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Original Article

Serum fibrinogen & total cholesterol: A significant primary biomarker and its interrelationship in stroke

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Abstract

Background: To study the association of plasma fibrinogen & total cholesterol levels, incidences, prevalence, and gender wise distribution in different etiologies of stroke.

Methods: Fibrinogen & total cholesterol levels, prevalence, incidences, comorbidities, and different etiologies were assessed along with routine investigations and radiology inputs as per investigator's discretion. The overall median values were represented in graphically format in MS-Excel.

Results: 292 Males: 218 females. Age 30 to 80 years. Among, 25.1% diabetic, 38.9 % hypertension (HTN) and 31% diabetes + HTN. 5 % diabetes + HTN + dyslipidemia and other comorbidities. Overall, 73% had ischemic stroke (IS) & 27 % have hemorrhagic stroke (HS). Hemiparesis in 76.5 %. Mean Fibrinogen elevated in 81% and range was 934±20 mg/dL. Total cholesterol level increased in 73.2% & range was 365±10 mg/dL. The HS patients were experienced headache 77 (19.60%) and vomiting 34 (24.6%) than IS patients. As per radiological finding, the territory of Middle Cerebral Artery was the ordinary location of arterial territory infarctions in the IS form that was present in 213 (57.2%) subjects following that in the anterior side of cerebral artery in 89 (23.92%) and posterior cerebral artery was 44 (11.82%). Arterial flutter found in 56 (10.9%), Structural heart disease present in 30 (5.88%), family history of stroke in 28 (5.49%).

Conclusion: Elevated fibrinogen & total cholesterol levels are independent significant primary biomarkers elevated with incidences of CV stroke. Stroke was higher in ischemic stroke group.

Keywords: Fibrinogen, Biomarker, Cholesterol, Association, Comorbid, Incidences, Prevalence and stroke.

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The cardiac diseases narration for almost the non-communicable diseases (NCD) deaths or near by 18.2 million people yearly, subsequently the second higher are cancers (9.3 million) of different localities, chronic diseases of respiratory system (4.1 million), and the diabetes mellitus (2.0 million along with kidney disease deaths caused by diabetes mellitus) (1). NCDs squarely cardio-diabetic diseases were stabilized to be the foremost mainspring of the transience throughout the globe (2). The anguish rate, death, and impairment explicable to extensive NCDs were rendering for just about 60% of entire deaths along with 47% of the international load of comorbidity (3). Stroke is the second leading cause or mortality worldwide. Stroke is more severe in terms of productive years lost and impact on a person's life. The etiology of CV stroke is different at young age population compared to the older age group due to the presence of certain age- specific factors. The CV stroke is a pernicious and debilitate cerebral and cerebrovascular condition with few proportions of extra shortage of most significant to remunerative deprivation. Stroke conceivably as a consequence of to higher universality of either hypertension or comorbidities like diabetes and dyslipidemias.

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Nowadays in the accelerated stride world, the infestation of non-transmissive diseases, in particular that incorporate cardiac and vascular diseases, hypertension, endocrine disease like diabetes, and stroke. The majority of these diseases are float of cancers and the related slash is moderately enhance an overall populations health condition of vault agitate. Beyond such circumstances, Cerebral and cardiovascular tragedy (mainly the stroke) is escalating significant as showing with medical emergency and may lead everlasting neurological rapture and may cause death (4). The noiseless bulk numbers of loss of life come about in amidst down and the middle-earning populations like India, Pakistan and China (5). Nontransferable Diseases statement provocative of approx.53% of all life loss in India and the leading furnish to reinforce load of foreboding and mortality because of less socio-economic domination level of the patients (6).

Numerous aspects are accorded to the in dept dominated distinction in subjects with the NCD in particular that encompasses illiteracy, insufficiency of blended care in the health related systems, slighter adherence or non-adherence to self-care or prescribed endorsements, and non - compliance to therapy or medications (7). In Asian continent the India come in to contact with a substantial population based adaptation for the over 20 years along with in a significant shifting of ill health overburden from the transferable to non-transferable disease (8). At present, the excess of 60% of the entire life loss are owing to nontransferable diseases in India, in particular that the CV stroke and cardiac events comprises of more or less 30% (8-9). Taking in to account this, elevated blood pressure has come up as a paramount health load, promoting to expand loss of life (10). Contrast to previous published record (11), elevated blood pressure pervasiveness in India own figure out as an enlarged inclination in the time of ended 20 years (12-13), with the almost current country wise evaluations of till 25 to 30% (14-15).

