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A Study to Determine the Correlation between Mean Platelet Volume and Outcome of Acute Ischaemic Stroke in Eastern India

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Abstract: ***Introduction:*** *Stroke is a major cause of morbidity and mortality. Stroke may be ischaemic or hemorrhagic. MPV is an emerging risk factor for atherothrombosis.*
Aims and objectives: *To determine the possible correlation between MPV and outcome of acute ischemic stroke.*
Materials and methods: *150 patients of General Medicine Department were selected to determine the correlation between MPV and outcome of stroke measured by MRS.*
Results: *MRS had a strong positive correlation with MPV.*
Conclusion: *In conclusion, this study has shown an elevation of MPV in acute stroke.*
Keywords: *MPV, MRS.*

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Abbreviations- MPV-Mean platelet volume , MRS- .Modified Rankin Score

I. Introduction

Stroke is rapidly developing clinical symptoms and/or signs of focal and at times global (applied to patients in deep coma and to those with subarachnoid haemorrhage) loss of brain function with symptoms lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin (Hatano 1976).

There are two major categories of brain damage in stroke patients:

(1) Ischemia

(2) Hemorrhage

The prevalence of stroke in India was estimated as 203 per 100,000 population above 20 years, amounting to a total of about 1 million cases. . It ranked as the sixth leading cause of disability-adjusted life years in 1990. Ischaemic stroke accounts for 85% of cases.[1] Stroke is associated with increased long term mortality, residual physical, cognitive, and behavioral impairments, recurrence, and increased risk of other types of vascular events.

The most important factors which predispose to occurrence of stroke are hypertension, heart disease, atrial fibrillation, diabetes mellitus, cigarette smoking, and hyperlipidemia [2]. Platelet size is also found to be elevated in individuals with hypertension and diabetes mellitus [3], both conditions that predispose to the development of vascular disease [4].

Platelets play a crucial role in the pathogenesis of atherosclerotic complications, contributing to thrombus formation [5].

Platelet size, measured as MPV, is a marker of platelet function and is positively associated with indicators of platelet activity, including aggregation and release of thromboxane A2, platelet factor 4, and β-thromboglobulin[6,7]. In normal individuals the platelet count is inversely proportional to MPV; platelet mass (the product of MPV and platelet count) is a near constant. Although platelets are incapable of de novo protein synthesis they are very active metabolically and respond rapidly to vascular injury or trauma, which ultimately result in the formation of a platelet–fibrin plug.

Platelets bud off megakaryocytes in the marrow. Platelet size and volume (e.g. MPV) depends on the circumstances of their production in the marrow. MPV is not related to aging of platelets in the circulation.

MPV correlates with the functional status of platelets and is an emerging risk marker for atherothrombosis [8]. There is evidence that platelet function is accentuated in acute ischaemic stroke [9]. Higher levels of MPV have been found in patients with acute ischemic stroke than in control subjects. Data from other studies regarding an association between MPV and stroke severity and outcome have been controversial. If such an association exists, MPV might help to identify patients at increased risk of a severe course of acute cerebrovascular disease. Thus an attempt has been made to study the association if any between MPV and ischaemic stroke in an Indian population.

II. Aims and Objectives

A) General Objective: To determine the possible correlation between MPV and outcome of acute ischaemic stroke.

B) Specific Objectives:

i. To determine the M.P.V of the patients of acute ischaemic stroke under study by automated cell counter.

ii. To determine the clinical outcome of the acute ischaemic stroke in patient according to the MRS (Modified Rankin Scale).

iii. To find out the correlation, if any exists between abnormal M.P.V and severity and clinical outcome of the ischaemic stroke.

iv. To find out whether MPV can be used as an independent risk factor for predicting outcome of acute ischaemic stroke.

III. Materials and Methods

Study setting:

In patients and Out Patients of Department of General Medicine, R. G. KAR MCH, Kolkata.

Duration of study:

One year

Study population:

Radiologically proven cases of acute ischaemic stroke presenting to the emergency department or the outpatient department .

Inclusion criteria:

1. Gender: Males/Females
2. Age Range: 18 years and above
3. Socioeconomic group: All socioeconomic groups were eligible
4. Ischaemic stroke proven radiologically (CT BRAIN and/or MRI BRAIN)
5. No other coexistent debilitating condition.

