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Assess the Serum Lipid Profile in Patient with Acute Ischemic Stroke at Tertiary Care Center in Nepal

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Abstract:-

➢ ***Introduction:***

Ischemic stroke takes place when the blood flow cessation endures for more than a few minutes leading to brain tissue infarction. After ischemic heart disease, ischemic stroke is the second most common cause of death worldwide and one of the top five diseases based on DALYs (disability-adjusted life years) in Nepal. Though dyslipidemia is a major risk factor for coronary heart disease, it has an unclear role in the pathogenesis of ischemic stroke. In a patient with a previous ischemic stroke, statins reduce the risk of ischemic stroke. So, this study analyses the plasma prevalence of total cholesterol (TC), low-density lipoprotein (LDL), High-density lipoprotein (HDL), and triglyceride (TG) in patients with acute non-cardioembolic ischemic stroke and their association with different non-modifiable risk factors (age, gender & family history) and modifiable risk factors (diabetes, hypertension, obesity, smoking & alcohol intake).

➢ ***Materials and Method:***

This is a descriptive and analytical cross-sectional hospital-based study carried out from December 5th, 2021 to December 4th, 2022 including 80 patients admitted to Chitwan Medical College, Chitwan, with a diagnosis of acute ischemic stroke. All the patients underwent a detailed history, physical examination, and baseline investigations including fasting lipid profile along with CT- scan/MRI head. The fasting lipid profile was done within the first 24 hours of hospitalization. Data was entered in MS Excel 2013 and converted it into SPSS 26 for statistical analysis.

➢ ***Result:***

A total of 80 patients with the diagnosis of acute ischemic stroke were enrolled. Out of them, 37 (46.25%) were female and 43 (53.75%) were male. A total number of 71 (88.75%) patients were from more than or equal to 55 years of age group and 9 (11.25%) patients were from less than 55 years of age group. The mean age ± standard deviation of male and female patients was 66.69 ±9.14 years and 68.54 ±14.96 respectively. Overall, derangement in serum lipid profile (dyslipidemia) was present in 63.75% of the patients. Among the total cases, high TC is found in 18 patients (22.5%), TG in 24 patients (30%), high LDL is found in 16 patients (20%), and low HDL is found in 23 patients (28.75%).

➢ ***Conclusion:***

The study highlights hypertriglyceridemia as the leading dyslipidemia in ischemic stroke patients, showing gender and age variations in prevalence. It confirms dyslipidemia's role in brain vascular changes, notably in the Middle Cerebral Artery, and its link to carotid artery stenosis severity. Despite common risk factors, their direct association with dyslipidemia remains statistically insignificant, stressing the need for focused lipid management to mitigate stroke risks.

Keywords:- *Serum Lipid Profile, Ischemic Stroke, Dyslipidemia.*

I. INTRODUCTION

Stroke is recognized as cerebrovascular disease, and manifests as a rapid onset of neurological impairment due to a localized vascular origin, either ischemic or hemorrhagic. The diagnostic criteria for stroke involve the integration of clinical symptoms and brain imaging findings, emphasizing the critical role of both clinical presentation and neuroimaging in defining this condition.[1]

Carotid artery stenosis is a condition where the carotid arteries, the major blood vessels in the neck that supply blood to the brain, become narrowed. This narrowing is usually caused by atherosclerosis, a process where fatty deposits, or plaques, build up on the inner walls of the arteries. These plaques can reduce blood flow, and in more severe cases, completely block the artery. The relationship between carotid artery stenosis and stroke is significant. When the carotid arteries are narrowed due to stenosis, the risk of stroke increases because it can lead to reduced blood flow to the brain. Additionally, pieces of the plaque or a blood clot formed on the plaque can break off and travel to the brain, leading to a blockage of blood flow, which is a common cause of ischemic stroke. Ischemic strokes, which account for the majority of stroke cases, occur when a blood vessel supplying blood to the brain is obstructed. Carotid artery stenosis is one of the risk factors for this type of stroke. Hence, diagnosing and managing carotid artery stenosis is crucial in stroke prevention. In the context of acute ischemic stroke and CT (Computed Tomography) imaging, the territories of the major cerebral arteries – the Middle Cerebral Artery (MCA), Posterior Cerebral Artery (PCA), and Anterior Cerebral Artery (ACA) – are crucial for identifying the regions of the brain that might be affected by a stroke. [2]

