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Prevalence and pattern of dyslipidemia among patients with ischemic stroke in a tertiary care center in south- south Nigeria

Chibuike Eze Nwafor [1, *] and Nicole Onep-Onne Ogbak [2]

[1] Cardiology Unit, Department of Medicine, University of Port Harcourt and University of Port Harcourt Teaching Hospital, Nigeria.
[2] Research Unit, GoodHeart Medical Consultants Hospital, Port Harcourt, Nigeria.

Abstract

Background: Stroke is a major public health problem worldwide. Dyslipidemia is a significant risk factor for ischemic stroke, but its prevalence and characteristics in this population remain understudied. Therefore, this study aims to investigate the prevalence and patterns of dyslipidemia among individuals diagnosed with ischemic stroke in a tertiary care center in South-South Nigeria.

Materials and Method: This is a retrospective hospital-based study on Ischaemic stroke patients admitted to GoodHeart Medical Consultant Hospital, Port- Harcourt, Rivers state, Nigeria, from July 2022 to June 2023.

Results: The study comprised 33 subjects consisting of 18(54.5%) males and 15(45.5%) females. The mean age of the total population was 62.6 ± 12.49. The most prevalent age group was elderly (>61 years) 20 (60.6%). The females were older than the males with a mean age of 64.1 ± 2.50 and 61.3 ± 12.69 respectively. The overall prevalence of dyslipidaemia was 97%, whereas the most common form of dyslipidaemia was reduced HDL (57.6%). There was no significant difference in dyslipidaemia among male and female stroke patients, nevertheless 63.6% of the males had dyslipidaemia.

Conclusion: Dyslipidaemia was common in the overall study population particularly reduced HDL and elevated LDL. The study revealed no statistically significant difference between gender and dyslipidaemia in stroke patients, nevertheless dyslipidaemia was more in the male stroke patients than females. Hence, prevention of dyslipidaemia as well as other risk factors is key to reducing the burden of stroke in our country.

Keywords: Dyslipidemia; Ischemic Stroke; Tertiary Care Centre; GoodHeart; South-South; Nigeria

1. Introduction

Stroke is a severe neurological disorder that may arise when the blood supply to the brain is disrupted either by a blockage of a blood vessel (ischemic stroke) or by a rupture or leakage of a blood vessel (hemorrhagic stroke)(1). Approximately 88% of strokes are ischemic, while the remaining 12% consist of hemorrhagic strokes, which can be further classified as either subarachnoid (9%) or intracerebral (3%). These subtypes may vary depending on the demographics of the population.

Stroke is the second-leading cause of death worldwide (5,6) with approximately 25.7 million individuals having survived a stroke globally(4). It is the leading cause of long-term disability in the world, leaving as many as one in every

six survivors permanently disabled (7). In Nigeria, it is the seventh leading cause of death(8) with hospitalization rates ranging from 0.9% to 4.0%, neurological admissions varying between 0.5% and 45%, and emergency medical admissions accounting for 3.7%(7). It also constitutes considerable burden of disability to both patients and their relatives(9).

About 80% of stroke occurrences can be reduced by lifestyle modifications (9). Identification of modifiable lifestyle and risk factors remains crucial for stroke prevention and management (10). Modifiable risk factors that predispose an individual to stroke include dyslipidaemia, hypertension, obesity, atrial fibrillation, diabetes mellitus (DM), smoking, physical inactivity and carotid stenosis (7). Dyslipidemia is a significant modifiable risk factor for stroke (10,11) characterized by abnormal levels of lipids or lipoproteins in the blood, including elevated total cholesterol (TC), elevated low density lipoprotein cholesterol (LDL-C), elevated triglycerides (TG) and reduced high density lipoprotein cholesterol (HDL-C) (7,12).

Dyslipidaemia, especially elevated levels of LDL poses a significant risk factor for stroke by promoting the development of atherosclerosis in both extracranial and intracranial blood vessels. It leads to ischemic stroke as a result of thrombus, embolism, or conditions that result in low systemic perfusion pressures within cerebral vessels. Additionally, dyslipidemia can compromise the integrity of small blood vessels, increasing the likelihood of aneurysms and spontaneous cerebral or non-traumatic hemorrhage (1,7,13,14). Hence lowering LDL levels to target, can significantly reduce the risk of cerebral infarction and stroke (7).

