Original Research Article

ANALYSIS AND UTILITY OF HAEMATOLOGICAL PARAMETERS IN CEREBROVASCULAR ACCIDENT PATIENTS- A RETROSPECTIVE STUDY IN TERTIARY CARE CENTRE

INTRODUCTION:

Cerebrovascular disease is defined by abrupt onset of a neurological deficit that is attributable to a focal vascular cause. It is due to injury to the brain as a consequence of altered blood flow. It is etiologically grouped into ischemic and haemorrhagic types with consequent tissue infarction. It is the third leading cause of death in the United States, and the most prevalent cause of morbidity and mortality from neurologic disease. The annual incidence of CVD in Western countries is estimated to be 500 to 800 per 100,000 people[1]. Although there are no precise data is available for India, some reports suggest that the incidence is between 13 and 33 per 100,000 people each year. The usual risk factors for vascular events have poor predictive value in individuals with evident vascular disease, emphasising the need for new biomarkers to improve risk stratification. Since haematological parameters are routinely assessed in clinical practice, which is readily available, the main aim of this study was to identify clinical haematological markers and their role in CVA

PATIENTS AND METHODS:

A retrospective study was carried out in line with research regulations, including the approval of the Ethical Committee. Total of 260 patients with CVA changes and normal healthy individuals are taken for this study. Demographic data and haematological parameters of 130 patients with CVA changes and 130 patients of control group were obtained during the period of December 2020 and May 2021.CVA due to ischaemic and haemorrhagic causes were also studied and the diagnosis was obtained by clinical history and radiological findings. Demographic data was obtained from the patients medical records and estimation of haematological parameters was done by Sysmex Automated Haematology Analyser XN-1000 from the department of Haematology, obtained during the time of admission.

STATISTICAL ANALYSIS:

The SPSS, version 19 software tool was used for the data processing. All the values were expressed as mean±standard deviation unless otherwise indicated. The differences in the mean values between the groups were analyzed by using the Student's t-test. A p-value of <0.05 was considered statistically significant.

RESULTS:

Table 1: Demographic data - Age and Gender distribution in CVA patients and control group

Parameters	CVA (Mean ± SD)	CONTROL (Mean ± SD)
Total no. of cases	130	130

Sex	Male - 84 Female -46	Male - 63 Female - 67
Age in years	58.177±11.781 Minimum 19 Maximum 82	38.8 ± 12.4 Minimum16 Maximum 68

Fig. 1: Age and Gender distribution in CVA patients and control group

Fig. 2 : Data showing number of CVA patients with ischaemic and haemmorhagic infarcts.

Fig. 3 : percentage of Causes of ischaemic and haemmorhagic.

S.No	Factors	Yes	No

1	**Diabetes mellitus**	52.3%	47.7%
2	**Hypertension**	64%	36%
3	**Smoking**	42%	58%
4	**Use of Alcohol**	8%	92%
5	**Family history**	15%	75%

S. No	Haematological parameters	Control	CVA	p value
1	**Hb**	12.495±1.632	11.98±2.579	0.061
2	**RBC**	4.181±0.637	4.398±0.800	0.016
3	**PCV**	45.81±3.422	37.977±7.235	**<0.001**
4	**MCV**	87.038±6.938	85.169±12.836	0.026
5	**MCH**	27.862±2.337	27.430±4.303	0.316
6	**MCHC**	33.685±2.131	31.342±2.821	**<0.001**
7	**RDW**	14.37±1.372	14.574±3.939	0.58
8	**Platelet**	2.203±0.742	2.696±1.371	**<0.001**
9	**TC**	7641.385±1220.634	10810.946±3321.782	**<0.001**
10	**Neutrophil**	69.112±7.232	73.970±13.224	**<0.001**
11	**Lymphocyte**	32.4±5.860	18.938±10.122	**<0.001**
12	**Eosinophils**	0.276±0.208	2.846±3.576	**<0.001**
13	**Monocytes**	4.91±1.531	4.819±2.179	0.697
14	**Basophils**	0.133±0.074	0.248±0.195	**<0.001**

