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Barthel Index Score and Total Serum Cholesterol Levels Correlation as Prognostic Tool for Acute Ischemic Stroke

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ABSTRACT

OBJECTIVE: To find a correlation between total serum cholesterol (TSC) in acute ischemic stroke and their prognosis is assessed employing the Barthel Index (BI) score.
METHODOLOGY: This prospective study was conducted at Medical Emergency of Allied Hospital Faisalabad and Social Security Hospital Lahore from 2020 to 2021. The written informed consent was obtained. In 58 sudden-onset acute Ischaemic stroke subjects, 36 males and 22 females were selected by purposive sampling. Patients were aged between 18-50 years.
The BI scoring system was used instantly on admission day, followed up at 48 hours, two weeks and one month of stroke to determine everyday routine in Personal care. Patients with a previous history of some stroke, transient ischemic attack (TIA), diabetes mellitus (DM), renal dysfunction, cardiac malfunctions, or valvular heart diseases were excluded. Stroke patients having an acute ischemic stroke for the first time were diagnosed and confirmed by non-contrast computed tomography (CT) scan and statistical analysis using SPSS version 17.0.
RESULTS: The mean BI score taken at four intervals was significantly correlated to the levels of TSC. The acute ischemic stroke patients with TSC level > 200 mg/dl showed better prognosis in comparison to those with TSC level < 200 mg/dl.
CONCLUSION: The present study on acute ischemic stroke patients suggests that TSC is correlated to a better future outcome as assessed by the BI score. This study demonstrates that high total serum cholesterol (HTSC) can be considered as a marker to anticipate the prognosis in patients of acute ischemic stroke.

KEYWORDS: Barthel Index Score, Total serum cholesterol, Transient ischemic stroke, Computed tomography (CT) scan.

INTRODUCTION

The frequency of cerebral ischemia has increased markedly in previous decennaries worldwide in equivalent along with further metabolic disorders, particularly Obesity and diabetes mellitus. It is estimated that 50% of demise recorded globally are due to cardiovascular disease (CVD) and stroke, per World Health Statistics annual reports[1]. Stroke emerges as the second reason for these deaths from the time when almost millions of populace undergo stroke every year. In underdeveloped nations, the foremost percentage of stroke overburden in current years, the frequency is raised by up to 100%. Additionally, the browns of South Asia had been exposed to an increased threat of having a stroke as compared to white people, and approximately 85% of demises caused by cerebral ischemia in these inhabitants.

According to WHO criteria, the primary reason for stroke is a disruption in the supply of blood to the brain cells due to which oxygen and nutritional supply are deficient, which hampers the requirement for its survival. Ischaemic Stroke leading factors include blockage of arterial vessels, which leads to thrombus and embolism, also by ruptured vessels or brain hemorrhage. In all the categories, the Ischemic type of stroke accounts for 87% of the total. In Pakistan, inadequate figures were obtainable for prevalence in our population[2]. In our region, almost 72% of stroke patients go to hospital and are diagnosed with Ischaemic stroke.

In comparison with Western society, in Pakistani subjects, the stroke occurred in 10 years younger's individuals. According to the Pakistan Stroke Society, the predictable frequency of stroke in our country is about 250/100,000, and the per annum ratio is 350,000. Fresh medical cases were presented with a pervasiveness of about 4.8%. Stroke occurrence has abrupt commencement of lightheadedness, inability to move, dysarthria, inability to comprehend spoken words, and lack of sensation involving one side of the body. Multiple transformable causative factors include obesity, diabetes mellitus (DM), hypertension (HTN), CVD, cigarette smoking, increased serum cholesterol levels, increased blood viscosity, previous transient ischemic attack (TIA), inactive lifestyle, and alcohol consumption[3].