Exclusion criteria:

1. Presence of coexistent debilitating condition e.g. Any orthopaedic disability, any psychiatric illness
2. Known cases of hereditary disorders of large platelets.
3. Medications that can reduce the platelet count: hydroxyurea, antineoplastic agents etc.
4. Haemorrhagic stroke.
5. Patients unable to communicate because of severe stroke, aphasia or dementia without a valid surrogate respondent.

(A valid surrogate respondent is considered a spouse or first degree relative that is living in the same home or is self- identified as aware of the participant‘s previous medical history and current therapies)

6. Patients presenting 48hrs after the onset of neurological symptoms.
7. Peripheral smear showing platelet aggregates.

Sample size:

150 patients were studied who met the inclusion criteria.

Sampling design:

As per previous year’s hospital admission record at least 5 Cases get admitted everyday in the ward with symptoms suggestive of stroke. Cases which met the inclusion criteria and had none of the exclusion criteria were selected twice weekly, Monday and Friday which was fixed by lottery. The first case i.e. Index case had been selected randomly in our study. On the particular day, of sample collection, at morning (7 am) lottery was done between 1-5 numbers. A single sample each day was collected based on selected number. The above methods were adopted to avoid bias.

Controls required:

No.

Study design:

Descriptive Cross Sectional study

Parameters to be studied:

1. Sociodemographic parameters: Mean Age, percentage of patients male/female, addicted to smoking or not, addicted to alcohol or not.

2. Clinical parameters: Proportion of patients presenting with loss of consciousness, convulsion, altered sensorium, paralysis or limb/truncal weakness, sensory involvement, aphasia, history of ischaemic cerebrovascular or cardiac diseases, other focal neurological deficits, also presence of hypertension, obesity(according to BMI).
3. Hematological parameters: Mean Haemoglobin (Hb), Total leukocyte count (TLC), Differential leukocyte count (DLC), Platelet Count, and M.P.V.
4. Biochemical parameters: Mean serum urea, creatinine, Bilirubin, Total protein, Albumin, SGOT, SGPT, Glucose (fasting and post prandial), Serum electrolytes, Complete lipid profile.
5. Radiological parameter: Distribution of the ischaemic stroke according to site, extent of area affected, as seen on CT Brain/MRI Brain. Also any coexistent ischaemic cardiac disease as evidenced by abnormal ECG/Echocardiography.
6. Clinical Scoring tools: The clinical outcome of the patient will be evaluated by the Modified Rankin Scale (MRS) [10,11]

Score Description
0 -No symptoms at all
1 -No significant disability despite symptoms;
Able to carry out all usual duties and activities
2 -Slight disability;
Unable to carry out all previous activities, but able to look after own affairs without assistance
3 -Moderate disability;
Requiring some help, but able to walk without assistance
4 -Moderately severe disability;
Unable to walk without assistance and unable to attend to own bodily needs without assistance
5 -Severe disability;
Bedridden, incontinent and requiring constant nursing care and attention
6 -Dead
Total (**0–6**): _____

IV. Procedure

All stroke patients admitted to the hospital were screened during the time period described above. Each of them was entered into a stroke log. Patients fulfilling the criteria were enrolled into the study after obtaining an informed consent. Data was collected by the principal investigator and recorded, as per the proforma. Each patient was given a serial number and was formally included into the study as a case. Each patient was assessed and a MRS assigned to them. A Blood sample was collected from the antecubital vein using a 5cc syringe and transferred to an EDTA vacutainers. The samples were then taken to the laboratory after storage at room temperature for 2 hours but before 4 hours of collection and analyzed using the ABX pentra automated analyzer using electrical impedance to measure the mean platelet volume. After the analysis the same sample was taken to the central laboratory and a peripheral smear was done to look for platelet aggregates. If platelet aggregates were found then such cases were excluded from the study.