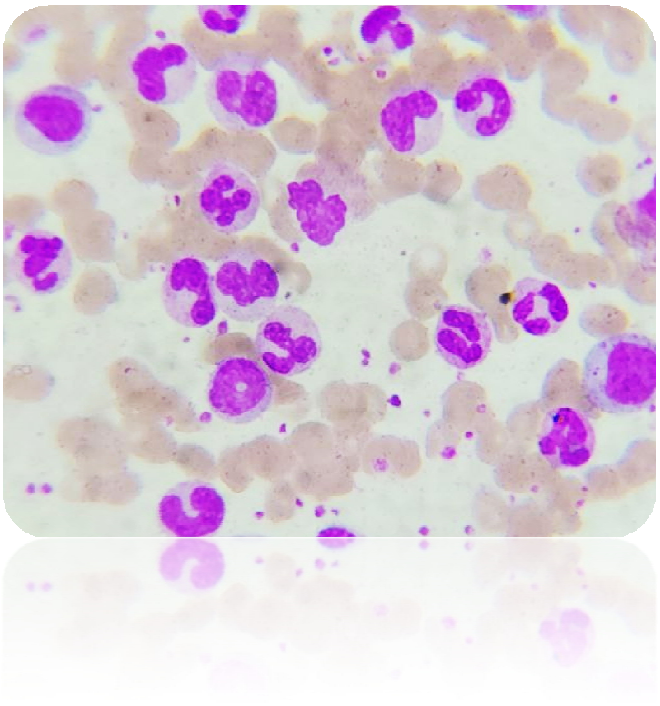

Fig.4 Toxic granules in neutrophils

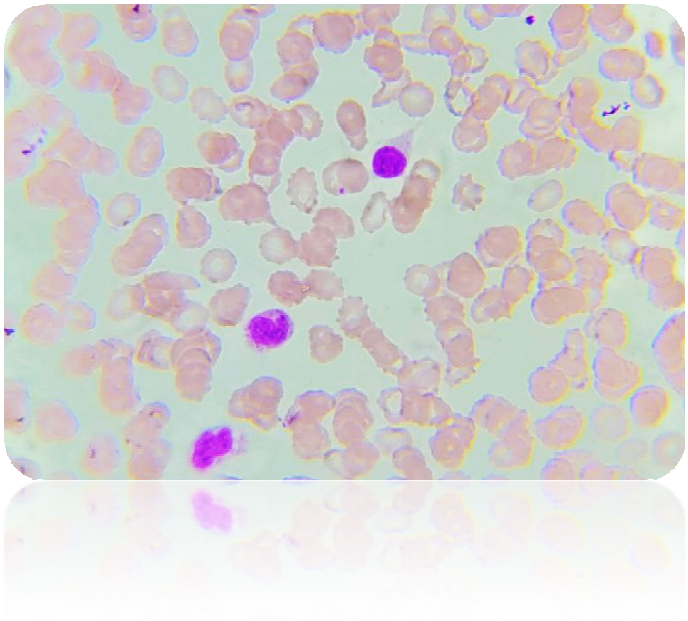

Fig.5 Reactive lymphocytes in peripheral smear

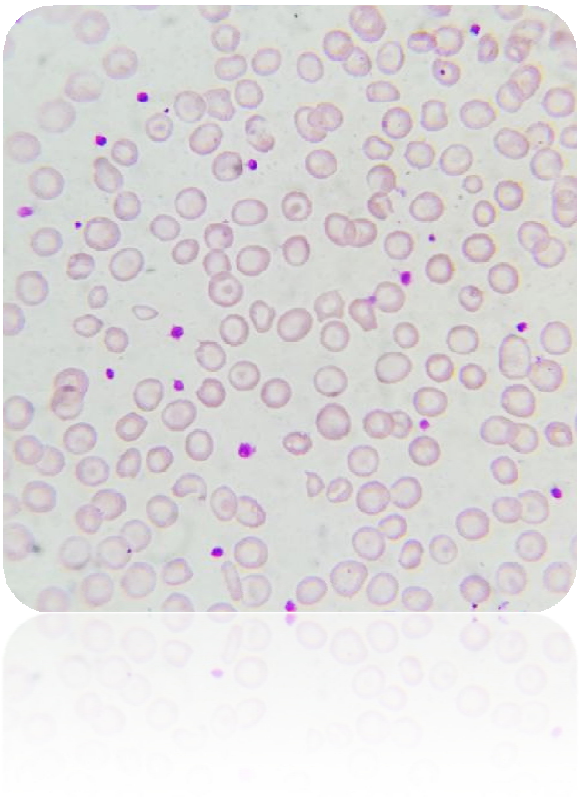

Fig.6 Thrombocytosis observed in a CVA case

A total of 260 blood samples were collected and divided into two groups, control and stroke group. To better understand the haematological parameters in CVA subjects, they were compared with the normal healthy individuals from the same population. The CVA group comprised of 130 subjects and control group consisted of 130 healthy subjects. The age range of stroke subjects was 47-69 years. Controls and CVA patients were further categorized by gender.

Cerebrovascular events are due to two main causes, ischaemic and haemorrhagic CVA, in our study they account about 63.84% and 36.15% respectively. In ischaemic stroke group 48.2% were females and 51.8% were males. Similarly, in control group 52% were females and 48% were males. Prevalence of cerebrovascular risk factors such as cigarette smoking, hypertension, diabetes were assessed in ischemic stroke patients. The mean age of control and ischemic stroke group was 38.80±12.40 years and 58.177±11.78 years respectively, indicating ischaemic stroke are more common in older age group. The mean values of haematological parameters were presented in Table 3.

Significant difference between the mean values of RBC haematocrit (HCT) ,PCV mean corpuscular haemoglobin concentration (MCHC),platelet, total leucocyte, neutrophil, lymphocyte, eosinophils and basophils was observed.

