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Prognostic Significance of Procalcitonin in acute ischemic stroke patients in India

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ABSTRACT

Introduction: Ischemic stroke is one of leading cause of mortality and it is serious long term disability worldwide. Ischemic stroke is the most common type of stroke, and it develops due to a blockage in the arteries around the brain. PCT was not commonly used as a diagnostic marker in India for acute ischemic stroke.
Objective: The present study evaluated the serum PCT level in acute ischemic stroke patients from Indian population.
Methods: In the present study 120 acute ischemic stroke patients were included as per World Health Organization criteria. Age, sex and ethnically matched 120 controls were also included in the study. Serum PCT level was measured in both the case and control group using kit method as per manufacturer guidelines. All data are analysed using SPSS 20.0 version
Results: The present study recorded high frequency of male AIS patients as compared to female patients (70.8% vs 29.2%). The serum PCT showed significantly high procalcitonin in AIS patients compared to control group (1.1±0.5ng/ml vs 0.02±0.6ng/ml, p value- 0.0001). The gender wise estimation of PCT in our study cohort showed, significantly higher PCT level in male as compared to female patients (1.0±0.5ng/ml vs0.9±0.3 ng/ml, p value- 0.0001).
Conclusion: The present study recorded an elevated serum PCT level in AIS patients. This can be further successfully used as an independent diagnostic marker for acute ischemic stroke in Indian AIS population.

Keywords: Acute Ischemic Stroke (AIS) , Procalcitonin (PCT), Diagnostic Marker, India.

INTRODUCTION

Ischemic stroke is among the leading cause of mortality and remains serious long term disability worldwide. A stroke occurs when the body stops supplying blood to the brain. Ischemic stroke is the most common type of stroke, and it develops due to a blockage in the arteries around the brain [1]. The brain relies upon a constant supply of oxygen rich blood, so a blockage that lasts for just a few minutes can begin to damage and destroy brain cells. Early detection and control of risk factors appear to be important for reducing the risk of stroke and providing optimised and effective care [2]. Inflammatory processes have fundamental roles in stroke in both the aetiology of ischemic cerebrovascular disease and the pathophysiology of cerebral ischemia [3]. The infection markers and inflammatory molecules, such as C-reactive protein (CRP), WBC, and IL-6, were suggested to be biomarkers for the outcome of an ischemic stroke. Compared with these markers, procalcitonin (PCT) is not a widely used diagnostic marker, but it is considered to be the best available biomarker to diagnose infection. In a recent study, PCT was suggested to be an independent risk factor for ischemic stroke. PCT was a protein of 116 amino-acids with a molecular weight of 13 kDa. The probable site of PCT production during inflammation is the neuroendocrine cells in the lungs or intestine [4].

Moreover, an early and transient release of PCT into the circulation was observed after severe trauma, and the amount of circulating PCT seemed proportional to the severity of tissue injury. The normal serum value of PCT is < 0.1 ng/mL. It was first reported to be present in increased concentration in patients with systemic infections [5]. Increased concentration has also been observed in other conditions such as trauma and surgery, and to a far lesser extent in systemic viral infections. The greatest elevations of serum PCT are seen in bacterial infections and multiorgan failure resulting

from trauma. An increased serum PCT level was reported to be associated with adverse clinical outcomes, including higher mortality in cerebrovascular diseases [6]. The concentration of PCT is transiently increased after severe trauma and seems proportional to the severity of tissue injury and hypovolemia. Furthermore, the levels of PCT were independently associated with ischemic stroke risk. Recently, a study reported that serum levels of PCT and high sensitivity C-reactive protein were associated with long term mortality in AIS [7]. In the present study we evaluated the serum PCT level in Indian acute ischemic stroke patients.

MATERIALS AND METHODS

Sample collection

The present study screened 150 acute ischemic strokes patients and 120 acute ischemic stroke patients were included for the study, less than 22 hours after symptom onset with acute ischemic stroke. Study was carried during the period of 2021-2022 in a S. Nijalingappa Medical College & Hanagal Shri Kumareshwar Hospital & Research Centre, Bagalkot, Karnataka and patients were included as per the World Health Organization criteria [8]. We excluded AIS patients with other types of stroke, severe systemic diseases, malignant tumours, intracerebral hemorrhagic, and systemic infections. 2-3ml of blood samples were collected and stored in temperature controlled condition until further use. The detailed clinical and demographical data such as age, family history etc was also recorded during sample collection. The written informed consent was obtained from each patients/family members before the collection of blood sample. Study also included healthy age, sex and ethnically matched 120 controls.