The frequency of stroke is on the rise in Nigeria and prompt diagnosis of dyslipidemia as a modifiable risk factor for ischemic stroke is essential for prevention and management of stroke. Therefore, this study aims to evaluate the prevalence and patterns of dyslipidemia by gender among patients with ischemic stroke in a tertiary care center in Port Harcourt, Nigeria.

2. Materials and method

This was a retrospective hospital-based investigation carried out on ischemic stroke patients admitted in GoodHeart Medical Consultant Hospital, a private medical facility in Port Harcourt, Nigeria.

2.1. Patient selection

The study population comprised July 2022 to June 2023 hospital records of Ischaemic stroke patients at least 38 years and above, registered with the Cardiology unit of the Hospital. Patient's information was retrieved from the hospital's electronic medical records and evaluated.

2.1.1. Inclusion criteria:

- Patients with a diagnosis of ischaemic stroke confirmed using a computed tomography (CT) scan.
- Patients with a record of fasting lipid profile within 48 hours.
- Patients not on lipid lowering drugs.

2.1.2. Exclusion criteria

Patients who did not meet the above criteria were excluded.

A total of 33 subjects satisfied the requirements and were enlisted in the study.

2.2. Sample collection and analysis

The records of the investigations were extracted from the Electronic Medical Records (EMR) and analyzed.

5ml overnight fasting blood samples were collected into a lithium heparin vacutainer, it was spun at 3000 Rpm for 5 minutes, the plasma was separated and analyzed following standard operating procedures (SOPs) by laboratory professionals.

Plasma lipids were determined using commercially available kits (Agappe and Spectrum Diagnostics). All optical density measurements were made using (EMPEROR) EMP - 168 semi-auto analyzer at 546 nm.

TC was determined using colorimetric enzymatic endpoint cholesterol oxidase/ peroxidase (CHOD-PAP) method, TG by enzymatic glycerol phosphate oxidase/peroxidase (GPO-PAP) method. HDL was determined after precipitation of LDL

and VLDL from plasma, by direct enzymatic end point method. LDL was calculated using the following formula; TG/2.2 + HDL - TC

Dyslipidemia was characterized as elevated levels of total cholesterol (TC) exceeding 200mg/dl (>5.2 mmol/L), elevated low-density lipoprotein cholesterol (LDL-C) exceeding 129mg/dl (>3.38 mmol/L), reduced levels of high-density lipoprotein cholesterol (HDL-C) below 40mg/dl (<1.0 mmol/L), and triglycerides (TG) equal to or greater than 150mg/dl (≥1.7 mmol/L) based on the Adult Treatment Panel III (ATP III) guidelines (21).

2.3. Statistical analysis

Data entry and analysis was done using EXCEL version 16 and STATA version 15.0. Quantitative variables were expressed as means and standard deviations. Qualitative variables were expressed as percentages. The chi-square test where applicable was used in comparing proportions, while Independent Sample t-test was used to compare means between the groups. A p-value of ≤0.05 was considered significant.

3. Result

The study comprised 33 subjects consisting of 18(54.5%) males and 15(45.5%) females. The mean age of the total population was 62.6 ± 12.49. The most prevalent age group was elderly (>61 years) 20 (60.6%), followed by middle age (41-60 years) 12 (36.4%), lastly young adults (30-40years) 1 (3.0%). The minimum age was 38 while the maximum age was 87. The females were found to be older than the males with a mean age of 64.1 ± 2.50 vs 61.3 ± 12.69 (Table 1).

In the total population, the overall prevalence of dyslipidaemia was 97%, the pattern of dyslipidaemia was found to be elevated HDL (57.6%) as the most common form of dyslipidaemia followed by elevated LDL (21.2%), elevated TC and TG were the least common with equal prevalence of 9.1% .