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Middle Cerebral Artery (MCA) Territory (MCA) is the largest cerebral artery and supplies a significant portion of the brain's outer layer (cortex), particularly in the frontal, temporal, parietal, and some parts of the occipital lobes. It is involved in many critical functions, including motor control, sensory input, speech, and spatial reasoning. In a normal CT head scan, the MCA territory appears symmetric with no signs of infarction or ischemia. An acute ischemic stroke in the MCA territory can lead to symptoms like contralateral paralysis and sensory loss, aphasia (if the dominant hemisphere is involved), and spatial neglect (if the non-dominant hemisphere is involved).[3]

Posterior Cerebral Artery (PCA) Territory(PCA) primarily supplies blood to the occipital lobe, the bottom part of the temporal lobe, and some thalamic structures. It is crucial for visual processing. In a normal CT scan, the PCA territory should show no abnormalities or signs of ischemia. A stroke in this territory can lead to visual disturbances like contralateral hemianopia (loss of half of the field of view in both eyes).

Anterior Cerebral Artery (ACA) Territory (ACA) supplies the medial surfaces of the frontal and parietal lobes, including the primary motor and sensory areas for the lower extremities. On a normal CT scan, these areas appear intact with no ischemic changes. Ischemic stroke in the ACA territory can result in contralateral weakness and sensory loss, particularly in the lower limbs, and can also affect cognitive and behavioral functions due to its supply to the frontal lobes. [2-4]

Stroke stands as the second leading cause of global mortality, trailing behind ischemic heart disease, as per the World Health Organization. Annually, around fifteen million individuals suffer from strokes worldwide, with five million succumbing to its effects and another five million experiencing enduring disabilities. In Nepal, the Jaya Stroke Foundation reports approximately 50,000 stroke incidents yearly, where ischemic strokes constitute 60–70% of cases, resulting in nearly 15,000 deaths. Reports highlight stark differences in disability-adjusted life years (DALYs) between developing and developed nations, with developing countries facing sevenfold higher rates. Nepal specifically ranks stroke among its top five diseases in terms of DALYs, underscoring its significant health burden within the nation's healthcare landscape.[5]

An ischemic stroke results from a prolonged interruption of cerebral blood flow. Roughly 12.8% of initial ischemic stroke survivors encounter a subsequent episode within a year, carrying an average annual risk of 8% over three years. This recurrence highlights the heightened vulnerability post-first stroke, emphasizing the importance of sustained vigilance and preventative measures to mitigate the substantial risk of subsequent ischemic events.[3] Immediate initiation and continuity of secondary preventive measures are pivotal in averting ischemic stroke recurrence and optimizing long-term outcomes. The research underscores the significance of targeting triglycerides (TG), low-density lipoprotein (LDL), and high-density lipoprotein (HDL) as therapeutic avenues to mitigate overall vascular risk post-stroke. Addressing these lipid profiles stands as a viable strategy for enhancing vascular health and reducing the likelihood of subsequent stroke events.[6-9] Research indicates a decline in recurrent ischemic stroke rates among individuals with recent stroke or TIA (transient ischemic attack) with statin (lipid-lowering drug) usage. This highlights the potential of statins in reducing the risk of subsequent ischemic events in this specific population.[10]

The observed threefold surge in dyslipidemia among stroke patients in a recent Kathmandu study underscores its preventable role in ischemic stroke. This stark increase compared to previous research hints at evolving individual lifestyles as a driving force behind dyslipidemia's rising prevalence. This revelation emphasizes the need to address lifestyle alterations as a significant contributor to the escalating incidence of dyslipidemia. By targeting these lifestyle factors, interventions can potentially mitigate dyslipidemia's impact on the increased risk of ischemic stroke in affected populations.[11]

Hence, focusing on dietary and lifestyle modifications stands as crucial preventive strategies to curb the escalating prevalence of dyslipidemia and subsequent ischemic stroke. This study aims to ascertain the prevalence of dyslipidemia and analyze lipid profile patterns among acute ischemic stroke patients across diverse clinical profiles. By delineating these correlations, the research endeavors to elucidate the relationship between clinical parameters and lipid profiles, paving the way for targeted interventions aimed at mitigating dyslipidemia's contribution to ischemic stroke occurrences.

II. METHODOLOGY

- *Type of Study:*

Hospital based descriptive and analytical cross-sectional study.

- *Study Population:*

All patients visiting Chitwan Medical College with acute ischemic stroke who fulfill the criteria of the study population.

