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Analysis of Pathological Characteristics and Clinical Significance of Patients with Transient Cerebral Ischemic Attack Based on Multidimensional Laboratory Indicators

Zongru Li*, Xinxin Zhang*, Xiangmiao Kong, Jinxian Liang, Juan Zheng, Getu Li#, Meifeng He#

Department of Clinical Laboratory, Rongxian Hospital of Traditional Chinese Medicine, Yulin, China
Email: *Zongru Li. 7734018@qq.com, *Xinxin Zhang. 493677789@qq.com, #Getu Li. Ligetuu@163.com, #Meifeng He. 597667641@qq.com

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Abstract

Objective: To analyze the pathological characteristics of patients with transient cerebral ischemic attack (TIA) through multidimensional laboratory indicators and explore their clinical significance. **Methods:** Patients who visited the outpatient department or were hospitalized in Rongxian Hospital of Traditional Chinese Medicine from January to December 2024 were selected. TIA patients were set as the experimental group (n = 31), and healthy physical examination subjects were set as the control group (n = 50). Multidimensional laboratory indicators such as blood routine, liver function, kidney function, blood lipids, electrolytes, hemorheology and blood glucose were detected and compared between the two groups. **Results:** In the experimental group, the WBC and NEUT# indexes in the blood routine were significantly different from those in the control group ($P < 0.05$); the AST, AST/ALT, TP, GLO and A/G indexes in liver function were significantly different between the two groups ($P < 0.05$); the K and CA indexes in electrolytes were significantly different between the two groups ($P < 0.05$). Although there were differences in other indexes, they did not reach statistical significance. **Conclusion:** Multidimensional laboratory indicator detection is helpful in revealing the pathological characteristics of TIA patients, and the abnormal changes of some indicators can provide an important reference for clinical diagnosis, disease assessment and treatment.

Keywords

Transient Cerebral Ischemic Attack, Multidimensional Laboratory Indicators, Pathological Characteristics, Clinical Significance

*First authors.
#Co-corresponding authors.

1. Introduction

Transient cerebral ischemic attack (TIA) is a common cerebrovascular disease characterized by transient neurological dysfunction caused by focal ischemia in the brain, spinal cord, or retina, without acute cerebral infarction [1]. The symptoms of TIA usually last from a few seconds to several hours, with a maximum duration of no more than 24 hours, and no sequelae remain after recovery [2]. Nevertheless, TIA is regarded as an important early warning sign of ischemic stroke. Studies have shown that TIA patients have a high risk of stroke in the near future. The risks of stroke within 2 days, 7 days, 30 days, and 90 days after TIA are 3.5%, 5.2%, 8%, and 9.2% respectively [3]. Currently, the diagnosis of TIA mainly relies on clinical symptoms and neurological examinations, but these methods have certain limitations. Multidimensional laboratory indicator detection can reflect the pathophysiological changes in patients from multiple perspectives such as hematology, providing more comprehensive information for the diagnosis, disease assessment, and treatment of TIA. This study aims to analyze the pathological characteristics of TIA patients through the detection of multidimensional laboratory indicators such as blood routine, liver function, kidney function, blood lipids, electrolytes, hemorheology, and blood glucose, clarify their clinical significance, and provide a reference for the clinical diagnosis and treatment of TIA.

2. Materials and Methods

2.1 Research Subjects

Patients who visited the outpatient department or were hospitalized in Rongxian Hospital of Traditional Chinese Medicine from January to December 2024 were selected. Inclusion criteria: Meeting the TIA diagnostic criteria revised by the Fourth National Conference on Cerebrovascular Diseases [4], and excluding other brain diseases such as cerebral infarction by cranial CT or MRI; aged 18 years or older. Exclusion criteria: Suffering from diseases that may affect laboratory indicators, such as severe liver and kidney dysfunction, malignant tumors, blood system diseases, and autoimmune diseases; having a history of infection, trauma, or surgery in the past (within 1 month). Finally, TIA patients were set as the experimental group (n = 31), and healthy physical examination subjects were set as the control group (n = 50).