There was no statistically significant difference in dyslipidaemia between male and female stroke patients, nevertheless 63.6% of the males and 33.3% of the females had dyslipidaemia. The pattern of dyslipidaemia differed in males and females. Males had reduced HDL (36.3%) as the most common form, followed by elevated LDL (15.2%) , elevated TC (9.1%) and elevated TG (3.0%). The pattern of dyslipidaemia in females was elevated HDL (21.1%) as the most common form, elevated LDL (6.1%) and elevated TG (6.1%) were the second most common with equal occurrence whereas elevated TC was not found in any female. (Table 2).

Table 1 Baseline characteristics of the study population

Variables	Frequency N=33	Percentage%
Gender:		
Male	18	54.5
Female	15	45.5
Mean age (SD)	62.6 ±12.49	
Male	61.3 ± 12.69	
Female	64.1 ± 12.50	
Age group:		
30-40(Young adults)	1	3
41-60 (Middle age)	12	36.4
>61 (Elderly)	20	60.6

Key: SD ; Standard deviation. All values are expressed as percentages and Mean ± Standard deviation

Table 2 Prevalence of dyslipidaemia among male and female ischaemic stroke patients

Parameters	Male N=18	Female N= 15	Total N=33	P-value
TC >5.2mmol/L N (%)	3(9.1)	0(0)	3(9.1)	0.097
HDL <1mmol/L N (%)	12(36.3)	7(21.1)	19(57.6)	0.247
LDL >3.3mmol/L N (%)	5(15.2)	2(6.1)	7(21.2)	0.312
TG >1.7mmol/L N (%)	1(3.0)	2(6.1)	3(9.1)	0.439
TOTAL	21(63.6)	11(33.3)	32(97)	

Key: TC; total cholesterol, HDL; high density lipoprotein, LDL; low density lipoprotein and TG; triglycerides, N; number of subjects

4. Discussion

The prevalence of dyslipidaemia is high in the study population with a higher occurrence observed among males compared to females. This trend may be attributed to the perception that males tend to prioritize their health less than females, leading to infrequent checkups to avoid being perceived as vulnerable. Consequently, abnormalities often go undetected until they escalate to critical levels. Moreover, a significant number of men opt for poorly prepared meals, considering it burdensome to prepare food themselves, hence relying on dining out as an alternative.

Among the study population, reduced HDL was the most prevalent form of dyslipidemia. This trend may be attributed to the limited intake of fresh fruits and vegetables in this region, alongside a high consumption of foods rich in saturated fats and trans fats.

There were more male than female Stroke patients in our study, this is similar to studies done in Abuja, Uyo, and Pakistan (4,7,13). The high incidence of stroke in males than females could be due to factors like smoking (14) and alcohol intake as researches have shown that men are more inclined to smoke than women, (16) and smoking adversely affects serum lipid metabolism, elevating LDL levels while reducing HDL levels. Moreover, the presence of nicotine and oxygen free radicals in tobacco aggravates vascular endothelial dysfunction, atherosclerosis and hypercoagulability thereby increasing the risk of thromboembolism and stroke occurrence(17,18). Additionally, men exhibit a higher likelihood of excessive alcohol intake, which can elevate blood pressure and consequently increase stroke susceptibility(19). Furthermore, excessive alcohol consumption contributes to increased triglyceride levels, a type of blood fat that can harden the arteries (18).

Majority of the study population were 61 years and above, this differs from a study that reported more persons to be within the age range of 50- 59 years (15). Stroke is considered to be a disease of older people and comes up with dementia further contributing to its morbidity, this calls for stroke control in the elderly to help improve their quality of life. Age related cerebral micro- and macro-circulatory changes are associated with older stroke patients. These changes are presumably mediated by endothelial dysfunction, impaired cerebral autoregulation and impaired neurovascular coupling. Endothelial dysfunction promotes neuro-inflammation, impaired cerebral autoregulation may lead to microvascular injury, and impaired neurovascular coupling fosters a decline in cortical function (20).

The males in the study were younger and had a higher prevalence of dyslipidaemia than the females. Men have been found to have a higher risk for stroke at a younger age and middle age than females, and generally have a short life expectancy than women, so men are usually younger when they have strokes and therefore have a higher rate of survival as compared to females(20).

