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Original research

SERUM TNF ALPHA CONCENTRATION AND ARTERIAL AGE OF PATIENTS WITH ACUTE CEREBRAL INFARCTION

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ABSTRACT

Aims: *To determine the serum TNF-α concentration and arterial age of patients with acute cerebral infarction; and explore the relationship between serum TNF-α concentration and arterial age with age, gender, smoking history, blood pressure, blood lipid profile, diabetes, ejection fraction, carotid atherosclerosis in patients with acute cerebral infarction.*

Methods: *A cross-sectional descriptive study was conducted on patients with acute cerebral infarction at the Department of Intensive Care and Stroke - Hue Central Hospital from May 2023 to June 2024. Clinical and paraclinical results were used to analyze factors related to TNF-α.*

Results: *The average TNF-α concentration was 23.81 ± 9.11 (pg/mL). Patients with arterial age (76.37 ± 8.05) were greater than actual age (68.63 ± 12.32) significantly (p < 0.001). There was a correlation between smoking, hypertension, diabetes, ejection fraction (EF), carotid atherosclerosis and arterial age with TNF-α.*

Conclusion: *In patients with acute cerebral infarction, TNF-α concentration was increased. Arterial age was greater than the actual age of the patient.*

Keywords: *Cerebral infarction, TNF-α. arterial age.*

I. INTRODUCTION

Stroke has become a pressing medical problem in every country and for every ethnic group [1]. According to the report of the World Health Organization in 2012, for every 100,000 people each year, there are 127 - 740 patients with stroke. In Vietnam, according to Le Van Thanh and colleagues, the average annual incidence of the disease is 416/100,000 people. The mortality rate due to stroke in Asian countries and developing countries ranks first among neurological diseases and third after cancer and myocardial infarction, accounting for about 20% of total deaths from internal medicine. In the United States in 2012, 1 in 15 deaths was due to stroke [2].

For early diagnosis and prognosis, biomarkers provide an effective solution. TNF-α is a biomarker related to cerebrovascular disease that has been studied worldwide. In Vietnam TNF-α has only been mentioned as a factor in the general inflammatory response. There have not been many studies clearly showing the relationship between TNF-α and cerebrovascular disease or arterial age. To better understand this issue, we conducted this study to determine the serum TNF-α concentration and arterial age of patients with acute cerebral infarction, and the relationship between serum TNF-α concentration, arterial age with age, gender, smoking history, blood pressure, blood lipid profile, diabetes, ejection fraction, carotid atherosclerosis in patients with acute cerebral infarction.

II. MATERIALS AND METHODS

2.1. Subjects

Inclusion criteria were patients with cerebral infarction who met all clinical and paraclinical

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criteria with the brain computed tomography (CT) scan being the most important (gold standard). Patients were treated at Hue Central Hospital.

Exclusion criteria were patients with a history of stroke, brain tumor, encephalitis, or brain trauma within the past 3 months.

Diagnostic criteria for cerebral infarction: To diagnose cerebral infarction, two clinical criteria are required: time of symptom onset and localized neurological signs, along with some paraclinical tests.

- Time of symptom onset: Sudden appearance (within seconds); Acute (within minutes); Step by step; Progressive (within hours).

- Localized neurological signs: There are divided into two groups: Main symptoms include: hemiplegia with ipsilateral facial paralysis, language disorder, unilateral blindness, acute cerebellar signs; Secondary symptoms: Babinski reflex, difficulty speaking, hemiplegia affecting only one arm or one leg.

Paraclinical: Cerebral infarction detected via CT scan.

2.2. Research methods

This study used a cross-sectional descriptive research method. It was conducted at the time when patients with cerebral infarction were being treated at Hue Central Hospital.

Data processing method: The data were processed using SPSS 26.0 software.

III. RESULTS

3.1. General characteristics

Most patients were aged ≥ 60 years (79.8%). Mean age was 68.63 ± 12.32 (Table 1). The proportion of men (56.6%) is higher than that of women (43.4%) (Figure 1).