2.2 Detection Methods

Early morning fasting venous blood of the two groups of patients was collected, and a fully automatic biochemical analyzer (Mindray BS2000) was used to detect indicators such as blood routine, liver function, kidney function, blood lipids, electrolytes, hemorheology, and blood glucose. Blood routine detection indicators include white blood cell count (WBC), neutrophil count (NEUT#), lymphocyte count (LYMPH#), red blood cell count (RBC), hemoglobin (HGB), platelet count (PLT), hematocrit (HCT), mean corpuscular volume (MCV), mean corpuscular

hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC). Liver function detection indicators include total bilirubin (TBIL), direct bilirubin (DBIL), indirect bilirubin (IBIL), alanine aminotransferase (ALT), aspartate aminotransferase (AST), the ratio of AST to ALT (AST/ALT), total protein (TP), albumin (ALB), globulin (GLO), the ratio of albumin to globulin (A/G), prealbumin (PA), total bile acid (TBA), alkaline phosphatase (ALP), gamma-glutamyl transpeptidase (GGT), and cholinesterase (CHE). Kidney function detection indicators include creatinine (CREA), urea (UREA), and uric acid (UA). Blood lipid detection indicators include total cholesterol (TC), triglyceride (TG), high-density lipoprotein cholesterol (HDL), and low-density lipoprotein cholesterol (LDL). Electrolyte detection indicators include potassium (K), sodium (NA), chlorine (CL), calcium (CA), and magnesium (Mg). Hemorheology detection indicators include whole blood viscosity at different shear rates (1, 5, 50, 100, 200s-1), plasma viscosity, and hematocrit. The blood glucose detection indicator is glucose (GLU).

2.3. Statistical Methods

SPSS 27.0 statistical software was used for data analysis. Measurement data are expressed as mean ± standard deviation (x ± s), and the independent-sample t-test was used for comparison between the two groups; count data are expressed as rate (%), and the x^2 test was used for comparison between the two groups. $P < 0.05$ was considered statistically significant.

3. Results

3.1. Comparison of General Data

In terms of age, the experimental group was (55.19 ± 13.65) years old, and the control group was (49.92 ± 8.75) years old, with a statistically significant difference ($t = 1.9190$, $P = 0.0307$). In terms of gender, there were 14 males and 17 females in the experimental group, and 29 males and 21 females in the control group, with no statistically significant difference ($x^2 = 0.5806$, $P = 0.4461$). The specific data are shown in Table 1.

Table 1. Comparison of general data of the two groups.

Group	Number of Cases	Age	Gender			
			Male	Female	x^2 value	P value
Experimental Group	31	55.19 ± 13.65	14	17	0.5806	0.4461
Control Group	50	49.92 ± 8.75	29	21	2.5600	0.1096
t value or x^2 value	—	1.9190	1.2665		—	—
P value	—	0.0307	0.2604		—	—

3.2. Comparison of Detection Results of Blood Routine Indicators

The WBC in the experimental group was (7.77 ± 2.50) × 10^9/L, and the NEUT# was (5.09 ± 2.36) × 10^9/L, which were significantly different from those in the

control group (t = 2.8905, P = 0.0029; t = 3.2777, P = 0.0011). There were no statistically significant differences in other blood routine indicators such as LYMPH#, RBC, HGB, PLT, HCT, MCV, MCH, and MCHC between the two groups (P > 0.05). The specific data are shown in Table 2.

Table 2. Comparison of detection results of blood routine indicators in the two groups.

Group	Number of Cases	WBC	NEUT#	LYMPH#	RBC	HGB	PLT	HCT	MCV	MCH	MCHC
Experimental Group	31	7.77 ± 2.50	5.09 ± 2.36	2.09 ± 0.83	4.75 ± 0.85	133.68 ± 20.45	265.94 ± 68.68	40.31 ± 6.15	85.61 ± 8.31	28.51 ± 3.32	331.94 ± 11.54
Control Group	50	6.29 ± 1.74	3.59 ± 1.22	2.05 ± 0.67	4.99 ± 0.77	138.00 ± 17.17	250.68 ± 62.02	42.10 ± 4.86	85.37 ± 9.77	28.06 ± 3.89	327.70 ± 12.78
t value	—	2.8905	3.2777	0.2381	1.3102	1.0224	1.0329	1.4537	0.1136	0.5343	1.5050
P value	—	0.0029	0.0011	0.4064	0.0977	0.1555	0.1530	0.0760	0.4549	0.2974	0.0685