In our study, we observed that dyslipidemia was seen in 97% of the stroke patients. Similarly, a study done in Nigeria showed an incidence of dyslipidemia at 92.30% (7) which is slightly lower as compared to our study. The high dominance of dyslipidemia could be due to the sedentary lifestyle, dietary habits and rapid urbanization in Nigeria. These finding is higher than reports from other parts of the world, with some differences. In Nepal, South Asia, it was found to be 80% (4), and 77.2% (21). These differences in the prevalence of dyslipidaemia may be attributed to the differences in genetic pattern, cultures, lifestyle and dietary habits.

The pattern of dyslipidaemia seen in the overall study population featured reduced HDL as the most common form of dyslipidaemia, followed by elevated LDL, elevated TC and TG were the least common forms with equal occurrence. This

is in contrast to a Another study in Ethiopia reported elevated LDL and TC as the most common forms of dyslipidaemia. (1) Another study in Nepal reported elevated TG as the most common form (4).

Elevated TC, reduced HDL, elevated LDL were higher in males than females except for elevated TG which was more in females than males. This is similar to a study done in Nepal that reported the same trend(4).

The high prevalence of reduced HDL in the overall stroke population agrees with previous studies which established that HDL is inversely proportional to stroke risk(22). The inverse relationship between serum HDL and stroke risk has strengthened in light of earlier epidemiological studies done. Large cohort studies done included the Honolulu heart program (23), the Atherosclerosis Risk in Communities (ARIC) study (24) and Oyabe study (25). Although using different HDL levels in comparison, the Honolulu Heart program and Oyabe study demonstrated a significant inverse association while ARIC study demonstrated non-significant trends toward an inverse relationship of serum HDL and ischemic stroke risk. The populations studied included middle-aged and elderly men and women from America, Hawaii, and Japan. When taken together it seems clear that higher baseline levels of serum HDL lowers the risk of subsequent ischemic stroke while reduced levels of HDL increases the risk of ischaemic stroke (26).

The beneficial effect of HDL is largely attributable to its key role in reverse cholesterol transport, whereby excess cholesterol in the peripheral tissues is transported to the liver, reducing the atherosclerotic burden. HDL also has pleiotropic properties, such as anti-inflammatory, anti-oxidative, and vasodilatory properties, which may contribute in reducing the incidence of ischaemic stroke (27). It has been demonstrated that individuals with ischemic stroke have higher LDL levels (29) this make them more sensitive to lipid peroxidation, and the products of lipid peroxidation are significantly linked to the risk of ischemic stroke (30).

Elevated TC was not found in any of the female stroke patient, this is in contrast with a study which reported TC as the strongest predictor of stroke in women (29). Elevated TC levels are linked to coagulation disorders and fibrinolysis, both of which are linked to ischemic stroke(28).

Elevated TG leads to ischemic stroke through its contribution to atherosclerosis and thrombosis. It contributes to atherosclerosis through its association with elevated C-reactive protein, fibrinogen levels, and circulating adhesion molecules; formation of oxidative stress due to lipid-derived free radicals; and causing endothelial dysfunction. The thrombosis effect is caused by changes in the coagulation system and increased plasma viscosity (29,30).

5. Conclusion and Recommendation

Dyslipidaemia was common in the overall study population particularly reduced HDL and elevated LDL. Dyslipidemia is a modifiable risk factor for stroke that should be treated in patients who are at high risk. Timely diagnosis and management in the general population can significantly alleviate the burden of this morbid condition, particularly among those at higher risk. Implementing Lifestyle modification and prescription of lipid-lowering drugs as primary stroke prevention measures may effectively reduce the incidence of Stroke. Additionally, more extensive studies are required to assess the prevalence of dyslipidemia in this region so that resources can be allocated appropriately for sensitization programmers.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

Ethical approval of this study was obtained from the University of Port Harcourt teaching Hospital ethical committee.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] Alemayehu E, Fasil A, Nigatie M, Ambachew S. Serum lipid profile of stroke patients attending at Dessie comprehensive specialized hospital, Dessie, Northeast Ethiopia: A comparative cross-sectional study. Heliyon. 2023 Mar;9(3):e14369.