- *Study Site:*

Medicine unit, Chitwan Medical College, Bharatpur, Chitwan, Nepal

- *Sample Size:*

A minimum of eighty patients aged more than 18 years including both male and female, diagnosed with acute ischemic stroke matching the inclusion and exclusion criteria will be selected. From June 2012 to November 2015, A study of 503 acute ischemic stroke patients admitted to Kathmandu Medical College Teaching Hospital was done, 34.1% prevalence of dyslipidemia was seen among these patients.

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So, regarding the above data, with 95 % of confidence interval, margin of error is taken as 20% of prevalence (34.10%) = 6.8 %

Therefore, Z = 1.96 for 95% confidence level,

p (prevalence) =0.34 &

d (margin of error) = 0.068

$$Sample\ size = \frac{Z2 * (P) * (1-P)}{d^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Therefore, using equation (1),

Sample size = 186

The total number of acute ischemic stroke patients admitted to our hospital last year, 2020, the data was 91.

The corrected sample size is:

$$Corrected Sample Size = \frac{Sample\ size\ in\ large\ population}{1 + \frac{Sample\ size\ in\ large\ population}{Minimum\ sample\ population}} \quad \ldots\ldots (2)$$

Now, using equation (2), the corrected sample size would be 62. However, I have taken all the cases of acute non-cardioembolic ischemic stroke admitted in our hospital during the one-year time which came to be 80.

Data was entered in Microsoft Excel 2013 and converted into SPSS (Statistical Package for social science) version 26 for statistical analysis. For descriptive statistics, percentage, mean, standard Sdeviation, and median interquartile range (minimum & maximum) were calculated along with tabular and graphical presentation. For, inferential statistics, chi-square (x2) and independent-t test were applied to find out the significant differences between dyslipidemia groups and other related or selected variables at a 95 % confidence interval, where the p-value was considered as < 0.05.

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III. RESULTS

Among 80 patients, the average age of patients with acute ischemic stroke was 67.55 ± 12.13 years; the average age of male patients was 66.67 ± 9.14 years, and the average age of female patients was 68.54 ± 14.96 years. This reveals that male undergoes acute ischemic stroke at an earlier age than females which is shown in Table 1.

Table 1 Mean and Standard Deviation of Age with Gender

Gender	Mean age in years	Number	Standard Deviation
Male	66.69	43	9.14
Female	68.64	37	14.96
Total	67.55	80	12.13

TG was found higher in 30% of ischemic stroke patients, total Cholesterol was higher in 22.5%, LDL was higher in 20%, and HDL was lower in 28.75%. Furthermore, we can imply that TG is more prevalent among the dependent variables.

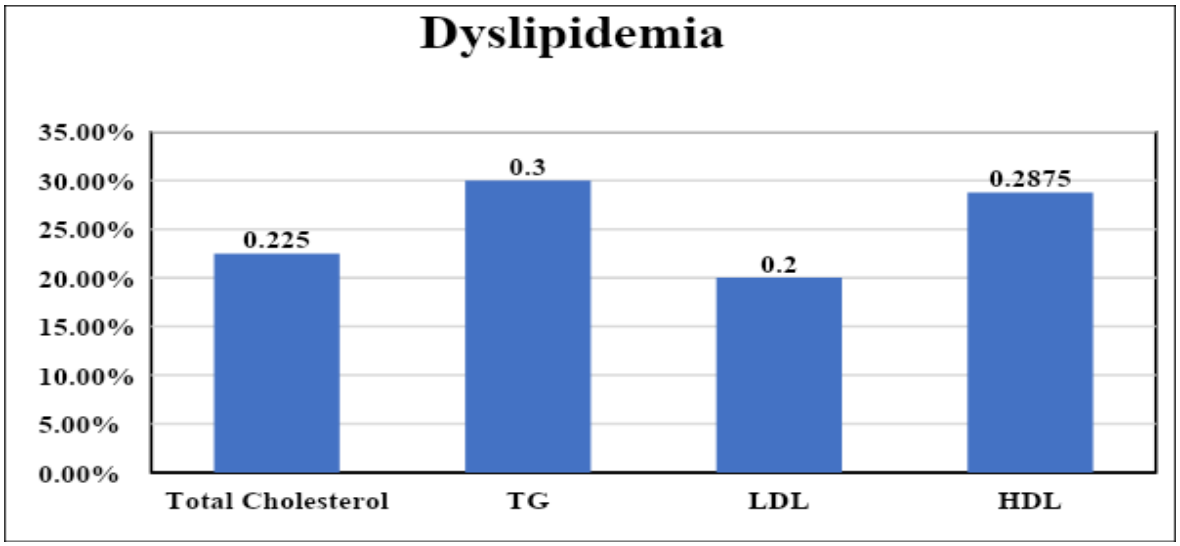

Fig 1 Bar Graph Diagram Showing Dyslipidemia Pattern Prevalence

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Figure 1 shows that high level of total cholesterol (≥200 mg/dl) was found in 18 patients (22.5 %), high level of triglycerides (≥150 mg/dl) was found in 24 patients (30 %), high level of LDL (≥130 mg/dl) was found in 16 patients (20 %) and low level of HDL (≤40 mg/dl) was found in 23 patients (28.75%).