3.3. Comparison of Detection Results of Liver Function Indicators

Liver function tests were performed on 29 out of 31 patients in the experimental group. The test results of the two groups showed that in the experimental group, AST was (19.38 ± 5.39) U/L, AST/ALT was (1.07 ± 0.45), TP was (74.13 ± 7.19) g/L, GLO was (26.43 ± 4.38) g/L, and A/G was (1.85 ± 0.32), which were significantly different from those in the control group (t = 2.5731, P = 0.0060; t = 1.1201, P = 0.1331; t = 2.7636, P = 0.0041; t = 2.5520, P = 0.0064; t = 2.0487, P = 0.0226). There were no statistically significant differences in other liver function indicators such as TBIL, DBIL, IBIL, ALT, ALB, PA, TBA, ALP, GGT, and CHE between the two groups (P > 0.05). The specific data are shown in Table 3.

Table 3. Comparison of detection results of liver function indicators in the two groups.

Group	Number of Cases	TBIL	DBIL	IBIL	ALT	AST	AST/ ALT	TP	ALB	GLO	A/G	PA	TBA	ALP	GGT	CHE
Experimental Group	29	11.59 ± 4.30	3.35 ± 1.56	8.23 ± 2.94	21.79 ± 11.58	19.38 ± 5.39	1.07 ± 0.45	74.13 ± 7.19	47.70 ± 4.24	26.43 ± 4.38	1.85 ± 0.32	242.69 ± 52.32	6.27 ± 6.29	71.05 ± 19.29	34.96 ± 17.29	9278.10 ± 2103.91
Control Group	50	11.57 ± 3.94	3.64 ± 1.66	7.93 ± 2.9	26.16 ± 21.06	24.1 ± 10.87	1.22 ± 0.74	78.04 ± 5.31	48.51 ± 3.72	29.53 ± 6.38	1.7 ± 0.31	257.12 ± 71.03	5.69 ± 6.17	75.9 ± 24.95	36.12 ± 38.09	8973.02 ± 2086.38
t value	—	0.0210	0.7649	0.4410	1.1896	2.5731	1.1201	2.7636	0.8859	2.5520	2.0487	0.9532	0.3999	0.9013	0.1850	0.6245
P value	—	0.4917	0.2236	0.3305	0.1190	0.0060	0.1331	0.0041	0.1899	0.0064	0.0226	0.1718	0.3454	0.1853	0.4269	0.2674

3.4. Comparison of Detection Results of Kidney Function Indicators

Kidney function tests were performed on 48 out of 50 subjects in the control group. The test results of the two groups showed that in the experimental group, CREA was (78.04 ± 18.76) μmol/L, UREA was (4.31 ± 1.61) mmol/L, and UA was (325.38 ± 97.95) μmol/L, with no statistically significant differences compared

with the control group (P > 0.05). The specific data are shown in Table 4.

Table 4. Comparison of detection results of kidney function indicators in the two groups.

Group	Number of Cases	CREA	UREA	UA
Experimental Group	31	78.04 ± 18.76	4.31 ± 1.61	325.38 ± 97.95
Control Group	48	79.51 ± 21.88	4.48 ± 1.67	354.21 ± 114.77
t value	—	0.3079	0.4480	1.1529
P value	—	0.3795	0.3278	0.1264

3.5. Comparison of Detection Results of Blood Lipid Indicators

Blood lipid tests were performed on 28 out of 31 patients in the experimental group and 39 subjects in the control group. The test results of the two groups showed that in the experimental group, TC was (5.23 ± 1.44) mmol/L, TG was (1.93 ± 1.92) mmol/L, HDL was (1.20 ± 0.30) mmol/L, and LDL was (3.58 ± 1.26) mmol/L, with no statistically significant differences compared with the control group (P > 0.05). The specific data are shown in Table 5.

Table 5. Comparison of detection results of blood lipid indicators in the two groups.