Nonetheless, such all research evaluated prevalence of uprise blood pressure utilizing by fragmentary analysis design in single center studies thus, restrain the initiation to the terrestrial switch inside the particular outfit. Furthermore, there are restricted published studies in India exploring the occurrence of hypertension between the population unit (16-20). Consequently, the further investigation analysis proposal is going to be greater detailed and believable to determine replacing inclination inside the identical cohort over a period. A couple of investigations were convey out in the advance province, nonetheless vastly few number of investigations are performed in the under developed territory such as India etc (21-24). Such investigations pin down a variety of threat items these are crucially linked and accompanied by CVD/cerebrovascular stroke. Additionally, several articles resulted that this paramount avoidance also lifestyle customization will diminish the extent of incidences of CV stroke. This contemporary work was accompanied for determining the ornaments of caution characteristic along with the feasibility of CV stroke in community. Pervasiveness throws back the steadiness allying occurrence and loss of life too, Furthermore, a squat pervasiveness imaginably owing to short frequency or up-rise life loss or the pair of; contrariwise, a raced universality conceivably owing to elevated extent or lower corporeality rate or both the pair possible (25).

On the best of available studies, the two known variety of events of stroke rest on its area of contingency inside the human brain. The slight occasion of the CV incidence may outcome in the negligible troubles, likewise delicacy in the upper body parts or lower legs, etc. A substantial scene of the symptom of stroke may accompany to limb or whole-body paralysis or even death of the patients. Over and above that a remarkable stroke subjects are rested along with debility in single side, struggling in proper speech, indulgence of urine and/or other urinary bladder related difficulties.

Furthermore, basically, the pair of paramount stroke subordinates: IS and hemorrhagic stroke. IS type coming about because of an obstacle inside the blood tube delivering blood to the parts of the brain. It narrates for approximately 87% of the stroke-related exhibitions reported (26). Hemorrhagic stroke mainspring next to the crack in vessel of the blood inside or on the exterior part of the human brain accompanied by running blood into the nearest tissue. Stroke symptom is the compounded condition that materializes owing to mingling innumerable threat, these all totally could not definitely exist in the course of contingency. This is on account of escalating pervasiveness of uprise blood pressure, diabetes, lipid imbalance, rapid switch of life and re-constructing of citizens, stroke will be a strong epizootic in our country for the upcoming years (27).

As explicate by the WHO, the accepted signal or symptom of a stroke is unexpected infirmity or dribble of the facial area, upper and lower arm/s or throughout the single side leg/s, predominantly on the unilateral site and slurred speech (FAST symptom). Furthermore, other dominant features consist of doubt, improper speaking, or concern about speech delivery; strain in seeing with either one or both eyes clearly; struggling in step out, lightheadedness, imbalance, or loss of proper cooperation;

drastic headache escorted by unknown mainspring and blankness in few cases (28). One of the region Haryana states in the India is affiliated to inflated population-based alteration intensity. Beneath this above-mentioned level, nearby the 34% of gross life loss is allocated to the account of CVDs, Furthermore, Haryana state itself accounts for an elevated in comparison with country-wise midpoint extant of IHD (29-30). Besides, upside BP is among the most relevant stakes for IHD and related symptom of the stroke. One of the fresh researches by Thakur J S and Nangia (31).

Total cholesterol & fibrinogen: The cholesterol is a very waxy substance, and it may stick to other present substitutes in the blood and itself form a hard, very thick collections in the inner part of the arteries. However, similar type of condition can join with other substances to form a thick, hard deposit on the inside of the arteries. Similarly, the excess amount of lipids on the blood in multiple form is well known as a condition of "hyperlipidemia" (32) The serum fibrinogen is well-known as a protein of coagulation parameters in the body and the foundation of the thrombin that are known to form the fibrin while the blood clot formation in the blood (33).