Furthermore, age, background, heredity, geography, weather, and social class are measured as non-transformable stroke hazards. Reduced blood, oxygen & nutrient supply to brain cells causes necrosis and is bounded by a spot known as the penumbra[4]. This bounded area experiences cell death and initiates inflammation, which further causes interruption of the blood-brain barrier BBB, impaired function of sodium potassium pump, increased calcium intracellularly, and formation of free radicals. Stroke is linked to macro-vasculature disorder, and it is reported that decreased serum cholesterol is correlated with stroke caused by hemorrhage[5]. A serum cholesterol level of less than 200mg/dl is traditionally required, while cholesterol of more than 200mg/dl is considered high. It is still debatable whether cholesterol is "good or bad". It is an essential component of all the membranes of cells, organelles, nerve myelin sheath, and forerunner of hormones, vitamin D3 & bile. Brain cells constitute 25% of total body cholesterol, specifically in white matter. They are responsible for the development of signal transduction, the transcription of genes, the bioequivalence of multiple steroid hormones, and the organization of synapses. It increases the quality of vasculature to bear up high pressures in blood. Cholesterol also acts as an antioxidant agent and anti-inflammatory mediator via 5-lipoxygenase and Cox pathways, and its deficiency causes a reduced immune response[6].

Multiple types of research indicate that increased serum cholesterol and triglycerides are linked with improved after-effects following Ischaemic stroke. In the sudden onset phase of ischemic stroke, the HTSC was accountable as a constructive and defensive predictive indicator for its

motor function for an extended period. As claimed by the MRFIT study, in multiple risk factor intervention trials held during the last 13 years, people with serum cholesterol of 330mg/dl had fewer strokes than those with cholesterol levels below 180mg/dl. So, it can be said that high cholesterol prevents strokes[7]. A better prognosis was seen in one of the extensive comparative studies between patients with HTSC and patients with normal cholesterol levels; it was observed that the mortality hazard would be reduced about 2.2 times with higher serum cholesterol and poorer results following the first month of stroke about 2.1 [8]. Various measuring tools, including scales, are used to find out the overall severity and forecast the pattern of disease, which helps manage diseased patients. A scoring system is used as a predictive tool to evaluate the functional activities of stroke subjects. Daily routine physical activities will be measured by a straightforward, practical, and helpful method; amongst them, Barthel Index (BI) score is favorable. It helps to quantify a person's functional disability by assessing their capability to execute (Ten) 10 activities daily[9].

This research study aims to explore the association between Barthel Index scores and total serum cholesterol levels in patients of acute Ischaemic stroke and to discover the potentiality of measuring serum cholesterol as a predictive factor for stroke conclusion. The Barthel Index evaluates the practical inability of routine living activities, whereas serum cholesterol levels are associated with cardiovascular health. Researchers will investigate their connection by investigating further indicators to foresee stroke prognosis and direct management choices.

METHODOLOGY

This prospective study was conducted at Medical Emergency of Allied Hospital Faisalabad and Social Security Hospital Lahore from 2020 to 2021. The written informed consent was obtained. In 58 sudden-onset acute Ischaemic stroke subjects, 36 males and 22 females were selected by purposive sampling. Patients were aged between 18-50 years.

The BI scoring system was used instantly on admission day, followed up at 48 hours, two weeks and one month of stroke to determine everyday routine in Personal care. Patients with a previous history of some stroke, transient ischemic attack (TIA), diabetes mellitus (DM), renal dysfunction, cardiac malfunctions, or valvular heart diseases were excluded. Stroke patients having an acute ischemic stroke for the first time were diagnosed and confirmed by non-contrast computed tomography (CT) scan and statistical analysis using SPSS version 17.0.

The non-contrast Brain CT scan was done to differentiate between types of stroke, either Ischaemic or hemorrhagic. Patients suffering from acute Ischaemic stroke, as validated in Brain CT scans, were incorporated into the study. The enrolled patients will undergo a detailed physical health check examination; all medical information and history will be recorded in a specially designed Performa. After admitting the Patient, blood samples were taken to evaluate TSC levels after 8 hours of fasting. In individual cases, Barthel index scores were used to assess the recovery chance through daily routine physical activities for each enrolled Patient. 100-point scale measure for BI score intended to determine everyday routine in Personal care includes taking a bath, using the toilet, dressing, bowel and bladder self-control, and the ability to move, shift, and walk without the need of any kind of assistance (ambulation), and going upstairs (stair climb). This scoring executes after the Patient gets admitted to the ward, then following this, 48 hours, two weeks & one month of stroke. Statistical analysis was accomplished using Social Package for Statistical Sciences (SPSS) version 17.0 (SPSS, Chicago, IL, USA). Pearson's association was used to institute a probable relationship between the parameters of significance.