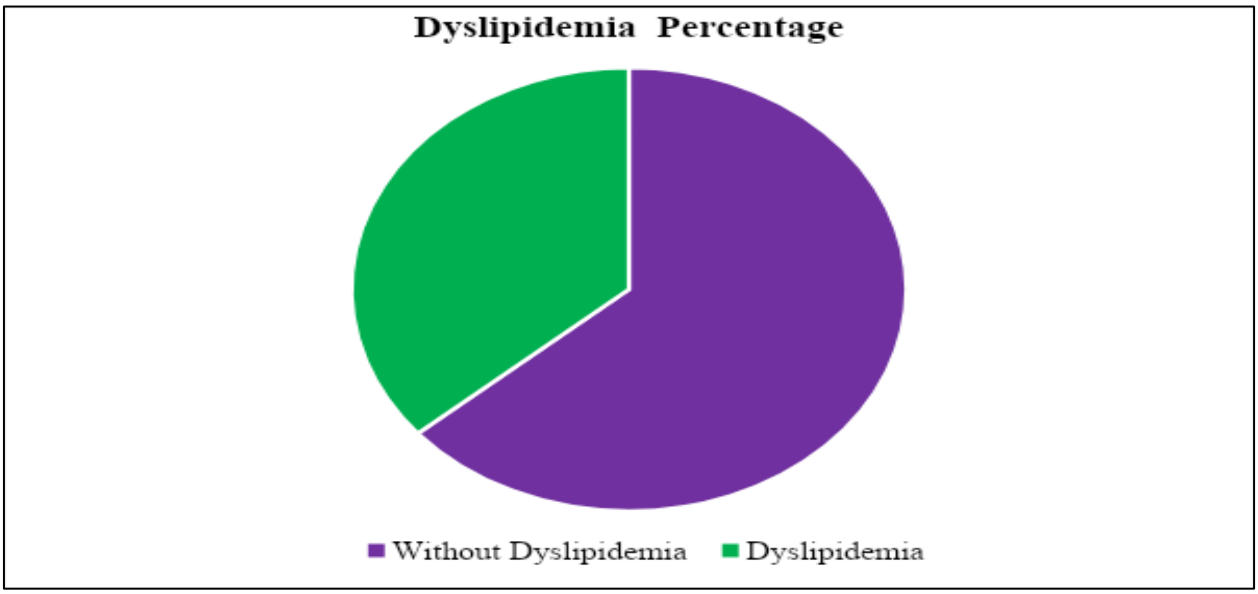

Fig 2 Pie chart Diagram Showing Dyslipidemia Prevalence

Figure 2 shows that among the total cases under study, 63.75% percentage of them were found to have dyslipidemia. Therefore, the bar graph (figure 1) and pie-chart direct toward hypertriglyceridemia as a major cause of dyslipidemia. Among ischemic stroke patients with dyslipidemia, carotid artery Doppler revealed 6% with moderate stenosis and 94% mild, with no cases of severe stenosis detected.t In ischemic stroke patients with dyslipidemia, CT scans reveal the distribution of affected vascular territories: 72.5% in the Middle Cerebral Artery (MCA), 9.8% in both the Anterior Cerebral Artery (ACA) and normal findings, and 7.8% in the Posterior Cerebral Artery (PCA), indicating the MCA is most commonly involved.

Table 2 Different Modes of Presentation of Ischemic Stroke

Modes of Presentation	Percentage
Left sided weakness	38.70%
Right sided weakness	61.30%
Deviation of face	76.30%
Aphasia	36.30%

Table 4 shows the mode of presentation in patients, which showed that 76.30% had a deviation of face out of the total patients. Right-sided weakness and left-sided weakness were 61.30% and 38.7% respectively. This table also shows the patients having aphasia were 36.60% of total patients.