The fibrinogen is an awarded and proven highlighter for inflammation which came to know that it sticks to the sub-clinical or acute CVD and CAD (34-35). Additionally, in Western world; even so, the proven data for the evident or interconnection of level of fibrinogen in stroke was enormously borderline along with few limited results and same were still irreconcilable (36-38). Many published studies have investigated & correlated serum fibrinogen level and total cholesterol with stroke. Nonetheless, this is still not clear that the reflection of fibrinogen level is only residual of attached other elements of dangerous or possible any internal relationship. Further, the function of biomarkers in the evolution of stroke is not completely investigated and well-known, thus, additional aim-based research work is needed due to the possibility of interconnection, likewise, in CVD for the serum fibrinogen. The majority of studies were concluded in the western's populations along with reginal and ethnic variations (39-42). Therefore, our population dependent observational work inside the western Indian peoples, in Gujarat, India. After overall understanding and based on available data, we purposely initiated this research work to know the interconnection between serum levels of fibrinogen and total cholesterol level in stroke, CV events and the possibility related all-causes of the life loss. We also studied the etiology and relationship of stroke on both genders along with prevalence in stroke.

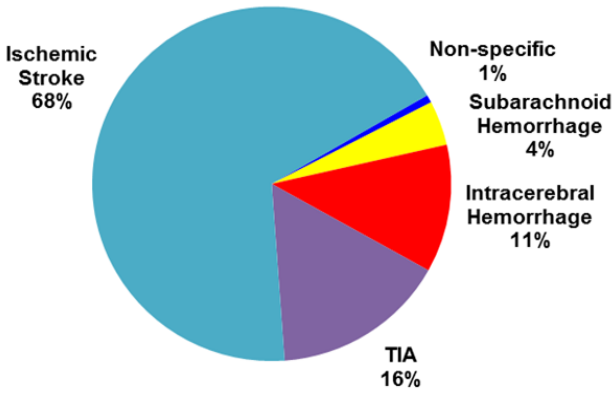

Figure 1. Epidemiology of stroke

Methods

Search strategy: PubMed, and related database of electronic medium along with MEDLINE, EMBASES and SciELO were found out allying from year 2000 to 2023 by the MeSH word (Heading) "Serum Fibrinogen & Total Cholesterol in Stroke" and includes the following concepts: serum fibrinogen, total cholesterol, dyslipidemia, stroke, CVD, lipid profile in stroke and serum fibrinogen & total cholesterol in CVD.

Ethical approval: All visits in the study materialized by the Declaration of Helsinki principles and ICMR statements considering human research. Nevertheless, the main investigator/ sub-investigators were already mandated by the Institutional Ethics Committee. Although all ICF and source record forms were already approved. Our Ethics committee approval number was-PUIECHR/PIMSR/00/081734/4701.

❖ **Study criteria**

▪ **Inclusion criteria**

1. Age about 18-75 years
2. BMI <35 kg/m^2
3. All patients having confirmed diagnosis of CV Stoke

▪ **Exclusion criteria**

1. Pregnant or planning to become pregnant and breast-feeding females.
2. Psychologically ill or mentally altered patients
3. Subjects who are on ongoing therapy or management for any oncological condition
4. Other multiple comorbid diseases which might impede the research work based on investigators inclination.

