 1.51–3.36). This means that there is a positive association between person's history of DM and stroke. The researcher concluded that the person with DM has more risk to develop stroke two times more than subject without DM. The medication and management of DM did not reach statistically significant level, meaning that the DM medication & control level of glucose don't affect to incidence to stroke.

This result is consistent with previous study Tuttolomondo et al. (2015), which found that DM was the strongest risk factor for stroke among both men and women, also the association between stroke and DM is bidirectional and not limited to stroke since DM may contribute to a more insidious brain damage. Another study by Abedelaal (2015) and Abu-Odah et al (2014) in Palestine found a high and significant relationship between DM and stroke. Another published study in 2010 by O' Donnell et al. reported history of DM was associated with an increased risk of stroke.

Cardiac disease

Heart disease is a strong risk factor for stroke, although it is a risk factor for only one type of stroke, heart disease is associated with stroke by causing damage to the heart and may make clots more likely to form within the heart. These clots can loosely break and travel to the brain, causing a cardio embolic stroke. Heart diseases and stroke are also linked because they are both manifestations of atherosclerotic disease in the blood vessels. Patients with evidence of coronary artery disease, congestive heart failure, left ventricular hypertrophy, disease of the heart valves, or arrhythmias have a several-fold increase in the risk of stroke.

Table 4.4 Distribution of study participant according to their history of Cardiac disease

Variables		**Type of Participant**				**Odds Ratio 95% CI**	**P-Value**
		Case (150)		**Control**			
		No	**%**	**No**	**%**		
Cardiac Disease	**Present**	55	36.7	77	25.7	1.67 (1.09–2.55)	0.010 *
	Absent	95	63.3	223	74.3		
Type Of Cardiac Disease	**Angina**	4	7.2	2	2.6	2.94 (0.45–23.49)	0.053
	Myocardial Infarction	28	51	28	36.4	1.81 (0.89–3.89)	
	Heart Failure	14	25.4	27	35	0.96 (0.42–2.14)	

	Arrhythmia	6	11	19	24.7	0.38 (0.13–1.00)	
	Valvular disease	3	5.4	1	1.3	4.33 (0.45–116.83)	

Table 4.4 clarifies that there is a significant difference between cases and controls regarding the history of cardiac disorder and the risk of developing stroke, the difference between cases and controls were statistically significant (OR= 1.67, P- value= 0.010) which means that the incidence of developing stroke was higher two times among people with history of cardiac disease. Findings also show that there were no significant association between stroke and other type of cardiac disorder.

This result was consistent with the results of a study by Llibre et al. (2010) which showed that the heart disease is the most important risk factor for stroke. Atrial fibrillation is a prime cardiac risk factor, since it quadruples the risk of stroke in the general population, followed by heart failure, which doubles or triples the risk. Another published study in 2010 by O'Donnell et al. that showed that atrial fibrillation was the most common cardiac source of thromboembolism in cases with ischemic stroke. Cardiac problem was associated with an increased risk of ischemic, but not hemorrhagic stroke.

Chronic disease and type of stroke

The relationship between DM and stroke most ischemic strokes in diabetic patients are due to occlusion of small paramedical penetrating arteries. The occlusions cause small infarcts within the white matter of the brain. Diabetic autonomic neuropathy may contribute to the development of cerebrovascular disease in people with DM (Tuttolomondo et al, 2015), O'Donnell et al. (2010) found that History of HTN was the strongest risk factor for stroke, and was stronger for intracerebral hemorrhagic stroke than for ischemic stroke.

Hypertension, Diabetes Mellitus and Type of Stroke

Table 4.5: Association between HTN & DM and Type of Stroke

Type of Participant		**N**	**Mean**	**SD**	**Z**	**Sig**
HTN	**Ischemic**	126	3.92	10.89	2.80	0.005*
	Hemorrhagic	24	6.59	5.99		
DM	**Ischemic**	126	4.59	9.46	3.21	0.001*
	Hemorrhagic	24	1.63	3.77		

***Statistically significant (P-value < 0.05)**

Table 4.5 shows that there is a statistically significant difference between the prevalence of ischemic stroke among DM [Mean 4.59] than hemorrhagic [Mean: 1.36] by using the Mann-Whitney test in patients with history of DM and the difference between two groups reached a statistically significant level [Z=3.21, P-value=0.001]. Additionally, the prevalence of hemorrhagic stroke among HTN [Mean 6.59] than ischemic [Mean 3,92] in patients with history of HTN and the difference between two groups reach statistically significant level [Z=2.80, P-value =0.005], meaning that the hemorrhagic stroke associated with HTN, and ischemic stroke could be related to DM.

