Carotid Doppler Findings and Risk Factors in Ischemic Stroke Patients

Dr. Dhafer Lazim Hussein

M.B.Ch.B., D.M.R.D., C.A.B.M.S. \ (Radiology and Medical Imaging)
Iraqi Ministry of Health, Baghdad Al-Russafa Health Directorate, Al-Kindy Teaching Hospital, Baghdad, Iraq

Abstract: Information and data were collected from several different hospitals in Iraq for patients suffering from ischemic stroke. The total number of patients was 140, including 130 patients. Written consent was obtained from all patients for the purpose of publishing this study. The research was designed according to a cross-sectional study of a group of patients ranging in age from 30 to 65 years in Iraq. The primary information collected included age, height, weight, and body mass index, as well as the type and location of plaque. A demographic and statistical analysis was conducted on the data extracted from patients using the IBM SOFT SPSS 22 program. In addition, the fees were generated using the Microsoft Excel 2013 program. Statistical relationships were established between the elements of this study. Furthermore, the risk factors for patients were identified using the value of logistic regression.

The research was conducted on Iraqi patients from various towns, with different prevalence rates for strokes resulting from various factors that predispose them. High blood pressure emerged as the most dangerous factor in the aged, with a significant prevalence in various areas of Iraq.

According to the literature, the risk factors associated with carotid artery disease with stroke include age, with a range of 1.1-1.4, with a value of 1.2. The results indicated that the prevalence of hypertension was 3.3 (95% CI: 2.981-4.21), with a P-value of 0.21. The prevalence of diabetes was 3.5 (95% CI: 2.81-4.2), with a P-value of <0.001. The prevalence of carotid bulb disease was 2.2 (95% CI: 1.934-3.1), with a P-value of <0.001.

Keywords: Carotid Doppler, plaque, High blood pressure, Ischemic stroke, Patients, BMI.

Introduction

Stroke is a disease that develops due to a severe disturbance of blood flow in the brain in which the blood constantly delivers oxygen and nutrients to the tissues - they are necessary for the normal functioning of cells where. If blood does not flow to the cells, they begin to die. A stroke is most often caused by cardiovascular disease, which results in blood vessels becoming blocked or ruptured [1].

According to [2], stroke is (or global) disturbance of focal (or global) signs of rapidly developing clinical symptoms developing with symptoms lastly for 24 hours or more, which are not caused by anything else but related to blood vessels either by leading to their end as life span or dying from unknown causes. For 11.6% % of all deaths, stroke ranks second worldwide; however, it also serves as another name for death in the United States, where it takes the lives of more than 600,000 patients annually [3,4,5,6]. Some reports estimate stroke to be among the five deadliest diseases in adults, with about 3.7% of hospital admissions for adults, accounting for approximately 3.7% of all hospital admissions among adults [7]. Stroke is an important cause of stroke and produces a higher risk of early recurrent ischemia than any other stroke subtype [8,9,10]. For patients who have carotid stenosis of less than 75%, there is a 1.3% stroke rate reported every year. Patients who suffer from more than 70% stenosis in their carotid arteries have 28% strokes within an 18-month period [11,12].

The CIMT is the established atherosclerosis and cardiovascular risk predictor that has non-invasively ever forecasted the future occurrence of ischemic stroke accurately [12].

Hardening of the CIMT complex indicates changes in the Common Carotid Artery (CCA) artery and also general atherosclerosis [13, 14]. Case-control studies have revealed the link between the CIMT and subsequent stroke cases [15–16].

The Doppler method for evaluating carotid arteries is safe and non-invasive for assessing early diagnoses of extracranial insufficiency. There are several carotid atherosclerotic parameters assessed in it, such as carotid artery stenosis, carotid intima-media thickness (CIMT), and atherosclerotic plaques (Davis et al. 2018). Nonetheless, it does more than measure how narrow a passage may be—it also differentiates between types of build-ups that might indicate which ones are more likely to burst, causing a stroke (Dawson et al., 2013).