▪ **Biophysical estimations**

1. All Physical examination and all values of vital parameters.
2. Height, weight, BMI along with all history.

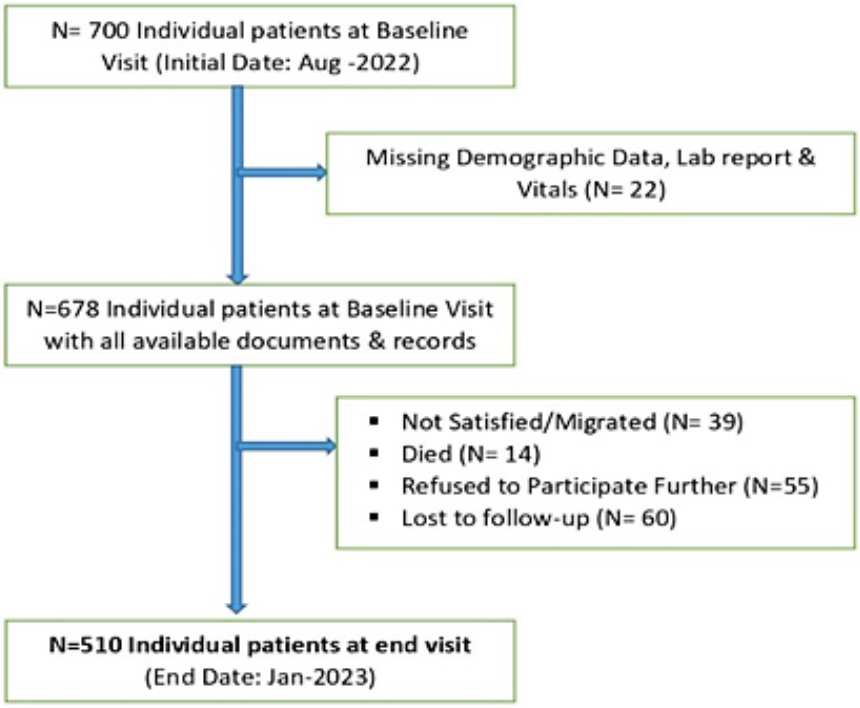

Figure 2. Flowchart of narrative selection process

▪ **Materials Required**

3. Data collection form.
4. AHA approved guidelines for stroke (2022-23).
5. JNC 9 standard hypertension guideline algorithm (2022).
6. WHO guidelines for diabetes mellitus.

▪ **Statistical analysis:** The median value was demonstrated in MS-Excel with graphical presentations along with SD and multivariate regression method.

Investigation variable: The required laboratory information (serum fibrinogen & total cholesterol, CBC with ESR, RBS, HbA1c, lipid profile, cardiac marker, PT-aPTT etc.). Additionally, CT scan, 2D-echo, carotid Doppler, nerve conduction velocity, x-ray and MRI was performed as and when required based on the investigators' discretion.

Variables of dependent area: Different types and subtypes of stroke, result of the incidence of stroke, infract and their locations along with the reportability of hematoma etc. if noted.

Variables of independent area: The overall variable of independent side was background characteristic after admission and the element of danger disease or cardiac related condition along with significant history, vomiting and headache were included in our study.

Study procedure: Patient data collection was started from the Emergency/Casualty, Outpatient Department and in-patient department Medicine and Neurology. However, Patient Profile Form was designed to capture all details of the subject along with history and Lab parameters. Patient's details were collected, and daily follow-up were taken along with all updates till discharge. Furthermore, patient's data, clinical status, all lab reports were also recorded during clinical visits along with clinical improvement/ status. After all available parameters, the data were calculated through median value. Subjects were bifurcated into three sets based on levels of baseline fibrinogen like fibrinogen of lower amount, <2.9 g/L; fibrinogen of medium amount, 2.9 to 3.5 g/L; and high fibrinogen level, ≥3.5 g/L. After ethical approval, independent predictors of 6-to-7-month clinical sequel were definitive by multivariate regression method. The raise discriminative amount of level of fibrinogen and total cholesterol for predicting stroke loss of life was checked out by C-statistic method and amalgamated refinement rectification in excel sheet.

Sample size determination: Overall, 700 back-to-back ill subjects from one place (Department of Medicine, Parul Institute of Medical Sciences, Vadodara, Gujarat, India) who underwent stroke protocol were enrolled at baseline and one by one in a prospective manner data were collected. 22 ill subjects' data were missing, and duplicates were removed; during the conduct of study, 39 patients were migrated, 14 patients died, 55 patients were withdrawn the consent and 60 patients were lost to follow-up. 510 eligible patients met the full text paper inclusion criteria taken as a study population.

Publicizing and consequence assessment: Biochemical test done at initial level for serum fibrinogen and total cholesterol. The total cholesterol amount was quantified by applying a high-reactiveness spectrophotometric assessment. The aftermath of our research was stroke and life loss of all causes. The pair of case like CAD and stroke encompasses in the precision of CVD. The cases of CAD are defined by infarction of myocardium at nonfatal, tragic disease of coronary of heart and admission in hospital as a consequence of all type of stroke (43-45).

Results

Overall, 510 patients having history and confirmed diagnosis of CV stoke were enrolled based on OPD visit and inpatient department whereas 57.25 were males and 42.74% were females. Age between 30 to 80 years and the mean age was 53.8 years±5.2 years.