Data analysis:
The Statistical software namely SPSS 20.0, Stata 8.0, MedCalc 9.0.1 and Systat 11.0 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc**.**

Statistical methods:
Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. Analysis of variance (ANOVA) has been used to find the significance of study parameters between three or more groups of patients, Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups. A multivariate logistic regression analysis has been carried out to find the risk factors associated with stroke [12,13,14,15].
1. Analysis of Variance: F test for K Population means [13,14]
Objective: To test the hypothesis that K samples from K Populations with the same mean.
Limitations: It is assumed that populations are normally distributed and have equal variance. It is also assumed that samples are independent of each other.
2. Student t test (Two tailed, independent) [15]
3. Significant figures

i. Suggestive significance (P value: 0.05<P<0.10)
ii. Moderately significant (P value: 0.01<P ≤ 0.05)
iii. Strongly significant (P value: P≤ 0.01)

Limitation of study:

Statistical power of the test might be reduced due to small sample size.

V. Results and analysis

		Frequency	Percent
	under 25	1	.7
	26-35	3	2.0
	36-45	8	5.3
	46-55	48	32.0
	56-65	57	38.0
	66-75	21	14.0
	above 75	12	8.0
	Total	150	100.0

TABLE 1: DISTRIBUTION OF STUDY POPULATION ACCORDING TO AGE

		Frequency	Percent
	male	84	56.0
	female	66	44.0
	Total	150	100.0

TABLE 2: DISTRIBUTION OF THE STUDY POPULATION ACCORDING TO SEX

		Frequency	Percent
	Absent	116	77.3
	Present	34	22.7
	Total	150	100.0

TABLE 3.DISTRIBUTION OF THE STUDY POPULATION ACCORDING TO SIMILAR PAST HISTORY

		Frequency	Percent
	non smoker	97	64.7
	smoker	53	35.3
	Total	150	100

TABLE 4: DISTRIBUTION OF THE STUDY POPULATION ACCORDING TO SMOKING HABIT

		Frequency	Percent
	non hypertensive	66	44.0
	hypertensive	84	56.0
	Total	150	100.0

TABLE 5: DISTRIBUTION OF STUDY POPULATION ACCORDING TO HISTORY OF HYPERTENSION

		Frequency	Percent
	non diabetic	98	65.3
	diabetic	52	34.7
	Total	150	100.0

TABLE 6: DISTRIBUTION OF STUDY POPULATION ACCORDING TO HISTORY OF DIABETES MELLITUS

		Frequency	Percent
	non dyslipidemic	102	68.0
	dyslipidemic	48	32.0
	Total	150	100.0

TABLE 7: DISTRIBUTION OF STUDY POPULATION ACCORDING TO HISTORY OF DYSLIPIDEMIA

		Frequency	Percent
	Score 1	21	14.0
	Score 2	53	35.3
	Score 3	47	31.3
	Score 4	17	11.3
	Score 5	12	8.0
	Total	150	100.0

TABLE 8.DISTRIBUTION OF STUDY POPULATION ACCORDING TO MODIFIED RANKIN SCALE

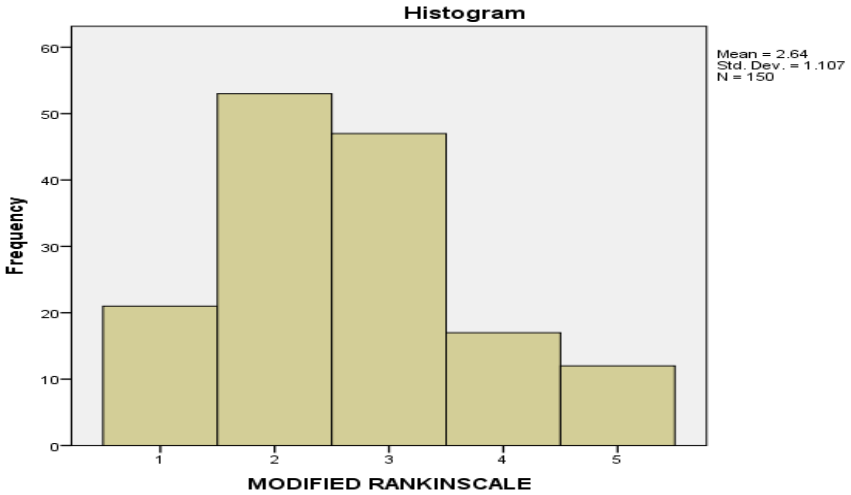

FIGURE 1: HISTOGRAM SHOWING DISTRIBUTION OF STUDY POPULATION ACCORDING TO MODIFIED RANKIN SCALE

Comments: 35% of the study population had a MRS score of 2 (slight disability) and 5% of the population had a MRS score of 5 (severe disability).