Table 1: Age

Age	n (%)
< 50	7 (7.1)
50 - 59	13 (13.1)
60 - 69	32 (32.3)
70 - 79	24 (24.2)
≥ 80	23 (23.3)
Total	99 (100.0)
$\overline{X}$±SD	68.63 ± 12.32

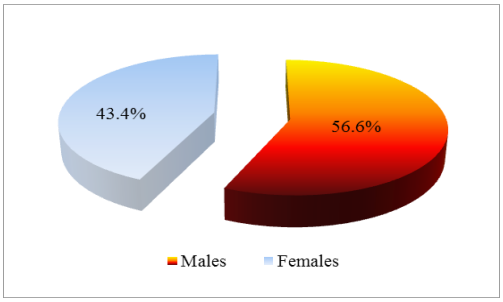

Figure 1: Gender characteristics

3.2. Characteristics of serum TNF-α concentrations

The mean TNF-α concentration was 23.81 ± 8.11 (pg/mL) (Table 2). The arterial age greater than the actual age ($p < 0.01$ to $p < 0.001$) (Table 3).

Table 2: Average TNF-α concentrations

TNF-α (pg/mL)	
$\overline{X}$±SD	23.81 ± 8.11
Min	4.55
Max	51.00

Table 3: Comparison of arterial age and actual age

Gender	Arterial age	Actual age	p
Males (n=56)	75.79 ± 9.51	66.00 ± 13.22	< 0.001
Females (n=43)	77.14 ± 5.64	72.05 ± 10.22	< 0.01
Total (n=99)	76.37 ± 8.05	68.63 ± 12.32	< 0.001

3.3. Relationship between blood TNF-α concentration and some factors

Smoking, hypertension, diabetes, EF, atherosclerosis and arterial age were factors associated with TNF-α ($p < 0.05$) (Table 4).

Table 4: Relationship between blood TNF-α concentration and some factors

Factor		TNF-α	p
Smoking	Yes	25.54 ± 9.57	< 0.05
	No	21.66 ± 8.10	
Hypertension	Yes	26.19 ± 6.77	< 0.01
	No	20.59 ± 10.83	

Factor		TNF-α	p
Diabetes mellitus	Yes No	27.28 ± 9.28 21.55 ± 8.33	<0.01
Ejection fraction	Yes No	30.53 ± 14.40 23.22 ± 8.36	< 0.05
Atherosclerosis	Yes No	28.22 ± 7.10 20.43 ± 9.09	< 0.001
Arterial age	≥ 80 (n=70) 70 - 79 (n=14) 60 - 69 (n=11) < 60 (n=4)	26.55 ± 7.79 20.11 ± 8.64 16.96 ± 8.33 7.66 ± 1.34	Reference < 0.01 < 0.001 < 0.001

IV. DISCUSSION

4.1. Serum TNF-α concentration and arterial age of patients with cerebral infarction

The average TNF-α in NMN patients was 23.81 ± 9.11 (pg/mL).

Flores-Cantus measured TNF-α concentration in 75 stroke patients and evaluated the relationship between TNF-α and stroke pathology, as well as in the prognosis of stroke. This study showed that the average TNF-α concentration of the study sample was 6 pg/dl (0.79-17.38 pg/dl) [3]. Maas showed that TNF-α was increased in patients with ischemic stroke [4]. Therefore, TNF-α is an essential marker in predicting stroke and diagnosing stroke.

Most patients had an arterial age of ≥ 80 years (70.7%), with only 4.1% having an arterial age less than 60 years. The average arterial age was 76.37 ± 8.05.

Patients with arterial age greater than their actual age showed statistically significant differences ($p < 0.01$).

Yang study on the healthy arterial age group (no hypertension and no increased vascular stiffness) and unhealthy arterial age groups showed that after a follow-up of about 3.3 years, the stroke rate in the healthy arterial age group was 0.5%, which was statistically lower than in the unhealthy arterial age group (2.6%) [5].

4.2. Relationship between blood TNF-α concentration and some factors

There was a relationship between smoking and TNF-α. The TNF-α concentration in the smoking group (25.54 ± 9.57 pg/mL) was higher than that in the non-smoking group (21.66 ± 8.10 pg/mL), with statistical significance ($p < 0.05$).