On approach to the hospital: A clinical appearance of the patients: 195 (52.37%) Ischemic and 42 (30.50%) HS sufferer be presented with mislaying of excitements and loosing of extremities with few areas of the human body. Among them 25.1% were diabetic, 38.9 % were hypertensive, 27.3 % have both DM+ HTN and 31% were diabetic + hypertensive and dyslipidemic. 5 % had diabetes + hypertension + dyslipidemia and other comorbidities. However, hemiparesis was present in 76.5 % population. The mean elevated fibrinogen range was 934±20 mg/dL and mean total cholesterol range was 365±10 mg/dL. As a result, the hemorrhagic stroke patients were experienced headache 77 (19.60%) and vomiting, 34 (24.6%), then ischemic stroke patients. The signify GCS level of hemorrhagic stroke ill subject eventually upon the declaration on acceptance at hospital was 8.9±5.8 (mean±SD), value differ from 3 to 15-point outcome, period of time in ischemic stroke, subjects the score be 11.1±4.6 fluctuate midst 5 to 15. The mid value of blood pressure of SBP and DBP of hemorrhagic stroke ill subject was (SBP = 146 ±20 mmHg; DBP= 91.8±13.8mmHg) whereas ischemic stroke patients (SBP= 161.7±20.4mmHg; DBP= 95.1±20.8mmHg) were higher than hemorrhagic stroke. Overall, majority of patients presented from rural areas, additionally the small vessel stroke was the most common subtype. Most common symptoms presented was hemiplegia followed by speech disorder and altered mental status.

The arterial sphere scattering ratio of in different types of stroke: As per the available radiological report, the artery of the middle cerebral area was the routine area of infarctions of arterial territory in the ischemic stroke in particular that is present in 213 (57.2%) ill subjects afterward artery of anterior area of cerebral part in 89 (23.92%) and posterior cerebral artery (PCA) was 44 (11.82%). However, the territories of vertebrobasilar arterial are the slighted pompous sphere in the brain, such cases were recorded in 26 (6.9%) ill subjects. Additionally, in HS cases artery of middle cerebral area was the customary location of hematoma, found in 59 (42.84%) patients.

Progenitor jeopardy in the stroke: In our attending research, atrial fibrillation was present in 56 (10.9%), structural heart disease was present in 30 (5.88%), family history of stroke in 28 (5.49%) as an outcome's estimation of IS and HS subject.

Table 1. Population status and patients' attribution

S. No	Demographic and Social Characteristics		Unit of subjects
1.	Gender	Male	292 (57.25 %)
		Female	218 (42.74%)
2.	Age category (in years)	30 - 45	111 (21.76 %)
		45 - 60	290 (56.86 %)
		> 60	109 (21.37 %)
3.	Education status	Illiterate	63 (12.35%)
		Primary	103 (20.19%)
		Middle-	156 (30.58%)
		Intermediate or more	188 (36.86%)
4.	Residency of patients	Urban	313 (62.37 %)
		Rural	197 (38.62 %)

S. No	Demographic and Social Characteristics		Unit of subjects
5.	Disease conditions	Diabetes Mellitus	128 (25.1 %)
		Hypertension	198 (38.9 %)
		HTN+DM	326 (64.0 %)
		HTN+DM and Dyslipidaemia	158 (31.0 %)
		HTN+DM+ Dyslipidaemia and Other	26 (5.1%)
6.	Daily Work Profile	< Normal	94 (18.43%)
		Normal	256 (50.19%)
		Moderate	106 (20.78%)
		Heavy	54 (10.58%)
7.	Medical & Surgical History	Surgical	89 (17.45%)
		Medical	113(22.15%)
		Accidental	19 (3.72%)
8.	Medication type	Single Medication	118 (23.13%)
		Multiple Medication	206 (40.39%)

