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RENAL AND HAEMATOLOGICAL INDICES OF ACUTE ISCHAEMIC STROKE SUBJECTS IN SOKOTO, NIGERIA

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ABSTRACT

Acute ischaemic stroke (AIS) is characterized by elevated level of oxidative stress indices, renal and haematological impairements. Increased oxidative stress is thought to play a pivotal role in the pathophysiology of AIS and its attendant complications. In this study, blood pressure, glucose, urea, creatinine, sodium, potassium, bicarbonate, chloride, red blood cell count, haemoglobin, white blood cell count and platelet counts were determined in 79 AIS patients admitted in Neuro Medical Ward of Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria and the results compared with 20 non acute ischaemic stroke (NAIS) subjects of comparable socio-economic status. The results suggested significant *($p<0.05$)* increase levels of blood pressure, glucose, urea, creatinine, potassium, wbc-count and platelet count and significant *($p<0.05$)* decrease levels of sodium, bicarbonate, chloride, rbc-count and haemoglobin in AIS compared with NAIS subjects. The findings suggest that AIS subjects had impairement of renal and haematological indices as part of associated complications.

KEYWORDS: Renal profile, haematological indices, acute ischaemic stroke.

INTRODUCTION

Stroke is a serious neurological disease and a leading cause of disability worldwide.[1] Ischaemic strokes constitute 85-87% of all cases. Haemorrhagic stroke includes intracerebral and subarachnoid haemorrhage and account for the remainder of cases.[2] Ischaemic stroke is characterized by the sudden loss of blood circulation to an area of the brain, resulting in a corresponding loss of neurologic function.[3]

Stroke continues to pose huge challenge and threat to the health and socio-economic well being of many nations. It caused an estimated 5.7 million deaths in 2005 and 6.5 million in 2015 and 87% of these deaths were in low-income countries. Without intervention, the number of global deaths is projected to 7.8 million in 2030.[4]

Oxidative stress is increasingly being recognized as central to the underlying pathophysiology of acute ischaemic stroke and its attendant complications such as renal and haematological impairements. ROS/RNS cause brain damage as a result of high lipid content and low antioxidant defence in the brain.[5]

In this study, blood pressure, glucose, urea, creatinine, sodium, potassium, bicarbonate, chloride, red blood cell count and platelet counts were evaluated in AIS subjects presented within 72 hour of symptoms onset and the results compared with NAIS subjects of comparable socio-economic status. It is expected that this study will stimulate interests discussion and further studies on renal functions profile and haematological indices vis-à-vis complications of AIS.

MATERIALS AND METHODS

Participants: The subjects employed for this study were 79 AIS subjects presented within 72 hour of symptoms onset of both sexes who were admitted at Neuro Medical Ward of the Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria and 20 NAIS subjects of comparable socio-economic status. The consents of all the participants were sought for and Ethical Committee approval was obtained from Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria.

Sample Collection: Blood samples of 72 hour onset of AIS confirmed by CT scan were collected by venipuncture and deliverd into clean dry tubes and allowed to clot at room temperature. The samples were

centrifuge and the serum separated and kept in labeled sample bottles at (-20^{0}C) until required.

Chemical and Reagents: All chemicals and reagents used were of analytical grade. Glucose, urea and creatinine assay kits were purchased from Randox Laboratory Limited, Switzerland.

Biochemical Analysis: Glucose was determined by enzymatic method,[6] urea was determined by Diacetylmonoxime method,[7] creatinine was determined by Jaffe's alkaline picrate method,[8] sodium and potassium were determined by flame photometry,[9] while bicarbonate and chloride were determined by titrimetric method,[10] Full blood counts determined using fully automated analyser by method of.[11]

Data Analysis: The values were presented as mean±SD. Level of significance was assessed using Student t-test. Turkey-Kramer multiple comparison test (In stat 3 software San Diego, USA). Significant difference was taken at 5% *(p<0.05)*.

RESULTS

The results of blood pressure and serum glucose is presented in Table1. The results indicated significant *(p<0.05)* increase in SBP, MABP and FBS and non significant *(p>0.05)* increase in DBP of AIS compared to NAIS subjects.