PCT measurement

2-3ml blood samples were collected in serum collection tube and were centrifuged at 3600rpm for 15 min at 4^{o}C. Serum was separated and transferred to 2ml sterile cryovials. Serum sample was stored in -80^{o}C until further use. The serum was measured for Procalcitonin using the Elecsys® BRAHMS PCT assay kitas per manufactures instruction within 1-2 hours after sample collection. The samples were analysed using Cobas e601 instrument, Roche.

STATISTICAL ANALYSIS

All data were analysed using SPSS 20.0 version. All values were presented as mean ± SD P value < .05 was considered statistically significant. Paired t test was performed for quantitative data.

RESULTS

The present study included 120 AIS patients with mean age of 65 ± 10. Study cohort included 85 male and 35 female acute ischemic stroke patients. Control group contain 120 healthy age matched individuals with mean age of 68± 12 and which include 80 male and 40 females. The present study recorded high frequency of male AIS patients as compare to females (70.8% vs 29.2%). The detailed are explained in table 1.

Table 1: Characteristics of AIS patients

	Patients	Control	P value
Age	65 ± 10	68± 12	0.03*
Male [n]	85 (70.8%)	80 (66.7%)	-
Female[n]	35 (29.2%)	40 (33.3%)	-
PCT	1.1±0.5	0.02±0.6	0.001*
Ethnicity	Indian	Indian	-
Family History	None	None	-

**P value <0.05 = statistically significant*

The serum PCT estimation in AIS patients showed significantly high procalcitonin in AIS patients compared to control group (1.1±0.5ng/ml vs 0.02±0.6ng/ml, p value- 0.0001). The gender wise estimation of PCT in our study cohort showed, significantly higher PCT level in male acute ischemic stroke patients as compared to females acute ischemic stroke patients(1.0±0.5ng/ml vs0.9±0.3 ng/ml, p value- 0.0001) in table.2.

Table 2: Gender wise distribution of PCT in AIS patients

Gender	Patients	Control	P value
Male	1.0±0.5	0.017±0.6	0.0001*
Female	0.9±0.3	0.015±0.7	0.0001*

**P value <0.05 = statistically significant*

The results indicated that the serum procalcitonin levels were significantly higher in stroke patients as compared with normal controls as shown in figure below.

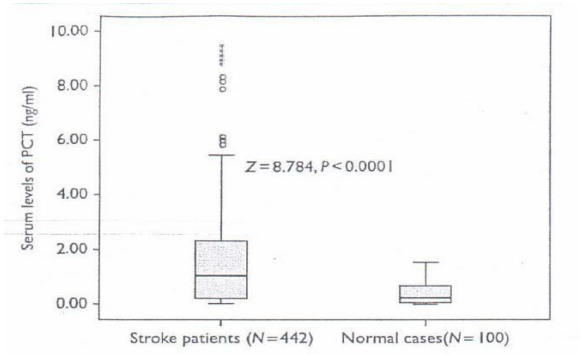


Fig: Serum PCT levels in AIS patients and normal cases

DISCUSSION

Stroke is the primary cause of disability in majority of the nations. Over two-thirds of stroke deaths worldwide occur in developing nations [9]. Inflammatory molecules may serve as both indicators and therapeutic targets for the treatment of stroke since they may play a significant impact in the progression of the disease. Infection markers and inflammatory molecules like CRP, WBC, and IL-6 were considered to be the biomarkers for the prognosis of an ischemic stroke [10].

PCT was not commonly used diagnostic marker in India as well as in worldwide but it is considered one of the best available biomarkers for diagnosis of infection. On this backdrop present study evaluated the procalcitonin level in serum of acute ischemic stroke patients from India. The normal serum value of PCT is < 0.1 ng/mL. It was first reported to be present in increased concentration in patients with systemic infection [4].

Previous studies have demonstrated that the neuroendocrine cells in the gut are the primary location of PCT synthesis during inflammation. Additionally, following severe trauma, an early and temporary release of PCT into the circulation was seen, and the quantity of circulating PCT appeared to be inversely related to the severity of tissue injury [6, 11]. Procalcitonin was a specific inflammatory biomarker, and systematic inflammation plays a crucial role in the pathogenesis of ischemic stroke. An important part of the aetiology of ischemic stroke is played by systemic inflammation, and procalcitonin was a particular inflammatory biomarker. Therefore, the inflammatory process in acute ischemic stroke may be the basis of the elevated PCT level in serum. [10].