Material and method

Information and data were collected from several different hospitals in Iraq for patients suffering from Ischemic Stroke, where the total number was 140, including 130 patients. In this study, written consent was included to all patients for the purpose of publishing this study where the research was designed according to a cross-sectional study of a group of patients ranging in age from 30 to 65 years in Iraq. The primary information collected included age, height, weight, and body mass index, as well as the type and location of plaque.

The research assistant identified patients who were admitted to the neurology department of both hospitals with the help of the attending. The study involved the recruitment of such participants using consecutive sampling after file reviews if they met the inclusion criteria.

The patient or his/her guardian gave informed consent before data collection. He or she provided answers to questions asked based on details taken out of his/her medical records: e.g., (i) sociodemographical characteristics of the patient like age, sex among others, (ii) atherosclerotic risk factors extracted from hospital records including the history of hypertension, being on antihypertensive medications/Diabetes Miletus diagnosis/ cigarette smoking since some time ago to date; lipid profile test result plus serum if any available together with fasting blood glucose concentration among others such as this case series' ranges were sought.

We conducted assessments on carotid arteries among subjects who qualified for inclusion in the study Using the EDAN U60 series portable sonography machine. EDAN U60 series portable sonography machine was used to conduct examinations of the carotid arteries among subjects who qualified for inclusion in the study. Participants used the EDAN U60 series portable sonography machine during the same month. IMAGE It employed a linear array transducer with a frequency range from 5 to 10 MHz in order to obtain images of the greatest resolution from the carotid artery and related structures (Koichi, 2002). To accomplish this, Doppler Administration was a directed intervention in the pre-test (Kervsel, 2012).

To minimize observer differences, the same radiology resident, who had done additional training in the application of Doppler for this research, performed all sonographic examinations under the guidance of a senior radiologist conversant in carotid Doppler ultrasound, and he habitually verified the findings where A demographic and statistical analysis was conducted on the data extracted from patients using the IBM SOFT SPSS 22 program. In addition, the fees were generated using the Microsoft Excel 2013 program.

Statistical relationships were established between the elements of this study. Furthermore, the risk factors for patients were identified using the value of logistic regression.

Results

Table 1 – General characteristics of patients Iraqi

Variable	Details
Age (mean±sd)	40±6.6
BMI (mean±sd)	32.1±3.6

SEX (F, P%)	
male	70 (53.8)
Female	60 (46.2)
LDL (mean±sd) mg/dl	144±10.1
HDL (mean±sd) mg/dl	101.2±12.1
Elevated total Cholesterol (mean±sd)	210.1±5.5
Comorbidities	
blood pressure	55 (43.3)
Diabetes	22 (16.9)
Kidney disease	13 (10)
Other diseases	40 (30.7)
Education	
Primary	19 (14.6)
Secondary	31 (23.8)
College	50 (38.4)
High	30 (23.07)

Table 2- Distribution of patients with Ischemic Stroke according to causes and symptoms

Variable	f	P%
Causes		
Blockage of an artery in the brain	66	50.77
There is a leak or rupture in a blood vessel	34	26.15
Temporary interruption of blood flow to the brain	30	23.08
symptoms		
Difficulty speaking	25	19.23
Paralysis of the face, arm, or leg	22	16.92
Vision disturbances in one eye	23	17.69
headache	28	21.54
Difficulty walking	32	24.62

Table 3-: Doppler findings of present patients

v	f	P%
Normal Doppler	10	7.69
Carotid Stenosis	30	23.08
Ipsilateral Stenosis	50	38.46
Bilat Stenosis	40	30.77

Table 4: Diameter percentage stenosis in internal carotid with velocities (n=77)

Stenosis	PSA velocity (cm/sec)	Frequency
>70	>230	55
>50-70	>125-230	40
<50	<125	35