On correlation of mean haemoglobin in CVA patients 11.98±2.579, value among control group was 12.495±1.632. There is a decrease in hemoglobin values in CVA patients than the control group. (Table.3)

On correlation of mean RBC in CVA patients 4.398±0.800, value among control group was 4.181±0.637. There is a increase in RBC values in CVA patients than the control group. (Table.3)

On correlation of mean PCV in CVA patients 37.977±7.235 , value among control group was 45.81±3.422. There is a decrease in PCV values in CVA patients than the control group. (Table.3)

On correlation of mean MCV in CVA patients 85.169±12.836, value among control group was 87.038±6.938. There is a decrease in MCV values in CVA patients than the control group. (Table.3)

On correlation of mean MCH in CVA patients 27.430±4.303, value among control group was 27.862±2.337. There is a decrease in MCH values in CVA patients than the control group. (Table.3)

On correlation of mean MCHC in CVA patients 31.342±2.821, value among control group was 33.685±2.131. There is a decrease in MCHC values in CVA patients than the control group. (Table.3)

On correlation of mean RDW in CVA patients 14.574±3.939, value among control group was 14.37±1.372. There is a increase in RDW values in CVA patients than the control group. (Table.3)

On correlation of mean platelet count in CVA patients 2.696±1.371, value among control group was 2.203±0.742. There is a increase in platelet count values in CVA patients than the control group. (Table.3)

On correlation of mean total leucocyte in CVA patients 10810.946±3321.782, value among control group was 7641.385±1220.634 There is a increase in total luecocyte values in CVA patients than the control group. (Table.3)

On correlation of mean neutrophil in CVA patients 73.970±13.224, value among control group was 69.112±7.232. There is a increase in neutrophil values in CVA patients than the control group.

On correlation of mean lymphocyte in CVA patients 18.938±10.122, value among control group was 32.4±5.860. There is decrease in lymphocyte values in CVA patients than the control group.

On correlation of mean eosinophils in CVA patients 2.846±3.576, value among control group was 0.276±0.208. There is a increase in eosinophil values in CVA patients than the control group.

On correlation of mean monocytes in CVA patients 4.819±2.179, value among control group was 4.91±1.531 . There is a decrease in monocyte values in CVA patients than the control group.

On correlation of mean basophil in CVA patients 0.248±0.195, value among control group was 0.133±0.074. There is a increase in basophil values in CVA patients than the control group

Table 4: Platelet indices in CVA patients

	PDW	MPV	PLATELET COUNT	PCLR	PCT
TOTAL CASES	130	130	130	130	130
MEAN	`13.619	13.851	3.398	26.394	0.213
STANDARD DEVIATION	2.910	2.299	1.354	7.605	0.085
MINIMUM	8.400	9.800	1.600	12.600	0.090
MAXIMUM	22.900	18.200	7.200	62.400	0.490

DISCUSSION:

In this study, we evaluated the routinely measured hematological parameters for the prediction of recurrent vascular events in patients with cerebrovascular disease

There was association between cerebrovascular accidents and haematological parameters, as there was a substantial difference in haematological parameters in ischemic participants compared to control subjects.

This study showed a proportional increase of **platelet count, mean platelet volume(MPV) and platelet lymphocyte ratio(PLR)** corresponding to higher grades of colorectal cancers

We observed that hemoglobin levels were reduced in CVA patients. During ischemic stroke erythrocyte undergoes oxidative and proteolytic changes resulting in a changed cellular and inflammatory process.

We also observed that WBC levels were increased in CVA patients. *Sharif et al.* that WBC significantly increased in ischemic stroke patients as compared to control group subjects [1]

Kazmierski et al. demonstrated increase in WBC count during ischemic stroke may be due to the mobilization of the leukocyte marginal pool as an inflammatory response to the ischemic damage to brain parenchyma. Immediately after an ischemic stroke, an increased expression of a of cytokines and chemokine precedes WBC infiltration into the ischemic tissue. [15]

This study reported increased **PLT** count in CVA as compared to control group. The result implies that enhanced platelet responsiveness and persistent systemic activation of circulating platelets is a critical mechanism in the pathophysiology of acute cerebrovascular diseasePlatelets play a critical role in acute and chronic inflammation. Platelet activation

plays a pivotal role in the pathogenesis of thrombotic vascular disorders, such as ischemic stroke and TIA.

We also observed that MPV PCT PDW levels were reduced in CVA patients.*Ahmed et al*. preliminary evaluation related to the ranges of hematological variable showed that WBC and PLT count increased in the same manner as in our study. MCV values also increased in ischemic stroke group.[16]

CONCLUSIONS :

The presences of persistently altered status of hematological parameters in patients with a recent cerebral ischemic event indicate that this aspect of hematological parameters can be considered a simple inflammatory marker occurring during the development of ischemic damage. However further studies are required by correlating with severity of cerebrovascular disease and larger sample size are required to confirm the findings of the present study.

Ethical Approval

This study was approved by Ethics Committee of Saveetha Medical and Hospital. As this study was a retrospective study, there was no patient's privacy data such as patient name, ID number, telephone and address were involved. Only demographic information and laboratory testing data of patients were collected and analyzed in this study.

Limitations of the study

There were some limitations in our study. Firstly, this was a retrospective study, therefore, complete information was not available for all the patients. Secondly, though our study was based on the data of the single tertiary care centre in Tamilnadu, a large-scale study involving other Tertiary hospitals are required.

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