Table 3 Association of Lipid Profile with Gender Lipid Profile

Lipid Profile	Male	Female	P-value
High LDL(≥ 130mg/dl)	8(26.66%)	8(38.09%)	0.737
Low LDL(≤ 40mg/dl)	15(50%)	8(38.09%)	0.191
High Triglycerides(≥150mg/dl)	15(50%)	9(42.85%)	0.303
High Total cholesterol(≥200mg/dl)	9(30%)	9(42.65%)	0.717
Total patients with dyslipidemia	30(100%)	21(100%)	

The table presents a comparative analysis of lipid profile abnormalities between male and female patients with dyslipidemia. It shows that high LDL levels were found in 26.66% of males and 38.09% of females, with no significant gender difference (pvalue=0.737). Low HDL levels were more common in males (50%) compared to females (38.09%), yet this difference was not statistically significant (p-value=0.191). Similarly, high triglyceride levels were observed in 50% of males and 42.85% of females, showing no significant gender disparity (p-value=0.303). High total cholesterol was reported in 30% of males and 42.65% of females, with no significant difference (p-value=0.717). Both genders had 100% prevalence of dyslipidemia, indicating widespread lipid abnormalities among the studied population without significant differences across gender lines.

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The male patients showed high levels of LDL and a significant occurrence of low HDL, while a similar trend of high LDL was observed in female patients, alongside notable instances of high total cholesterol (TC). Furthermore, both male and female patients exhibited high triglyceride (TG) levels, with these conditions being more pronounced in males for low HDL and high TG, and in females for high LDL and TC. This indicates gender-specific patterns in dyslipidemia, highlighting the importance of tailored approaches in managing lipid levels across different patient groups.

Consequently, we found among the 29 patients without dyslipidemia, all of them (100%) have less than 50% stenosis, and none have 50-69% stenosis. Similarly, Of the 51 patients with dyslipidemia, 48 (approximately 94.1%) have less than 50% stenosis, and 3 (approximately 5.9%) have 50-69% stenosis. Furthermore, the total number of patients with less than 50% stenosis is 77, and those with 50-69% stenosis is 3. The overall total number of patients in the study is 80.

IV. CONCLUSION

The study identified hypertriglyceridemia as the predominant dyslipidemia in ischemic stroke patients, with high triglycerides and low HDL-C in males, and low LDL-C and cholesterol in females. Dyslipidemia incidence was higher in males and increased with age. Moreover, this study solidifies the connection between dyslipidemia and vascular changes in the brain, specifically within key arteries such as the Middle Cerebral, Posterior Cerebral, and Anterior Cerebral Arteries. Our observations align with prior research, indicating a notable pattern where dyslipidemia correlates with a higher incidence of brain alterations visible on CT scans, especially in the Middle Cerebral Artery region. This relationship underscores the critical need for diligent lipid management to mitigate stroke risks and severity. Furthermore, examining carotid artery stenosis through Carotid Doppler has revealed a distinct variance in stenosis severity linked to dyslipidemia status, with dyslipidemic patients more likely to experience significant artery narrowing. Collectively, these findings emphasize the importance of controlling lipid levels not only to reduce stroke risk but also to prevent severe carotid artery stenosis. In addition, we found acute ischemic stroke (AIS) occurs earlier in males, with a higher prevalence of dyslipidemia compared to females. Despite the presence of risk factors like hypertension, high BMI, diabetes, smoking, and alcohol use, statistical analysis didn't show a significant association with dyslipidemia. This underscores the complex etiology of dyslipidemia, unaffected by common risk factors

RECOMMENDATIONS

Based on the findings of our study that reveal a significant link between dyslipidemia and vascular changes in the brain, as well as its impact on the severity of carotid artery stenosis in acute ischemic stroke patients, we recommend assessment, prevention, and interventions. Healthcare professionals should prioritize rigorous lipid management strategies for patients at risk of or currently experiencing acute ischemic stroke. Routine dyslipidemia screening should be implemented for individuals at risk of acute ischemic stroke, particularly those with a history of vascular diseases or stroke. Early detection of abnormal lipid levels can facilitate timely intervention to mitigate the risk of stroke and its associated complications. For patients diagnosed with acute ischemic stroke or those at high risk, incorporating Carotid Doppler and CT head scans into the standard diagnostic protocol can provide valuable insights into the severity of carotid artery stenosis and the specific vascular territories affected. Encourage a collaborative approach involving cardiologists, neurologists, radiologists, and primary care physicians to ensure a holistic and coordinated care plan for patients with or at risk of dyslipidemia and ischemic stroke. This team effort can enhance the effectiveness of prevention, early intervention, and management strategies.

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Country: Nepal

City: Kathmandu

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