Fig 1- Type of plaque

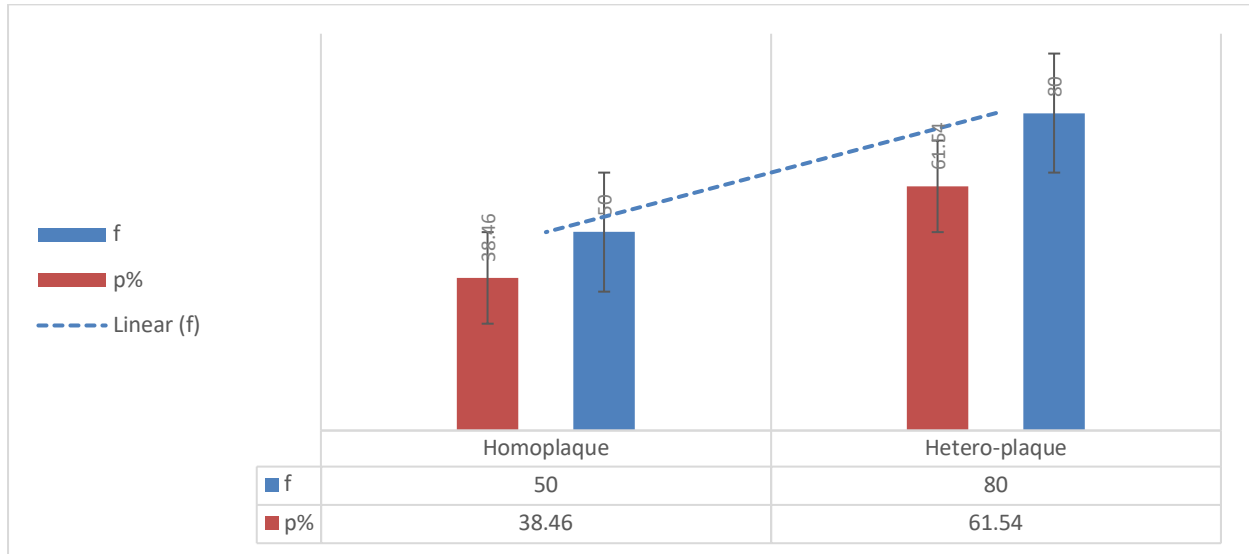|	Homoplaque	Hetero-plaque
f	50	80
p%	38.46	61.54

Fig 2- Location of plaque
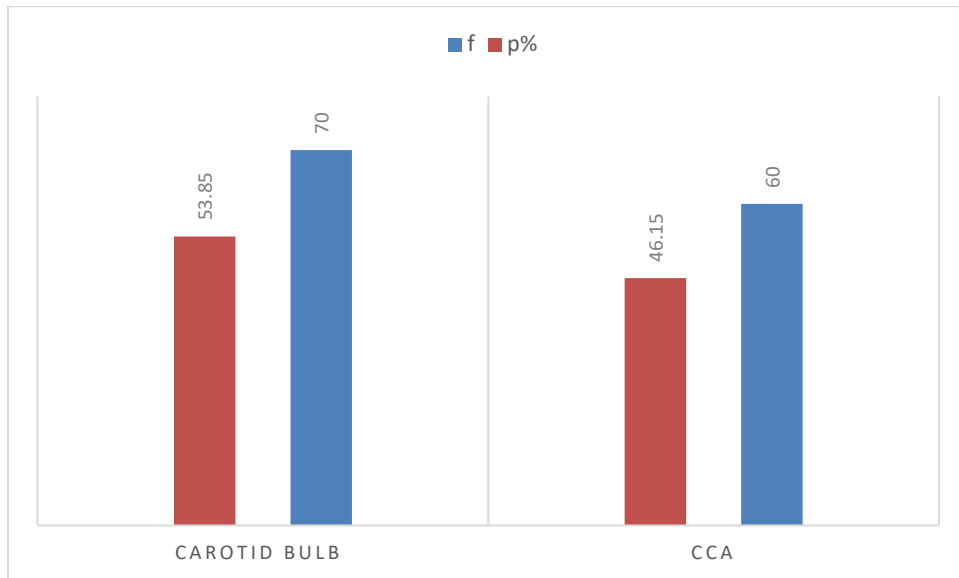
Table 5- Risk factors associated with carotid artery disease with stroke include