Renal functions profile of acute ischaemic stroke subjects is shown in Table 2. The results indicated significant *(p<0.05)* increase levels of urea, creatinine, Na^+, HCO_3^- and Cl^- and non-significant *(p>0.05)* increase level of K^+ in AIS compared to NAIS subjects.

The haematological parameters of AIS subjects are presented in Table 3. The results show significant *(p<0.05)* decrease levels of rbc-count and haemoglobin and increase levels of wbc-count and platelet counts in AIS than controls (NAIS).

Table 4 shows correlation coefficient between MABP and renal profile of AIS subjects. The results indicated significant positive correlation of urea, creatinine and potassium against MABP while Na^+, HCO_3^- and Cl^- are negatively correlated with MABP of AIS subjects.

Table 5 shows correlation coefficient between MABP and haematological parameters of AIS subjects. The results revealed strong positive correlation of all studied parameters against MABP of AIS subjects.

Correlation coefficient of FBS and renal profile of AIS subjects is presented in Table 6. The results indicated strong positive correlation of urea, potassium and bicarbonate against FBS and negative correlation of creatinine, sodium and chloride against FBS of AIS subjects.

Strong negative correlation of rbc-count and haemoglobin against FBS and positive correlation of wbc-count and platelet against FBS is presented in Table.7.

Table 1: Blood Pressure and Serum Fasting Blood Sugar of Acute Ischaemic Stroke Subjects.

Parameter	Acute Ischaemic stroke (n=79)	Nonacute Ischaemic stroke (n=20)
SBP (mm Hg)	157.14±26.83^a	119.55±4.52^b
DBP (mm Hg)	92.81±15.99^a	79.85±2.08^a
MABP(mm Hg)	114.25±19.60^a	95.48±4.03^b
FBS (mmol/l)	7.60±3.14^a	4.70±0.53^b

Values are expressed as mean±SD. Values bearing different superscripts on a row differ significantly ($p<0.05$) and the same superscripts show no significant different ($p>0.05$). n-number of participants; SDP-systolic blood pressure; DBP-diastolic blood pressure; MABP-mean arterial blood pressure and FBS-fasting blood sugar.

Table 2: Renal Functions Profile of Acute Ischaemic Stroke Subjects.

Parameter	Acute Ischaemic stroke (n=79)	Nonacute Ischaemic stroke (n=20)
Urea (mmol/L)	6.75±2.65^a	4.62±0.69^b
Creatinine (mg/dL)	1.24±o.45^a	0.85±0.18^b
Sodium (mmol/L)	134.75±8.11^a	142.55±4.05^b
Potassium (mmol/L)	4.92±0.94^a	3.88±0.34^a
Bicarbonate (mmol/L)	22.86±4.01^a	27.79±2.06^b
Chloride (mmol/L)	97.42±3.33^a	102.85±3.56^b

Values are presented as mean±SD. Values bearing different superscripts on a row differ significantly *(p<0.05)* and the same superscripts show no significant different *(p>0.05)*. n=number of participants.

Table 3: Haematological Parameters of Acute Ischaemic Stroke Subjects.

Parameter	Acute Ischaemic Stroke (n=79)	Non-acute Ischaemic Stroke(n=20)
RBC -Count X10^6/µL	3.06±1.13^a	3.25±0.22^b
Haemoglobin (g/dL)	11.69±2.33^a	14.74±0.89^b
WBC-Count X10^6/µL	10.27±2.10^a	6.56±1.84^b
Platelet Count X10^6/µL	259.37±88.30^a	224.02±48.02^b

Values are expressed as mean±SD. Values bearing different superscripts on a row differ significantly *(p<0.05)*. n=number of participants; rbc-count=red blood cell count and wbc-count=white blood cell count.

Table 4: Correlation Coefficient (r) between MABP and renal profile of AIS subjects.