Group	Number of Cases	TC	TG	HDL	LDL
Experimental Group	28	5.23 ± 1.44	1.93 ± 1.92	1.20 ± 0.30	3.58 ± 1.26
Control Group	39	5.30 ± 1.56	2.32 ± 2.79	1.28 ± 0.31	3.59 ± 1.11
t value	—	0.1870	0.6776	1.0559	0.0344
P value	—	0.4261	0.2502	0.1475	0.4863

3.6. Comparison of Detection Results of Electrolyte Indicators

Electrolyte tests were performed on 30 out of 31 patients in the experimental group and 21 subjects in the control group. The test results of the two groups showed that in the experimental group, K was (3.29 ± 0.3) mmol/L and CA was (2.24 ± 0.11) mmol/L, which were significantly different from those in the control group (t = 9.1414, P = 0.0000; t = 1.7785, P = 0.0408). There were no statistically significant differences in other electrolyte indicators such as NA, CL, and Mg between the two groups (P > 0.05). The specific data are shown in Table 6.

Table 6. Comparison of detection results of electrolyte indicators in the two groups.

Group	Number of Cases	K	NA	CL	CA	Mg
Experimental Group	30	3.29 ± 0.3	140.40 ± 2.09	104.31 ± 2.86	2.24 ± 0.11	0.87 ± 0.10
Control Group	21	4.02 ± 0.25	140.53 ± 2.1	103.74 ± 2.26	2.3 ± 0.13	0.88 ± 0.18
t value	—	9.1414	0.2182	0.7613	1.7785	0.2309
P value	—	0.0000	0.4141	0.2251	0.0408	0.4092

3.7. Comparison of Detection Results of Hemorheology Indicators

Hemorheology tests were performed on 22 out of 31 patients in the experimental

group and 29 subjects in the control group. The test results of the two groups showed that in the experimental group, the whole blood viscosities at different shear rates (1, 5, 50, 100, 200s − 1) were (21.28 ± 3.44), (9.58 ± 1.73), (5.07 ± 1.10), (4.57 ± 1.03), and (4.24 ± 0.98) mPa·s respectively, the plasma viscosity was (1.34 ± 0.08) mPa·s, and the hematocrit was (0.41 ± 0.05). In the control group, the corresponding indicators were (21.73 ± 3.89), (9.43 ± 1.46), (4.8 ± 0.64), (4.29 ± 0.56), and (3.95 ± 0.5) mPa·s respectively, (1.33 ± 0.07) mPa·s, and (0.41 ± 0.04). There were no statistically significant differences in all hemorheology indicators between the two groups (P > 0.05). The specific data are shown in Table 7.

Table 7. Comparison of detection results of hemorheology indicators in the two groups.

Group	Number of Cases	Whole Blood Viscosity-Shear Rate-1	Whole Blood Viscosity-Shear Rate-5	Whole Blood Viscosity-Shear Rate-50	Whole Blood Viscosity-Shear Rate-100	Whole Blood Viscosity-Shear Rate-200	Plasma Viscosity	Hematocrit
Experimental Group	22	21.28 ± 3.44	9.58 ± 1.73	5.07 ± 1.10	4.57 ± 1.03	4.24 ± 0.98	1.34 ± 0.08	0.41 ± 0.05
Control Group	29	21.73 ± 3.89	9.43 ± 1.46	4.8 ± 0.64	4.29 ± 0.56	3.95 ± 0.5	1.33 ± 0.07	0.41 ± 0.04
t value	—	0.4297	0.3355	1.0269	1.1524	1.2684	0.4751	0.0000
P value	—	0.3346	0.3693	0.1547	0.1274	0.1053	0.3184	0.5000

3.8. Comparison of Blood Glucose Detection Results

Blood glucose tests were performed on 29 out of 31 patients in the experimental group and 43 subjects in the control group. The test results of the two groups showed that GLU in the experimental group was (6.25 ± 2.58) mmol/L, and in the control group was (5.81 ± 1.05) mmol/L, with no statistically significant difference between the two groups (t = 0.8710, P = 0.1949). The specific data are shown in Table 8.

Table 8. Comparison of blood glucose detection results in the two groups.