Age and Type of Stroke

The risk of stroke rises significantly with age. After age 55 years, it is more than double with each passing decade. Each year, about 1% of people between ages 65 and 74 have a stroke and 5% to 8 % of people in that age group who have had a TIA go on to ischemic stroke (Lawrence & Brass, 2002). Stroke occurs at all ages, about 25%, are under age 65 years and Between 40% & 50% of strokes in younger adults are hemorrhagic (Love & Biller, 2009).

Table 4.6: Association between Age and Type of Stroke

Variable		Type of Participant				χ^2	P-Value
		Ischemic (126)		Hemorrhagic (24)			
		No	%	No	%		
Age	≤ 50 years	8	6.3	12	50	34.30	0.001 *
	50 to 59	26	20.7	7	29		
	≥ 60 years	92	73	5	21		

Likelihood ratio was used ***statistically significant (P-value < 0.05)**

According to age, table 4.6 shows that 50% of hemorrhagic stroke patients are less than 50 years and 92% from ischemic stroke more than 60 years. The differences between Ischemic and hemorrhagic reach to statistically significant level [χ^2= 34.30, P-value =0.001]. Meaning that the people less than 50 years and have HTN are more likely at risk of developing hemorrhagic stroke. So, researchers believe that psychological pressures, economic pressures facing the people in this age are risk of increasing the incidence of hemorrhagic stroke.

Family history of chronic disease

Many things influence overall health and likelihood of developing a disease. Sometimes, it's not clear what causes a disease. Many diseases are thought to be caused by a combination of genetic, lifestyle, and environmental factors. The importance of any particular factor varies from person to person. So, Family members share genes, behaviors, lifestyles, and environments that can influence their health and their risk for disease. Some families have a more predisposition to develop stroke than others, and the risk of stroke can increase based on your age, sex, and race or ethnicity (CDC, 2014).

Table 4.7 Distribution of study participants according to their family history of chronic disease

Variable		Type of Participant				χ^2	P-Value
		Case (150)		Control (300)			
		No	%	No	%		
Father history	Present	56	37.3	111	37	1.819	(0.945)
	Absent	94	62.7	189	63		
Mother history	Present	76	50.7	166	55.3	0.876	(0.349)
	Absent	74	49.3	134	44.7		
Brother history	Present	98	56.3	180	60	1.205	0.304
	Absent	52	34.7	120	40		

Likelihood ratio was used ***Statistically significant (P-value < 0.05)**

Familial aggregation of stroke suggested that genetic factors may play an important role in the occurrence of ischemic stroke (Wang et al, 2013). The significance of family history in predicting the occurrence of strokes is still controversial. Nevertheless, mass screening programs worldwide include questions about an individual's family history of diseases (Kayaba, 2008).

Table 4.7 shows that there was not statistically significant difference between the chronic disease such as HTN, DM, cardiac disease, stroke and family history with incidence of stroke. This result was inconsistent with a study by Kadota et al. (2008) HTN examined the relationship between stroke mortality and family history of HTN and stroke using a nationwide public health center study in Japan. For all strokes, a family history of HTN significantly increased the risk among men aged ≥ 60 years and women aged <60 years after adjustment of blood pressure. Another congruent study by Mvundura et al. (2010), the association between familial risk for stroke and prevalence of the disease was examined and the use family history of stroke was assessed as a risk assessment tool for the disease. The result showed that people with a high familial risk for stroke were four time more likely to have had a stroke than people with moderate or low familial risk. But other study supported result by previous study conducted by Wang et al (2013) that found a significant and independent association between family history of stroke and ischemic stroke with onset younger than 70 years.

4.2.6 Smoking

Smoking doubles the risk of stroke when comparing smokers to a nonsmoker. Smoking increases clot formation, thickens blood, and increases the amount of plaque buildup in the arteries (National Stroke Association, 2015).

Table 4.8 Distribution of study participants according to their smoking habits

Variable		Type of Participant				χ^2	P-Value
		Case (150)		Control (300)			
		No	%	No	%		
Current smoking	Yes	40	26.7	57	19	3.427	0.062
	No	110	73.3	243	81		
Past Smoking	Yes	10	66.7	34	11.3	2.469	0.116
	No	140	93.3	266	88.7		

Likelihood ratio was used ***statistically significant (P-value < 0.05)**

Table 4.8 illustrates that there is a difference at smoking habits between cases 26.7% and controls 19% but the difference between cases and controls was not statistically significant (X^2= 3.427, P-value= 0.062). Meaning that the smoking habits are not considered as a risk factor for developing stroke. This comes in line with a study conducted by Abedelaal (2015), in this study there were not a statistical significant between smoking and stroke in Palestine. In the other hand, other studies conducted by Abu-Odah et al. (2014); O'Donnell et al. (2010) were inconsistent with our study which they reported that smoking was associated with an increased risk of stroke.