TABLE 9. CORRELATION OF MPV WITH SYSTOLIC BLOOD PRESSURE

		MEAN PLATELET VOLUME	BLOOD PRESSURE(SYSTOLIC)
MEAN PLATELET VOLUME	Pearson Correlation	1	.365**
	Sig. (2-tailed)		.000
	N	150	150
BLOOD PRESSURE(SYSTOLIC)	Pearson Correlation	.365**	1
	Sig. (2-tailed)	.000	
	N	150	150

**. Correlation is significant at the 0.01 level (2-tailed).

Comment: There is a positive correlation between MPV and Systolic Blood Pressure and the correlation is statistically significant.

TABLE 10. CORRELATION OF MPV WITH DIASTOLIC BLOOD PRESSURE

		MEAN PLATELET VOLUME	BLOOD PRESSURE(DIASTOLIC)
MEAN PLATELET VOLUME	Pearson Correlation	1	.168*
	Sig. (2-tailed)		.040
	N	150	150
BLOOD PRESSURE(DIASTOLIC)	Pearson Correlation	.168*	1
	Sig. (2-tailed)	.040	
	N	150	150

*. Correlation is significant at the 0.05 level (2-tailed).

Comment: There is a positive correlation between MPV and Diastolic Blood Pressure and the correlation is statistically significant.

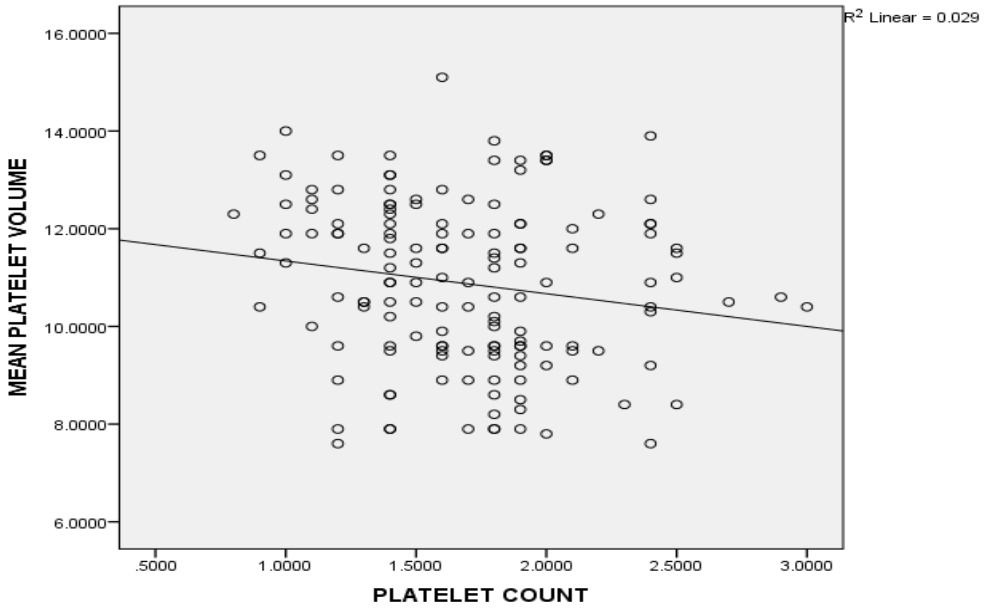

FIGURE 2: SCATTER DIAGRAM SHOWING CORRELATION BETWEEN MPV AND PLATELET COUNT

Comment: There is a negative correlation of MPV with Platelet Count and the correlation is statistically significant.

TABLE 11. CORRELATION OF MRS SCORE WITH MPV(PEARSON'S)

		MODIFIED RANKIN SCALE	MEAN PLATELET VOLUME
MODIFIED RANKIN SCALE	Pearson Correlation	1	.454**
	Sig. (2-tailed)		.000
	N	150	150
MEAN PLATELET VOLUME	Pearson Correlation	.454**	1
	Sig. (2-tailed)	.000	
	N	150	150

**. Correlation is significant at the 0.01 level (2-tailed).

TABLE 12. CORRELATION OF MRS SCORE WITH MPV(SPEARMAN'S RHO)