RESULTS

The physical distinctiveness of study subjects with mean age ranges 18-50 years. The enrolled Patient was not considerably dissimilar for both sexes. Every subject's mean body mass index (BMI) was approximately at the higher edge of the normal range. Thirty out of 58 (51%) stroke subjects appeared hypertensive (HTN), and 30 (51%) of them had>200mg/dl serum total cholesterol level. HTN was correlated significantly using increased serum cholesterol (P = 0. 029), and family history of HTN accounts for thirty-six (62%) (P = 0.18). Within 8 hours of the onset of ischemia, the Mean total serum cholesterol levels were determined to be 189.9±5.2 mg/dl. Even though females have higher mean values than males (198.8±8.6 vs. 184.4±6.4 mg/dl, respectively) other than the differentiation was not significantly dissimilar (P= 0.179). Of 58 patients, 30 subjects (51.7%) had cholesterol levels exceeding 200mg/dl (17 males; 13 females). Brain CT scan outcome the variable areas of the brain affected by ischemic stroke in these subjects. The common areas affected are the parietal area on the left side (19% of subjects) and basal ganglia on the left side (12% of subjects). The remaining patients affect varying brain locations. The mean BI scores are recorded at four intervening times for all Ischaemic stroke patients. As predictable, the mean BI score progressively improved over time and was more significant than before, from 23.88±2.25 to 50.3±3.0 in the moment in 4 weeks.
The stroke subjects' BI was exceedingly and optimistically associated with TSC levels (P< 0.00). It may be noted that a patient with cholesterol exceeds 200 mg/dl, its score perpetually beyond 50 following four weeks of incidence of Ischaemia, regardless of age and sex. However, nevertheless, in 28 participants having serum cholesterol ≤200 mg/dl, the BI score was instituted to be ≤50 in 27 subjects at similar length of time.

Table I: Physical Characteristics of Patients

Variables	All patients (n=58) Mean±SEM Median (Range)	Males (n=36) Mean±SEM Median (Range)	Females (n=22) Mean±SEM Median (Range)	P-value
Age	45.9±0.8 48.0 (18.0 – 50.0)	45.9±1 48.0 (18.0 – 50.0)	49.9±1.4 48.0 (19.0 – 50.0)	0.995
Body weight kg	71.6±1.7 70.0 (45.0 – 105.0)	75.7±2.2 75.0 (55.0 – 105.0)	64.9±2.2 64.0 (45.0 – 88.0)	0.002
Height m	1.6±1.5 1.57 (1.5 – 1.9)	1.7±2.0 1.63 (1.5 - 1.9)	1.6±2.0 1.54 (1.5 – 1.9)	0.015
BMI	27.2±0.7 25.7 (18.8 – 44.3)	28.0±1.1 25.7 (19.9 - 44.3)	25.9±1.0 26.1 (18.8 – 32.5)	0.195

Table II: Biochemical Characteristics of Patients

	All patients (n=58) Mean ± SEM Median (Range)	**Males** (n=36) Mean ± SEM Median (Range)	**Females** (n=22) Mean ± SEM Median (Range)	**P-value**
Total cholesterol mg/dl	189.9±5.2 210.0 (120.0 – 250.0)	184.4±6.4 180.0 (120.0 – 240.0)	198.8±8.6 220.0 (120.0 – 250.0)	0.179

Table III. Barthel Index Score of Ischaemic patients (n=58) at separate intervening times

Week(s) Following ischaemic stroke	**BI Score All patients (n=58) Mean±SEM Median (Range)**	**BI Score Males (n=36) Mean±SEM Median (Range)**	**BI Score Females (n=22) Mean±SEM Median (Range)**	**P- value**
0	23.88±2.25 30.0 (0 – 55.0)	21.67±2.99 20.0 (0 – 55.0)	27.5±3.29 30.0 (0 – 55.0)	0.211
1	35.43±2.99 47.5 (0 – 65.0)	31.67±3.9 35.0 (0 –65.0)	41.59±4.43 50.0 (0 – 65.0)	0.09
2	43.02±2.94 55.0 (10.0 – 70.0)	39.58±3.78 37.5 (10 – 70.0)	48.64±4.51 55.0 (10 – 70.0)	0.136
4	50.3±3.0 60.0 (15.0 – 80.0)	46.8±3.8 45.0 (15.0 – 80.0)	55.9±4.4 65.0 (15.0 – 80.0)	0.134