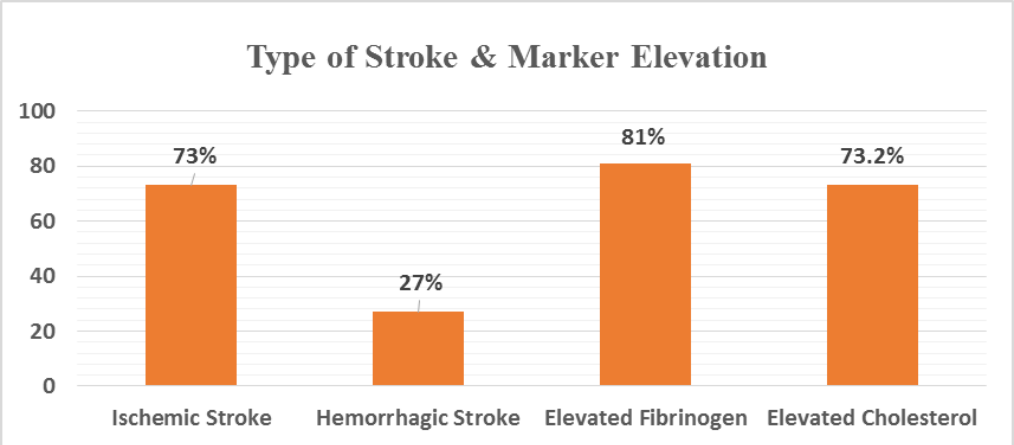

Figure 3. Type of stroke & marker elevation

Discussion

Our original research estimates the interconnection between fibrinogen level in serum and total cholesterol on stroke patient in 2 cohort groups of factual ill subjects over a single center. Elevated level of fibrinogen and total cholesterol enumerate a minimal intelligence regarding supplemental prognostic counsel set side by side along with conservative liability of CV stroke. However, there are numerous elements of dangers identical to hypertension, diabetes, hyperlipidemia, obesity, emit smoke, and old age, which lead to stroke. Considering an original research, we concluded that the elevated serum fibrinogen and total cholesterol levels are a significant biomarker in patients with stroke protocol. Furthermore, we evaluated CT scan reports and other lab parameters too to confirm the significance of elevated fibrinogen and high cholesterol in stroke. Based on radiological prospective, the bunch of blood orientation of the infarction of the brain or parts of brain hang on the flow of arterial territory sub-area was identified and the CT scan report suggested blood supply interruption in voluminous field inside the brain that materialized in 19.2% of ischemic stroke instance. Radiologist's opinions were taken in few complex cases to determine the severity of ischemia. Additionally, we saw infraction in basal area of ganglia, parietal area, and most orthodox frontal lobes section of the part of cerebrum which took place at the almost all mainstream area of infarctions. However, blood clot in intracerebral region in heterogenous tract in the brain parts is distinguished in 11.9% of hemorrhagic strokes. Furthermore, in different published

researches, basal area of ganglia was 38% and were concluded to be the commonplace area of hematomas afterward the thalamus which was 29.6% and blood clot of lobar region 8.3% which was at the higher side as compared to our study (46).

Furthermore, levels of the fibrinogen compound were originally studied and narrated in the case of MI in in the year 1954, similarly in the past years when numberless research studies have concluded the interconnection allying levels of the serum fibrinogen and total cholesterol in stroke, cardiovascular menace, and the extent of outcomes of CAD. Even so, anyhow level of fibrinogen and total cholesterol take part as an influential role in stroke or solely take action as a biomarker possess prevail delicate. Research conducted by Kaptoge et al (47) the fibrinogen level collaboration studies found that there was an estimated double risk of extensive cardiovascular events when there was a long-term advancement of serum fibrinogen level of 1 gm/litre. The meta-analysis of 10 case-control studies was conducted by Prasad et al. (48) and brings to come that higher the amount of fibrinogen always represents surge risk of IS.

Peycheva et al (49) conducted a study aimed to explore associations between fibrinogen and acute ischaemic stroke, neurological impairment, cerebral ischaemia, and clinical evaluation of stroke patients and concluded that a fibrinogen is an authentic biomarker in the condition of IS that may probably justify acute phase of the stroke. The Kailuan investigation of serum total cholesterol interchange level in two-year long duration was conducted by Wang et al (50) to survey the connection in the middle of couple of years total cholesterol switch and that the menace of happening symptom of stroke, i.e. the pair of ischemic and hemorrhagic, in the local community. The study concluded that higher total cholesterol be corresponding escorted by proceeding stroke.

A study by Tirschwell et al. (51) declared that higher total lipid level is matched with uplifted endanger of stroke in patient subgroups. One case-control study by Sacco et al. (52) found that the association of high cholesterol and stroke was more important in atherosclerotic stroke condition as per few published studies by Petrea et al. (53), Cordonnier et al. (54), and Dong et al. (55). There are obvious proven differences in many stroke features between male and female. Age-specific stroke occurrence was lower for women than men at ages 55 to 80 years and similar at the other age's group according to the 2016 Global Burden of Diseases, bruise, and element of danger survey (56). IInto view, such analysis was stablished in the Indian inhabitants and the outcome would perhaps not be like such other races considering single center study. Our observed alliance in the middle of fibrinogen level and total cholesterol in stroke corresponded such remarked in Western province of the word. The notice may imply a racial difference in the interconnection in the middle of fibrinogen levels in serum and high cholesterol in stroke risk. This population dependent unit work recommended an excessive level of fibrinogen in serum could be significant consequence for stroke in Indian population. In addition, serum fibrinogen and high total level of cholesterol as well was fairly analogous with the chance of antecedent loss of life in the midst of citizens aged <60 years in CVD.