			MEAN PLATELET VOLUME	MODIFIED RANKIN SCALE
Spearman's rho	MEAN PLATELET VOLUME	Correlation Coefficient	1.000	.470**
		Sig. (2-tailed)	.	.000
		N	150	150
	MODIFIED RANKIN SCALE	Correlation Coefficient	.470**	1.000
		Sig. (2-tailed)	.000	.
		N	150	150

**. Correlation is significant at the 0.01 level (2-tailed).

TABLE 13. CORRELATION OF MRS SCORE WITH MPV

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.454[a]	.207	.201	.989

a. Predictors: (Constant), MEAN PLATELET VOLUME

TABLE 14. CORRELATION OF MRS SCORE WITH MPV(ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37.702	1	37.702	38.520	.000[b]
	Residual	144.858	148	.979		
	Total	182.560	149			

a. Dependent Variable: MODIFIED RANKIN SCALE
b. Predictors: (Constant), MEAN PLATELET VOLUME

TABLE 15. CORRELATION OF MRS SCORE WITH MPV(COEFFICENTS)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-.613	.530		-1.156	.250	-1.661	.435
	MEAN PLATELET VOLUME	.299	.048	.454	6.206	.000	.204	.394

a. Dependent Variable: MODIFIED RANKIN SCALE

Correlation of MRS score with MPV

Theoretical model-

Y=a+bx where a is constant or intercept, b is coefficient. Y is dependent variable and x is predicted variable.

Estimated model-

Modified Rankin Scale Score= (-0.613) + (0.299 × Mean Platelet Volume)

One unit change in Mean Platelet Volume give rise to 0.299 times increase in Modified Rankin Scale Score considering the constant is zero and it is statistically significant.

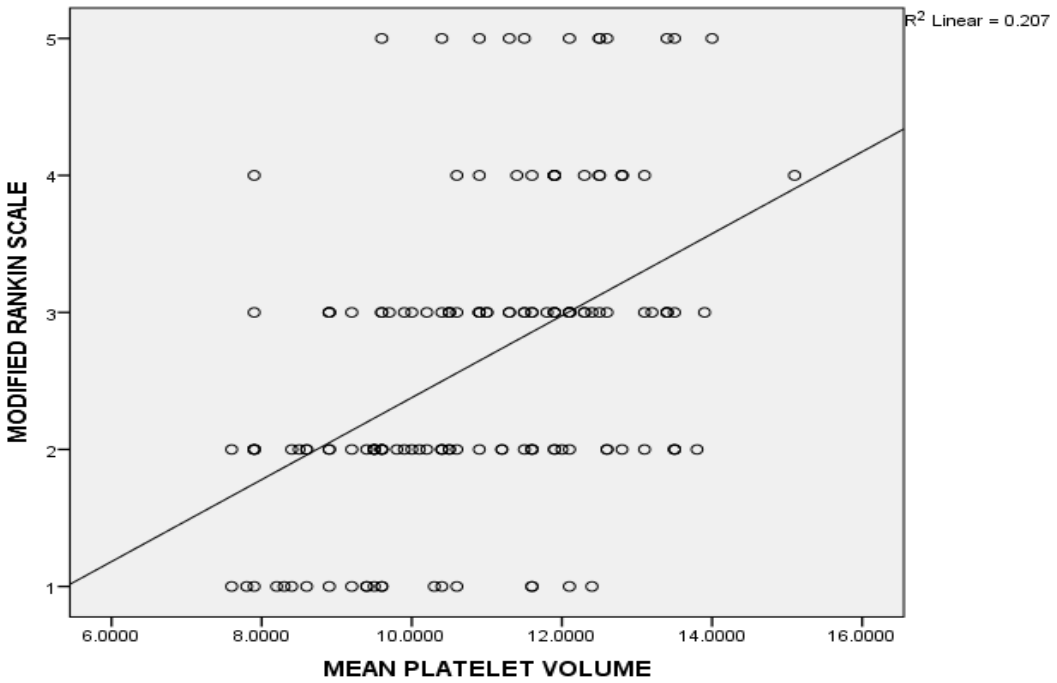

FIGURE 3: SCATTER DIAGRAM SHOWING CORRELATION BETWEEN MODIFIED RANKIN SCALE SCORE AND MPV

Comment: There is a positive correlation of Modified Rankin Scale Score and Mean Platelet Volume and the correlation is statistically significant.