Table 4.9 Distribution of smoking habits according to their stroke patients

Variable		Type of Participant				χ^2	P-Value
		Ischemic (126)		Hemorrhagic (24)			
		No	%	No	%		
Current smoking	Yes	27	21.4	13	54.2	9.936	0.002*
	No	99	78.6	11	45.8		
Duration of smoking	≤ 20 years	2	7.4	1	7.7	9.937	0.007*
	≥ 20 years	25	92.6	12	92.3		

Likelihood ratio was used ***statistically significant (P-value < 0.05)**

Smoking is an established risk factor for both cerebral ischemia and subarachnoid hemorrhage. There is supporting evidence for a causal relationship between smoking and stroke. This is supported by reports of a dose response relationship between smoking levels and these two types of strokes, as well as a return to never smoking risk levels with increased time since quitting smoking (Paul et al, 2004).

Concerning smoking among stroke patients, table 4.9 demonstrates that 54.2% of the current smokers with hemorrhagic stroke and 21.4% with ischemic stroke, the difference between ischemic and hemorrhagic reach to statistically significant level ($\chi 2$= 9.936, P-value=0.002). Meaning that the smokers are more likely to develop hemorrhagic stroke than ischemic strokes, also the results showed that the duration of smoking associated with strokes. Duration of smoking is increased more than 20 years the chance of ischemic stroke increases. The difference between ischemic and hemorrhagic stroke reach to statistical significant level [$\chi 2$= 9.937, P-value =0.007]. This result was consistent with a study O'Donnell, et al. (2010) which showed that the current smoking status was associated with an increased risk of stroke, which seemed to be stronger for ischemic stroke than for intracerebral hemorrhagic stroke.

Obesity

Overweight and obesity have become a major public health problem in both developing and developed countries as they are causally related to a wide spectrum of chronic diseases including DM, cardiovascular diseases & stroke (Huxley et al, 2010). However, uncertainty regarding the most appropriate means by which to define excess body weight remains. Traditionally, BMI has been the most widely used method by which to determine the prevalence of overweight in, and across, populations as well as an individual's level of risk (Bodenant et al, 2011). However, in recent years, measures of central obesity, principally WC and WHR which more accurately describe the distribution of body fat compared with BMI, have been suggested to be more closely associated with subsequent morbidity and mortality (Hankey, 2011).

Table 4.11 Distribution of study participants according to BMI, WC and WHR

Variables		Type of Participant				OR	95% CI
		Case (150)		Control (300)			
		No	%	No	%		
BMI	Normal weight	21	14	52	17.3	1.117	(0.628–1.951)
	Over weight	32	21.3	88	29.3	0.847	(0.54–1.313)
	Obesity (Class I)	52	34.7	81	27	1.611	(1.058–2.445)
	Obesity (Class II)	25	16.7	42	14	2.149	(1.274–3.610)
	Extreme obesity (Class III)	20	13.3	37	12.3	1.883	(1.346–4.245)

Table 4.11 indicates that there is a significant difference between the study population and obesity. We noted according to BMI that 64.7% of cases were obese, and 53.3% of the controls were with obesity. This reflects the increase of obesity among the Palestinian people. These differences were statistically significant according class of obesity [OR= 1.611, 95% C.I. 1.058–2.445; OR= 2.149, 95% C.I. 1.274–3.610; OR= 1.883, 95% C.I. 1.346–4.245] respectively. The risk of stroke associated with obesity according BMI measurement, so, obesity is a high and significant risk factor of stroke.

Several studies have shown an association of obesity, as defined by BMI, with the risk of stroke. Kurth et al. (2002) reported that individuals with a BMI of 30 kg/m2 or more have double the incidence of stroke compared with individuals with a BMI of less than 23 kg/m2. Each unit increase in BMI is associated with an increase in the adjusted risk of stroke by about 6% (relative risk 6%, 95% CI 4–8). Among adults who are overweight or obese (BMI 25–50 kg/m2), each 5 kg/m2 increase in BMI is associated with about 40% higher mortality from stroke (HR1.39, 95% CI 1.31–1.48), Whitlock et al, 2009. Another published study reported that BMI was a strong risk factor for stroke (Abedelaal, 2015; Abu-Odah et al, 2014).

Although BMI do not meaningfully improve prediction of stroke risk when added to causal risk factors such as SBP and history of DM, excess adiposity remains a major modifiable determinate of these causal risk factors (Wormser et al, 2011).

CONCLUSION

This is a study that quantifies the contribution of different factors to the chronic disease risk of stroke. It was found that, hypertension؛ diabetes and cardiac disease are the biggest risk factors for all types of strokes and more importantly are modifiable risks, which can be treated with appropriate medication and lifestyle changes. This is very important to low-income settings as screening programs, relatively little training, resources and interventions are expensive: lifestyle alterations have a greater potential for stroke prevention. Moreover, public awareness about the complication of stroke can causes a reduction of stroke burden. Suitable measures to reduce the stroke risk can be adopted as primary and secondary prevention in these cases.

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