[2] Maredza M, Bertram MY, Tollman SM. Disease burden of stroke in rural South Africa: an estimate of incidence, mortality and disability adjusted life years. BMC Neurol. 2015 Apr 12;15(1):54.

[3] leading causes of death in the world 2024 - Google Search [Internet]. [cited 2024 Mar 20]. Available from: https://www.google.com/search?q=leading+causes+of+death+in+the+world+2024&oq=leading+causes+of+de ath+in+the+world+2024&gs_lcrp=EgZjaHJvbWUyCQgAEEUYORiABDINCAEQABiGAxiABBiKBdIBCTE2OTA1ajB qN6gCALACAA&sourceid=chrome&ie=UTF-8

[4] Khan RSU, Nawaz M, Khan S, Raza HA, Nazir T, Anwar MS, et al. Prevalence of Dyslipidemia in Ischemic Stroke Patients: A Single-Center Prospective Study From Pakistan. Cureus. 14(6):e25880.

[5] Olamoyegun MA, Akinlade AT, Fawale MB, Ogbera AO. Dyslipidaemia as a risk factor in the occurrence of stroke in Nigeria: prevalence and patterns. Pan Afr Med J [Internet]. 2016 Apr 10 [cited 2024 Mar 20];25(72). Available from: https://www.panafrican-med-journal.com/content/article/25/72/full

[6] CDC in Nigeria | Global Health | CDC [Internet]. 2023 [cited 2024 Mar 20]. Available from: https://www.cdc.gov/globalhealth/countries/nigeria/default.htm

[7] Otu A. Serum lipid profile in ischaemic stroke patients in southern Nigeria. IOSR J Dent Med Sci. 2018 Jun 8;

[8] Vangen-Lønne AM, Wilsgaard T, Johnsen SH, Løchen ML, Njølstad I, Mathiesen EB. Declining Incidence of Ischemic Stroke. Stroke. 2017 Mar;48(3):544–50.

[9] Chang Y, Eom S, Kim M, Song TJ. Medical Management of Dyslipidemia for Secondary Stroke Prevention: Narrative Review. Medicina (Mex). 2023 Apr;59(4):776.

[10] Ariyanti R, Besral B. Dyslipidemia Associated with Hypertension Increases the Risks for Coronary Heart Disease: A Case-Control Study in Harapan Kita Hospital, National Cardiovascular Center, Jakarta. J Lipids. 2019 Apr 30; 2019:2517013.

[11] Tirschwell DL, Smith NL, Heckbert SR, Lemaitre RN, Longstreth WT, Psaty BM. Association of cholesterol with stroke risk varies in stroke subtypes and patient subgroups. Neurology. 2004 Nov 23;63(10):1868–75.

[12] Ma YH, Leng XY, Dong Y, Xu W, Cao XP, Ji X, et al. Risk factors for intracranial atherosclerosis: A systematic review and meta-analysis. Atherosclerosis. 2019 Feb 1;281:71–7.

[13] Onwuegbuzie Gerald A, S. RengRifkatu. Serum Lipid Profile of Patients with Ischaemic Stroke in A Tertiary Centre in Nigeria. [cited 2024 Mar 20]; Available from: https://www.researchgate.net/profile/Gerald-Onwuegbuzie/publication/370418770_Serum_Lipid_Profile_of_Patients_with_Ischaemic_Stroke_in_A_Tertiary_ Centre_in_Nigeria/links/644f6684809a5350213ef202/Serum-Lipid-Profile-of-Patients-with-Ischaemic-Stroke-in-A-Tertiary-Centre-in-Nigeria.pdf

[14] Abdu H, Seyoum G. Sex Differences in Stroke Risk Factors, Clinical Profiles, and In-Hospital Outcomes Among Stroke Patients Admitted to the Medical Ward of Dessie Comprehensive Specialized Hospital, Northeast Ethiopia. Degener Neurol Neuromuscul Dis. 2022 Jan 1;12:133–44.