VI. Discussion

Previous studies have documented various platelet abnormalities in cerebrovascular disease. In the current study we have run the samples between 2 and 4 hrs when they are relatively stable.

Determinants of Clinical Outcome

MRS

35.3% patients had Score 2. 31.3% patients had Score 3. 14% patients had Score 1. 11.3% patients had Score 4. 8% patients had Score 5. Patients with Score 0 could not be detected without screening procedures and thus were excluded from the study as were patients with Score 6 .

Clinical Outcome MRS and MPV

MRS score had a strong positive correlation with Mean Platelet Volume (Pearson coefficient=0.454, Spearmans rho=0.470) and the correlation is significant at the 0.01 level (2-tailed)(p value=0.000). About 20.7% (R^2 =0.207) change in dependent variable (MRS score) can be explained by independent variable (MPV).

Because the average life span of the platelet is about 8 days, the elevated MPV seen within the first 48 hours after stroke probably represents platelets released before infarction. Furthermore, it is unlikely that platelet consumption due to localized thrombosis would affect peripheral venous estimations of platelet variables. We suggest that large platelets may promote the thrombotic event in a susceptible individual and that the increase in MPV contributed to the development of the stroke rather than simply being a consequence of the acute event itself and also influenced the severity of stroke independently.

In conclusion, this study has shown an elevation of MPV in acute stroke. Within this relationship and adjusting for other significant variables in multivariate regression analysis, an increase in MPV is independently associated with poorer outcome of stroke. The observations here suggest a role for larger platelets in the pathogenesis of cerebral thrombosis. Further research is required into the role of platelet volume in stroke pathology, outcome, and, most importantly, in individuals at risk for stroke.

Bibliography

[1]. Cordonnier C, Leys D. Stroke, the bare essentials. Neurology in Practice 2008; 8:263–272.
[2]. Victor M, Ropper AH, Adams RD.Cerebrovasculardiseases.Adam's and Victor's Principles of Neurology.Ed.Ropper A H,Samuels MA. 9th ed. United States of America,McGraw Hill 2009.
[3]. Pathansali R, Smith NM, BathPM. Prothrombotic megakaryocyte and platelet changes in hypertension are reversed following treatment: a pilot study. Blood 2001; 12**:**144-149.
[4]. Ross R. Cell biology of atherosclerosis. Annual Review of Physiology 1995; 57**:**791-804 .
[5]. Greisenegger S, Endler G, Hsieh K, Tentschert S, Mannhalter C, Lalouschek W. Is elevated mean platelet volume associated with a worse outcome in patients with acute ischemic cerebrovascular events? Stroke 2004; 35:1688–91.
[6]. Sharp DB, Bath PMW, Martin JF, et al. Cigarette smoking sensitizes and desensitizes impedance-measured ADP-induced platelet aggregation in whole blood. Thromb Haemost. 1995; 74:730–735.
[7]. D'Erasmo E, Aliberti G, Celi F, et al. Platelet count, mean platelet volume and their relation to prognosis in cerebral infarction. J Intern Med.1990; 227:11–14.
[8]. *Arch Pathol Lab Med*. Vol 133, September 2009; 1441-43.
[9]. Smith N, Pathansali R, Bath P. Platelets and stroke. Vascular medicine 1999; 4:165-172.
[10]. Rankin J. ―Cerebral vascular accidents in patients over the age of 60.‖ Scott MedJ 1957; 2:200-215.
[11]. Bonita R, Beaglehole R. ―Modification of Rankin Scale: Recovery of motor
[12]. function after stroke.‖ Stroke 1988 ; 19(12):1497-1500..
[13]. Rosner B. Fundamentals of Biostatistics. 5th Edition, Duxbury, 2000; 11: 80-240.
[14]. Reddy MV. Statistics for Mental Health Care Research, NIMHANS publication, INDIA, 2002; 12:108-144.
[15]. Rao P S, Richard J: An Introduction to Biostatistics, A manual for students in health sciences , New Delhi: Prentice hall of India. 86-160.
[16]. Griner PF, Mayewski RJ, Mushlin AI, Greenland P. Selection and interpretation of diagnostic tests and procedures. Annals of Internal Medicine, 1981; 94:555-600.

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