Our research detects the basic bonus of record fibrinogen level in serum along with concentrations of total cholesterol in research. Supplemental research is necessitated to result the particular change in the character of serum fibrinogen levels and total cholesterol in the jeopardized stroke and supplemental CVD in the middle of Asian continent and province of Western areas of the earth. We advised adequate adherence to the prescribed medications to manage CVD is indispensable for accomplishing good dominance prestige for subject with CVD status. These all necessitated to be warrant by patients, family doctors/healthcare providers who contribute medical assistance to most subjects with cardiac illness in the kingdom.

Possible CVD risk due to medication non-adherence: High adherence to antihypertensive prescribed medications within 6 months post stroke was engaged with the overcome risks of both major adverse cardiovascular events (MACE) and patient's falls requiring prolonged hospitalization. Overall reduces CVD events. Patients must be uplifted to adhere to their antihypertensive medications to maximize CVD outcomes. Furthermore, patient's adherence led to the best control of sugar level and improve patients' quality of life. Augmentation in blood pressure, lipid level monitoring and drug intake for the same must commence first among the subject's side. We necessitate to encourage ample to the patients to be fixed to the prescribed therapy adequately by the physicians along with healthy diet plan. Proper heat checkup needs to be done in casual way to overcome the CVD problems. Due to the increasing number of similar cases counseling regarding stroke (FAST symptom) and the importance of golden hours after stroke for the subjects must be given at least once individually or as feasible or involve the medical persons nearby patients. However, supplementary research necessitates to be performed through escort mediation research resemble the potency of solo or together counseling for upgrade subjects therapy post CVD medication stickiness to determine whether all are identically efficacious.

Our present study concluded that elevated serum fibrinogen & total cholesterol levels are significantly independent on primary biomarker with incidences of CV stroke. However, stroke was higher in ischemic than haemorrhagic and the prevalence of stroke increases with higher age group. Territory of Middle cerebral artery was the major pretentious part with regard to human brain for the pair of ischemic and hemorrhagic strokes. Females were less influenced in ischemic stroke than male patients, but incidences were almost equal in hemorrhagic stroke. The hypertension was among the leading risk factor coupled with an evocator of symptom of stroke accompanied with death for both ischemic and hemorrhagic stroke than DM alone. The accelerated recovery was seen in ischemic stroke with long term follow-up. The solitary imperfection of our research was a one location-based work, less sample size, a single cross-sectional sectional, and few biochemical reports which was possibility not perfect. Our overall analysis work applied only a small number of specific variables i.e. lipid level, hemoglobin A1c, cardiac marker and fibrinogen level that one was very likely not adequate unfold extended existence erythrogenic condition, co-morbid status, and another health-related issue inside the human anatomy. Therefore, intermittent correlation in the middle of CVD and component accompanying might not be ascertain accurately and bias might be possible. A randomized, double-blind trials on large sample size need to be performed to confirm our study results.

Table 2. Investigational and clinical level of Ischemic and hemorrhagic stroke condition

Clinical Status	Ischemic Stroke (N=372)		Hemorrhagic Stroke (N=138)	
	No. of cases	%	No. of cases	%
Loss of alertness	195	52.37	42	30.50
Weakness and sensory loss	232	62.4	98	71.4
Hemiplegia/hemiparesis	119	32	61	44.5
Aphasia	86	23.11	61	44.20
Urinary incontinence	91	24.46	40	28.98
Facial drop	100	26.88	69	50
Quadriplegia	14	3.76	38	27.53
Dysarthria	8	2.15	10	7.24
Headache	34	24.6	77	19.60
Diplopia	12	3.22	11	7.79
Visual deficit	51	13.70	22	15.94
Ataxia	27	7.25	18	13.04
Vomiting	34	24.6	77	19.60
Convulsion	8	2.15	7	5.07
Systolic Blood Pressure (mean±SD)	161.7±20.4mmHg		146±20 mmHg	
Diastolic Blood Pressure (mean±SD)	95.1±20.8mmHg		91.8±13.8mmHg	
Glasgow Coma Scale (mean±SD)	11.1±4.6		8.9±5.8	

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Authors' contribution: All authors critically revised the manuscript and contributed equally to the final draft.

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