Group	Number of Cases	GLU
Experimental Group	29	6.25 ± 2.58
Control Group	43	5.81 ± 1.05
t value	—	0.8710
P value	—	0.1949

4. Discussion

4.1 Significance of Changes in Blood Routine Indicators

In this study, the levels of WBC and NEUT# in the experimental group of TIA patients were significantly higher than those in the control group. White blood cells play a key role in the body's immune defense, and their elevation may reflect the presence of an inflammatory response during TIA attacks. Some studies have

shown that the inflammatory process is involved in the occurrence and development of atherosclerosis, which is an important pathological basis of TIA [5]. As the main component of white blood cells, the increase in neutrophils may indicate that the inflammation is in an active state, with increased release of inflammatory mediators, damage to vascular endothelial cells, promotion of thrombus formation, and thus triggering TIA attacks [6].

4.2. Significance of Changes in Liver Function Indicators

There were significant differences in the AST, AST/ALT, TP, GLO, and A/G indicators between the experimental group and the control group. AST is a sensitive indicator reflecting liver cell damage, and changes in its level may imply that TIA patients have a certain degree of liver cell dysfunction. The change in the AST/ALT ratio helps to judge the type and degree of liver cell damage. A decrease in the ratio may indicate acute liver cell damage [7]. The changes in TP and GLO reflect the alterations in the body's protein metabolism, and the abnormal A/G ratio may be related to the liver's synthetic function and immune status. This may indicate that TIA patients not only have local brain lesions but may also be accompanied by disorders of systemic metabolism and immune function.

4.3. Significance of Changes in Electrolyte Indicators

There were significant differences in the K and CA levels between the experimental group of TIA patients and the control group. Potassium ions are crucial for maintaining the normal osmotic pressure, acid-base balance, and neuromuscular excitability of cells [8]. A decrease in potassium ion levels may affect nerve conduction and muscle contraction, and further affect the normal vasomotor function of cerebral blood vessels. Calcium ions are involved in various signal transduction processes within cells, and changes in their levels may affect the contraction and relaxation of vascular smooth muscle, having an impact on cerebral blood flow [9]. Therefore, the abnormalities of potassium and calcium ions may play a certain role in the pathogenesis of TIA.

4.4. Analysis of the Reasons Why Other Indicators Did Not Show Significant Differences

There were no statistical differences in indicators such as kidney function, blood lipids, hemorheology, and blood glucose between the two groups. The lack of differences in kidney function indicators may be related to the fact that the sample did not include TIA patients with severe kidney function impairment, or it may indicate that the impact of TIA on kidney function is not obvious within the observation scope of this study. The lack of differences in blood lipid indicators may be due to the relatively small sample size, large individual differences among patients, and the complex relationship between TIA and blood lipid abnormalities, which requires further in-depth research with an expanded sample size [10]. The lack of significant differences in hemorheology indicators may be because the

transient nature of TIA attacks did not cause persistent and detectable significant changes in hemorheology. The lack of differences in blood glucose indicators suggests that there is no direct association between TIA and blood glucose abnormalities in the population of this study, but the possibility of a connection between the two under other populations or different research conditions cannot be excluded [11]-[30].

5. Conclusion

Through the detection of multi-dimensional laboratory indicators, this study found that there were significant differences in some indicators of blood routine, liver function, and electrolytes between transient cerebral ischemic attack patients and healthy people. The changes in these indicators reflect pathological characteristics such as inflammatory response, liver cell dysfunction, and electrolyte imbalance in TIA patients, providing a valuable reference for clinical diagnosis and disease assessment. Clinicians should comprehensively consider these multi-dimensional laboratory indicators when diagnosing and treating TIA patients to more comprehensively understand the patient's condition and develop personalized treatment plans.

Limitations of the Study

This study has certain limitations. First, the relatively small sample size may affect the universality and representativeness of the research results, and subsequent studies should expand the sample size for verification. Second, this study is a cross-sectional study and cannot clarify the causal relationship and time sequence between the changes in various indicators and the occurrence and development of TIA. Future prospective studies are needed for further exploration. In addition, this study only analyzed common laboratory indicators and did not detect some emerging biomarkers such as homocysteine and high-sensitivity C-reactive protein. Subsequent studies can include more indicators to deeply analyze the pathological mechanism of TIA.

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Conflicts of Interest

All authors declare that there is no conflict of interest in the authorship of this paper.

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