Elfiky showed that TNF-α concentration had a significant difference between smokers and non-smokers, suggesting that TNF-α could be considered a marker for the early detection of diseases related to cigarette smoke [6].

The concentration of TNF-α in the group with hypertension (26.19 ± 6.77 pg/mL) was higher than in the group without hypertension (20.59 ± 10.83 pg/mL) with statistical significance ($p < 0.01$).

Our results aligned with previous studies showing a relationship between TNF-α and hypertension. Eamonn and Dewan showed that TNF-α was a proinflammatory cytokines associated with salt-sensitive hypertension (SSH) and related renal damage [7]. In addition, the TNF-α inhibitor trial by Rishi J Desai showed that patients treated with TNF-α inhibitors had a reduced risk of developing hypertension compared to the control group (OR= 0.85. 95% CI 0.67 - 1.1) [8].

There was no statistically significant difference in TNF-α levels between patients with increased total cholesterol (24.82 ± 9.06 pg/mL) and those without increased total Cholesterol (23.18 ± 9.16 pg/mL) ($p > 0.05$). The same applied to the group with decreased HDL-C (24.17 ± 10.23 pg/mL) and no decreased HDL-C (23.60 ± 8.45 pg/mL) ($p > 0.05$).

The study by Cheng et al. showed that patients with TNF-α-238 had increased triglyceride levels and decreased LDL-C levels, both of which are

factors that increase the risk of coronary artery disease [9].

The TNF-α concentration in the diabetic group (27.28 ± 9.28 pg/mL) was higher than that in the non-diabetic group (21.55 ± 8.33 pg/mL), with statistical significance ($p < 0.01$).

Research by Muhammad indicated that TNF-α is one of the important factors involved in the process of insulin resistance and leading to type 2 diabetes. The authors suggested that "anti-TNF-α" treatment strategies would contribute to reducing the incidence of type 2 diabetes and insulin resistance [10].

The TNF-α concentration in the group with reduced EF (30.53 ± 14.40 pg/mL) was higher than in those without reduced EF (23.22 ± 8.36 pg/mL), with statistical significance ($p < 0.05$).

The study by Boulogne et al. showed that TNF-α levels were significantly elevated in patients with acute heart failure acute (low ejection fraction) and slightly elevated in patients with chronic heart failure (ejection fraction < 40%). TNF-α levels were slightly elevated above normal levels and significantly elevated in 85% of patients with acute heart failure (low EF) [11].

The TNF-α concentration in patients with carotid atherosclerosis (28.22 ± 7.10 pg/mL) was higher than that in patients without carotid atherosclerosis (20.43 ± 9.09 pg/mL), with statistical significance ($p < 0.001$).

Tay concluded that TNF-α, produced by B2 cells, plays an important role in promoting atherosclerosis by enhancing TNF-α production in macrophages [12]. In further analysis by Lu et al. C1q/TNF-related protein-1 (CTRP) was shown to be a contributor to atherosclerosis in humans [13].

TNF-α concentration in the group with arterial age ≥ 80 (26.55 ± 7.79 pg/mL) was higher than those with arterial age 70 - 79 (20.11 ± 8.64 pg/mL), 60 - 69 (16.96 ± 8.33 pg/mL), and < 60 (7.66 ± 1.34 pg/mL), with statistical significance ($p < 0.01$ to $p < 0.001$).

Tesauro et al. showed that TNF-α increases with age and this contributed to increased blood lipid indices [14]. A. Harvey et al. showed that endothelial cells play an key role in the aging process of the vascular wall, resulting in hypertension. One of the factors that contributes to stimulating endothelial cells is TNF-α [15].

V. CONCLUSIONS

In patients with cerebral infarction, serum TNF-α concentrations were elevated. The average TNF-α concentration was 23.81 ± 9.11 (pg/mL). Additionally, patient's arterial age (76.37 ± 8.05) was statistically greater than their actual age (68.63 ± 12.32) ($p < 0.001$). There is a relationship between TNF-α concentration, arterial age, and other factors such as smoking, hypertension, diabetes, EF, and carotid atherosclerosis.

Disclosure

The authors report no other conflicts of interest in this work.

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