DISCUSSION

A higher number of data points out that an increased level of serum cholesterol is the foremost hazard that causes CVD advancement. Captivatingly, it remains the topic of debate that cholesterol predisposes the occurrence of brain Ischaemic. Multiple investigators specify that raised cholesterol is not essentially considered a risk factor for incidents of Brain Ischaemia[10]. It accounted for a lower risk for stroke and remained risky for CVD and still appeared contradictory. Except for the undetermined participation of cholesterol in the prevalence of stroke, the data facts show that raised cholesterol in patients with stroke has a better conclusion as compared to lower levels of cholesterol[11]. Therefore, the current study examines a potential relationship between serum cholesterol and results following acute ischemic stroke. In our study, the mean total serum cholesterol levels at the onset of Ischaemia was 189.9±5.2 mg/dl compared to express for Ischaemic stroke subjects from further Asian states.

The Asians had lower serum cholesterol than Westerners. In this research, 50% of patients had normal cholesterol levels, and the remaining subjects had ≥200 mg/dl cholesterol levels[12]. Even though these interpretations are found in comparatively small group samples, they also fall short of recommending the aim of raised serum cholesterol, which causes a significant risk to the commonness of Ischaemic stroke[13].

Additionally, it is revealed that major strokes appear in patients with decreased serum cholesterols, while small strokes are generally linked with increased serum cholesterols. The prognosis of Ischaemic strokes depends upon the BI scoring system, which reflects consistent measures of the practical conclusion of this ailment and determines at four intervals leading to stroke. An exceedingly positive and significant ($P<0.001$) association was discovered between serum cholesterol and BI scoring points, demonstrating the function of serum cholesterol in the practical results of patients with stroke[14]. The serum cholesterol, up to 200 mg/dl, comes out to a severe threshold level for forecasting faulty or appreciative prospects of patients with Ischaemic stroke. All ≥70% of study subjects are associated with lower and lower middle social class[15]. Past studies also mention that an increased incidence of stroke is recorded in low-income and poor-sector people in industrialized regions like European countries. It is speculated that low-profile income job stresses and social pressures aid in the development of depression and hypertension, which results in increased chances of acquiring Ischaemic stroke[16]. Increased intake of calories from fast food, inactive lifestyle, and cigarette smoking have been accountable as significant factors leading to brain Ischaemia and cardiovascular diseases[17].

In this research, 66.7% of males were smokers. Smoker women have a lower ratio of strokes as sturdy sexual characteristics variations present in our community concerning smoking. In Eastern countries, the ratio of male smokers is more significant than females compared to the Western nations, with an equal ratio of both male & female smokers[18]. Interestingly, in this study, subjects were unrestricted for sex, and female subjects were lower than males (22 F vs. 36 M). These study outcomes claim that Cholesterol measurement is linked to a better prognosis after Acute Ischaemic Stroke.

In our region, it is pretty beneficial for stroke patients if one of the routine investigations like TSC provides help in determining the future outcome of stroke patients. Although we cannot describe an exact phenomenon, our findings are well associated with similar previous studies done in developed countries of the world[19]. However, HTSC is reflected as hazardous for Ischaemic diseases related to the heart and brain. Thus, our study needs confirmation by further

research in the future on acute ischemic stroke patients before thinking about stopping the therapeutic lowering of cholesterol in patients with HTSC[20].

CONCLUSION

The present study on acute ischemic stroke patients suggests that TSC is correlated to a better future outcome as assessed by the BI score. This study demonstrates that high total serum cholesterol (HTSC) can be considered as a marker to anticipate the prognosis in patients of Acute Ischaemic Stroke.

Ethical permission: Avicenna Medical College & Hospital, Lahore, Pakistan IRB letter No. IRB-44/9/23/AVC.
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Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publically.

AUTHOR CONTRIBUTION

Ali Z: Study design, literature search and review
Aamir H: Questionnaire designing and data collection
Akbar A: Statistical data analysis
Huda A: Literature search
Riaz M: Data interpretation
Habib F: Manuscript drafting

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