Variable	CS	OI	P-value
Age	1.1-1.4	1.23	0.21
sex	2.1-2.7	2.65	0.92
hypertension	2.981-4.21	3.3	<0.001
diabetes	2.81-4.2	3.5	<0.001
smoking	1.72-2.5	2.1	0.06
high cholesterol levels	2.1-2.82	2.54	0.03
CCA	2.73-3.8	3.1	<0.001
Carotid bulb	1.934-3.1	2.2	<0.001
Stenosis	3.7-4.9	3.5	<0.001

Discussion

In the past, studies have pointed out various factors that increase the chance of someone experiencing an ischemic stroke; examples include but are not limited to old age, gender, weight problems (both too much or too little), high blood pressure, issues with sugar control in the body (usually termed as diabetes), having abnormal levels of fats in the blood (often called dyslipidemia), use of tobacco products among others. The average age among those who suffered from this type of stroke was 40±6.6 in patients Iraqi

Ischemic stroke is more likely to occur in overweight people and obese individuals than in leaner people because obesity is a contributing factor to this health condition; thus, studies have shown that many cases of obesity have been diagnosed as stroke [17].

New studies have shown the impact of diabetes as a key predictor on stroke types [29], yet the most common risk elements include hypertension 79.46 %, diabetes 75 %, smoking 74.11 %, and dyslipidemia.

[18] Generally, the research was carried out on Iraqi patients from various towns who showed different prevalence rates for strokes as a result of factors that predispose; however, high blood pressure emerged as the most dangerous factor in the aged and was a major disease in varied areas of Iraq. Our research examines risk factors in the context of stenosis type, with both the univariate and multivariable analysis results proving that overweight, hypertension, diabetes, and dyslipidemia were predictive risk factors for Ipsilateral Stenosis.[19] It is very important to assess the risk factors for ischemic stroke patients in order to recognize particular individuals that are more likely to contract these diseases. This includes hypertension, diabetes, smoking, high cholesterol levels, atrial fibrillation, age, sex, and family history of stroke, among others, both modifiable and non-modifiable risk factors.

By knowing the mechanisms of first stroke development, we can more specifically implement the prevention of recurrent cerebrovascular accidents. For all subtypes of stroke, antiplatelet agents are prescribed for prophylactic purposes, and the drugs of choice are low-dose aspirin, ticlopidine, clopidogrel, and dipyridamole. In the case of ischemic stroke (especially in the presence of atrial fibrillation) and stroke due to antiphospholipid syndrome, anticoagulants (warfarin or phenylene) are prescribed in addition to antiplatelet agents. To prevent recurrent hemodynamic strokes, reconstructive surgery on the main arteries of the head is indicated in some cases. Qualified rehabilitation with prevention of recurrent strokes can significantly improve the quality of life of patients [20]

Analysis of the main risk factors for stroke demonstrated that stroke today remains the most important medical and social problem not only in Iraq but throughout the world due to high rates of morbidity, mortality, and disability. Stroke is a clinical syndrome of focal neurological and/or cerebral disturbances, developing suddenly as a result of an acute cerebrovascular accident, lasting at least 24 hours or ending with the death of the patient at that time or earlier. Stroke in daily practice includes cerebral infarctions (ischemic strokes) and cerebral hemorrhages (hemorrhagic strokes).