Parameter	Correlation coefficient against MABP
Urea	0.11
Creatinine	0.24
Sodium	-0.29
Potassium	0.26
Bicarbonate	-0.24
Chloride	-0.07

Urea, creatinine and potassium are significantly *(P<0.05)* positively correlated with mean arterial blood pressure (MABP) while sodium, bicarbonate and chloride are negatively correlated with MABP.

Table 5: Correlation Coefficient (r) between MABP and haematological indices of AIS subjects.

Parameter	Correlation coefficient against MABP
Rbc-count	0.05
Wbc-count	0.10
Haemoglobin	0.07
Platelet count	0.12

All haematological indices are strongly positively correlated with MABP.

Table 6: Correlation Coefficient (r) between FBS and renal profile of AIS subjects.

Parameter	Correlation coefficient against FBS
Urea	0.21
Creatinine	-0.03
Sodium	-0.25
Potassium	0.19
Bicarbonate	0.05
Chloride	-0.52

Urea, potassium and bicarbonate are strongly positive correlated with fasting blood sugar (FBS) while creatinine, sodium and chloride are strongly negative correlated with FBS.

Table 7: Correlation Coefficient (r) between FBS and haematological indices of AIS subjects.

Parameter	Correlation coefficient against FBS
Rbc-count	-0.27
Wbc-count	0.34
Haemoglobin	-0.23
Platelet count	0.38

Red blood cell count (rbc-count) and haemoglobin are strongly negative correlated with FBS while white blood cell count (wbc-count) and platelet count are strongly positive correlated with FBS.

DISCUSSION

Acute ischaemic stroke (AIS) is characterized by elevated level of oxidative stress indices, renal and haematological impairements. Increased oxidative stress is thought to play a central role in the development of AIS and its attendant complications. AIS is often associated with large infart size and poor outcome due to increased autoregulation and changes in blood coagulability.[12]

There is strong evidence pointing out that the production of free radicals during the ischaemia and reperfusion is one of the important mechanisms causing brain damage. Due to certain reasons, the brain tissue is especially prone to the deleterious effects of the free radicals.[13,14]

The significant increase *(p<0.05)* in urea, creatinine and potassium and significant decrease *(p<0.05)* levels of sodium, bicarbonate and chloride is consistent with previous studies of:[15,16] who reported significant increase levels of serum urea, creatinine and potassium and significant decrease in bicarbonate, sodium and chloride of AIS subjects compared with controls.[16] further demonstrated that higher plasma urea and creatinine levels are associated with more severe stroke and low GCS score.

Several published studies observed an increased wbc-count, raised ESR and decreased rbc-count and haemoglobin in AIS subjects compared with controls.[17,16] Previous publication reported that elevated wbc-count has been associated with cardiovascular disease and cerebrovascular disease in several epidemiological studies.[18] Our study is in line to these findings. Possibly, changes in haematological parameters at the onset of stroke play an important role in altering the cerebral blood flow.[19] The haematological impairements could be due to depletion of antioxidant micronutrients which are known to altered redox balance of affected fluids, tissues or organs in AIS subjects. Vitamin E is required for normal function of the immune system and control of aggregation of platelets.Vitamin C has been shown to be capable of decreasing haemolysis under in vitro conditions,apparently by strengthening the physical integrity of the erythrocytes.[20] Leukocytosis influences the prognosis, several mechanisms by which leukocytes may be implicated in parenchymal brain injury include vessel pluggeding, release of hydrolytic enzymes, oxygen free radicals or initiation of thrombosis.[20]

The positive correlation established in this study between urea, creatinine and potassium against MABP indicated that, the higher the MABP the higher urea, creatinine and potassium. This could be being MABP as one of the risk factor of AIS. The reported FBS positively linked to urea, potassium and bicarbonate and inversely linked to creatinine, sodium and chloride of AIS subjects support the evidence that, elevated glucose is a risk factor of AIS.

Mean arterial blood pressure and glucose are positively linked to white blood cell and platelet counts.The finding is consistant with previous works.

CONCLUSION

In conclusion, the present study indicated that AIS subjects had renal and haematological impairements compared with non-acute ischaemic stroke subjects, an indication of associated complications.

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