[15] FastStats [Internet]. 2023 [cited 2024 Mar 30]. Available from: https://www.cdc.gov/nchs/fastats/mens-health.htm

[16] Zhang XX, Wei M, Shang LX, Lu YM, Zhang L, Li YD, et al. LDL-C/HDL-C is associated with ischaemic stroke in patients with non-valvular atrial fibrillation: a case-control study. Lipids Health Dis. 2020 Oct 7;19(1):217.

[17] CDC. Centers for Disease Control and Prevention. 2023 [cited 2024 Mar 30]. Men and Stroke | cdc.gov. Available from: https://www.cdc.gov/stroke/men.htm

[18] Excessive Alcohol Use and Risks to Men's Health | CDC [Internet]. 2024 [cited 2024 Mar 30]. Available from: https://www.cdc.gov/alcohol/fact-sheets/mens-health.htm

[19] Yousufuddin M, Young N. Aging and ischemic stroke. Aging. 2019 May 1;11(9):2542–4.

[20]   Brain Basics: Preventing Stroke | National Institute of Neurological Disorders and Stroke [Internet]. [cited 2024 Mar 29]. Available from: https://www.ninds.nih.gov/health-information/public-education/brain-basics/brain-basics-preventing-stroke

[21]   Baral S, Pokhrel A, B.K. SK, Kshetri R, Regmi P, Gyawali P. Dyslipidemia among Patients with Ischemic Stroke in the Department of Medicine of a Tertiary Care Centre: A Descriptive Cross-sectional Study. JNMA J Nepal Med Assoc. 2022 Jun;60(250):511–6.

[22]   Bhatta S, Kafle R, Dhungana K, Shrestha R, Shakya D. Ischemic stroke: Observations and analysis of stroke patients admitted in a tertiary hospital of Kathmandu. J Kathmandu Med Coll. 2019 Jun 30;8(2):66–71.

[23]   Sanossian N, Saver JL, Navab M, Ovbiagele B. High-Density Lipoprotein Cholesterol. Stroke. 2007 Mar;38(3):1104–9.

[24]   Curb JD, Abbott RD, Rodriguez BL, Masaki KH, Chen R, Popper JS, et al. High Density Lipoprotein Cholesterol and the Risk of Stroke in Elderly Men: The Honolulu Heart Program. Am J Epidemiol. 2004 Jul 15;160(2):150–7.

[25]   Shahar E, Chambless LE, Rosamond WD, Boland LL, Ballantyne CM, McGovern PG, et al. Plasma Lipid Profile and Incident Ischemic Stroke. Stroke. 2003 Mar;34(3):623–31.

[26]   Soyama Y, Miura K, Morikawa Y, Nishijo M, Nakanishi Y, Naruse Y, et al. High-Density Lipoprotein Cholesterol and Risk of Stroke in Japanese Men and Women. Stroke. 2003 Apr;34(4):863–8.

[27]   Banach M, Shekoohi N, Mikhailidis DP, Lip GYH, Hernandez AV, Mazidi M. Relationship between low-density lipoprotein cholesterol, lipid-lowering agents and risk of stroke: a meta-analysis of observational studies (n = 355,591) and randomized controlled trials (n = 165,988). Arch Med Sci AMS. 2022 Jan 19;18(4):912–29.

[28]   Nagao M, Nakajima H, Toh R, Hirata K ichi, Ishida T. Cardioprotective Effects of High-Density Lipoprotein Beyond its Anti-Atherogenic Action. J Atheroscler Thromb. 2018 Oct 1;25(10):985–93.

[29]   Pan Y, Wangqin R, Li H, Jin A, Li J, Lin J, et al. LDL-C levels, lipid-lowering treatment and recurrent stroke in minor ischaemic stroke or TIA. Stroke Vasc Neurol [Internet]. 2022 Aug 1 [cited 2024 Apr 2];7(4). Available from: https://svn.bmj.com/content/7/4/276

[30]   Li Z, Bi R, Sun S, Chen S, Chen J, Hu B, et al. The Role of Oxidative Stress in Acute Ischemic Stroke-Related Thrombosis. Oxid Med Cell Longev. 2022 Nov 16; 2022:8418820.