The incidence of stroke is increasing worldwide. According to statistics, every 10,000 people have 25-30 strokes every year. More than 4 million cases of stroke are recorded worldwide annually, of which 519,000 cases are in Europe [2, p. 21]. According to statistical analysis [3], stroke affects every year at a rate of 3 people per 1000 people. In 2023, stroke claimed 6.24 million lives worldwide [4]. And in China,

Stroke cases tend to be younger. Data obtained by American researchers George MG, Tong In both men and women. Specifically in women aged 18 to 54 years. Moreover, it nearly doubled from 1995 to 1996 for men aged 18 to 34 years. The incidence of stroke increased by 41.5% among men aged 35 to 44 years from 2003-2004 to 2011-2012 [6].

In recent years, several works have appeared that highlight the main risk factors for stroke, which are divided into unchangeable (old age, sex, genetic history, low birth weight) and modifiable (arterial

hypertension (HTN), diseases) Heart, arterial insufficiency in the vessels of the lower extremities, smoking, diabetes mellitus, carotid artery stenosis, hypercholesterolemia, obesity, lack of physical activity, alcohol abuse, use of oral contraceptives, sleep apnea syndrome).

Carotid artery stenosis, thickened intima-media thickness (CIMT), and atherosclerotic plaques are among common carotid Doppler findings in patients with ischemic stroke, and their prevalence varies from 12.5% to 60.41%. The presence of these findings is related with hypertension, diabetes mellitus type 2, cigarette smoking, dyslipidaemia, and age over 60 years, where there is an increased likelihood for abnormal CIMT.

"The presence of atherosclerosis and plaques in the arteries that carry blood to the brain is quite common. Most patients will have these two signs. Moreover, Doppler ultrasound is an essential tool used for finding out if there are any blockages in the veins, for measuring how narrow these blockages are, and for specifying the category of risk presented by patients who might have more strokes in future".

Conclusion

Studies have shown that factors such as old age, gender, weight problems, high blood pressure, diabetes, dyslipidemia, and tobacco use increase the risk of ischemic stroke. High blood pressure is the most dangerous factor in the aged, and obesity is a contributing factor. The most common risk elements for ischemic stroke include hypertension, diabetes, smoking, and dyslipidemia. To prevent recurrent strokes, antiplatelet agents are prescribed for all subtypes of stroke, and reconstructive surgery is indicated in some cases. Stroke remains a significant medical and social problem worldwide, with high rates of morbidity, mortality, and disability. Risk factors for stroke include unchangeable (old age, sex, genetic history, low birth weight) and modifiable (arterial hypertension, heart diseases, arterial insufficiency, smoking, diabetes mellitus, carotid artery stenosis, hypercholesterolemia, obesity, lack of physical activity, alcohol abuse, use of oral contraceptives, sleep apnea syndrome).

References

1. Bhatti TS, Harradine KL, Davies B, Earnshaw JJ, Heather BP. Urgent carotid endarterectomy can reduce the risk of stroke after a TIA. Br J Surg. 1999;86:699. [PubMed] [Google Scholar]

2. Calanchini PR, Swanson PD, Gotshall RA, Haerer AF, Poskanzer DC, Price TR, et al. Cooperative study of hospital frequency and character of transient ischemic attacks. IV. The reliability of diagnosis. JAMA. 1977;238:2029–33. [PubMed] [Google Scholar]

3. Rothwell PM, Villagra R, Gibson R, Donders RC, Warlow CP. Evidence of a chronic systemic cause of instability of atherosclerotic plaques. Lancet. 2000;355:19–24. [PubMed] [Google Scholar]

4. Bluth EI. Evaluation and characterization of carotid plaque. Semin Ultrasound CT MR. 1997;18:57–65. [PubMed] [Google Scholar]

5. Fontenelle LJ, Simper SC, Hanson TL. Carotid duplex scan versus angiography in the evaluation of carotid artery disease. Am Surg. 1994;60:864–8. [PubMed] [Google Scholar]

6. Carrol MR, Stephine RW, William JC. Diagnostic Ultrasound. 3rd ed. St. Louis, USA: Elsevier Mosby; 2005. The extracranial cerebral vessels; pp. 946–9. Ch. 27. [Google Scholar]

7. GBD 2019 Diseases and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990– 2019: A systematic analysis for the Global Burden of Disease Study 2020, 396, 1204– 1222.

8. World Health Organization (WHO). WHO Methods and Data Sources for Global Burden of Disease Estimates 2000–2019; Global Health Estimates Technical Paper 2020, WHO/DDI/DNA/GHE, WHO: Geneva, Switzerland.

9. Touboul, J. et al. Carotid Intima-Media Thickness, Plaques, and Framingham Risk Score as Independent Determinants of Stroke Risk. Stroke 2005, 36, 1741.

10. Baktash, M. Q.; Ali, M. M.; Hassan, A. A.; Aziz. A. A. Iraqi Adults Individuals Attending AL-Sheikh Zayed Hospital in Baghdad City. Advances in Health Sciences Research 2021, vol. 38.

11. Nasir, A. S.; Arteen SA; Jaladet MS. Methylenetetrahydrofolate reductase C677T polymorphism in Iraqi patients with ischemic stroke. Neurology India 2009, 57, 5, 631-636.

12. Sulaiman, M. A.; and Al-Rawi, W. W. Profile of stroke patients admitted to Azadi Teaching Hospital in Duhok. Duhok Medical Journal 2017, 11, 2, 46-58.

13. Pignoli P, Tremoli E, Poli A, Oreste P, Paoletti R: Intimal plus medial thickness of the arterial wall: a direct measurement with ultrasound imaging. Circulation 1986, 74 (6):1399–1406. [PubMed] [Google Scholar]

14. Simons PC, Algra A, Bots ML, Grobbee DE, van der Graaf Y: Common carotid intima-media thickness and arterial stiffness: indicators of cardiovascular risk in high-risk patients the SMART study (Second Manifestations of ARTerial Disease). Circulation 1999, 100 (9):951–957. [PubMed] [Google Scholar]

15. Bots ML, Hoes AW, Koudstaal PJ, Hofman A, Grobbee DE: Common carotid intima-media thickness and risk of stroke and myocardial infarction: the Rotterdam Study. Circulation 1997, 96 (5):1432–1437. [PubMed] [Google Scholar]

16. Lorenz MW, Polak JF, Kavousi M, Mathiesen EB, Völzke H, Tuomainen T-P, Sander D, Plichart M, Catapano AL, Robertson CM: Carotid intima-media thickness progression to predict cardiovascular events in the general population (the PROG-IMT collaborative project): a meta-analysis of individual participant data. The Lancet 2012, 379 (9831):2053–2062. [PMC free article] [PubMed] [Google Scholar]

17. Saxena Y, Saxena V, Mittal M, Srivastava M, Raghuvanshi S: Age-wise association of carotid intima-media thickness in ischemic stroke. Annals of Neurosciences 2017, 24 (1):5–11. [PMC free article] [PubMed] [Google Scholar]

18. Harris S: The association of carotid intima-media thickness (cIMT) and stroke: a cross-sectional study. Perspectives in Medicine 2012, 1 (1–12):164–166. [Google Scholar]

19. Song P, Fang Z, Wang H, Cai Y, Rahimi K, Zhu Y, Fowkes FGR, Fowkes FJ, Rudan I: Global and regional prevalence, burden, and risk factors for carotid atherosclerosis: a systematic review, meta-analysis, and modelling study. The Lancet Global Health 2020, 8 (5):e721–e729. [PubMed] [Google Scholar]

20. Dabilgou AA, Dravé A, Kyelem JMA, Koanda H, Napon C, Kaboré J: Extracranial Carotid Atherosclerosis and Acute Ischemic Stroke in a Tertiary Hospital in Burkina Faso. World Journal of Neuroscience 2019, 9 (02):39. [Google Scholar]