Several recent studies also suggested that PCT is independent risk factors acute for ischemic stroke [10,11, 12].In our study, we found significantly higher level of PCT level in acute ischemic strokes(0.95±0.5ng/ml vs 0.02±0.9 ng/ml, p value- 0.0001) in Indian population. The previous studies on different population from different countries also recorded significantly high level of Procalcitonin in serum of acute ischemic stroke. Our study also showed male acute ischemic stroke patterns have significantly higher PCT as compared to female acute ischemic stroke patterns (1.0 ±0.5 ng/ml vs 0.9 ±0.3 ng/ml, p value- 0.0001).

Present study results clearly supports that serum procalcitonin level is the potential biomarker for the screening of acute ischemic stroke in Indian population.

CONCLUSION

The present study recorded an elevated serum PCT level in acute ischemic stroke patients. Which can further used an in dependent diagnostic marker for acute ischemic stroke in Indian population.

CONFLICTS OF INTEREST

Declare no conflicts of interest

REFERENCES

1. Zhang ZG, Wang C, Wang J, Zhang Z, Yang YL, Gao L, et al. Prognostic value of mannose-binding lectin: 90-day outcome in patients with acute ischemic stroke. Mol Neurobiol. 2015;51(1):230-9. doi: 10.1007/s12035-014-8682-0, PMID 24691546.
2. Murad LB, Guimarães MR, Paganelli A, de Oliveira CA, Vianna LM. Alpha-tocopherol in the brain tissue preservation of stroke-prone spontaneously hypertensive rats. J Physiol Biochem. 2014;70(1):49-60. doi: 10.1007/s13105-013-0279-y, PMID 23949732.
3. Tu WJ, Zhao SJ, Liu TG, Yang DG, Chen H. Combination of high-sensitivity C-reactive protein and homocysteine predicts the short-term outcomes of Chinese patients with acute ischemic stroke. Neurol Res. 2013;35(9):912-21. doi: 10.1179/1743132813Y.0000000228, PMID 23816540.
4. Maruna P, Nedelníková K, Gürlich R. Physiology and genetics of procalcitonin. Physiol Res. 2000;49;Suppl 1:S57-61. PMID 10984072.
5. Assicot M, Gendrel D, Carsin H, Raymond J, Guilbaud J, Bohuon C. High serum procalcitonin concentrations in patients with sepsis and infection. Lancet. 1993;341(8844):515-8. doi: 10.1016/0140-6736(93)90277-n, PMID 8094770.
6. Mimoz O, Benoist JF, Edouard AR, Assicot M, Bohuon C, Samii K. Procalcitonin and C-reactive protein during the early posttraumatic systemic inflammatory response syndrome. Intensive Care Med. 1998;24(2):185-8. doi: 10.1007/s001340050543, PMID 9539079.
7. Li YM, Liu XY. Serum levels of procalcitonin and high sensitivity C-reactive protein are associated with long-term mortality in acute ischemic stroke. J Neurol Sci. 2015;352(1-2):68-73. doi: 10.1016/j.jns.2015.03.032, PMID 25868898.

8. Hatano S. Experience from a multicentre stroke register: a preliminary report. Bull World Health Organ. 1976;54(5):541-53. PMID 1088404.
9. Feigin VL. Stroke epidemiology in the developing world. Lancet. 2005 Jun 25-Jul 1;365(9478):2160-1. doi: 10.1016/S0140-6736(05)66755-4, PMID 15978910.
10. Yan L, Wang S, Xu L, Zhang Z, Liao P. Procalcitonin as a prognostic marker of patients with acute ischemic stroke. J Clin Lab Anal. 2020 Jul;34(7):e23301. doi: 10.1002/jcla.23301, PMID 32196744.
11. Li G, Zhu C, Li J, Wang X, Zhang Q, Zheng H et al. Increased level of procalcitonin is associated with total MRI burden of cerebral small vessel disease in patients with ischemic stroke. Neurosci Lett. 2018 Jan 1;662:242-6. doi: 10.1016/j.neulet.2017.10.040, PMID 29061396.
12. Tian D, Zhang S, He X, Liu H. Serum procalcitonin as a diagnostic marker in acute ischemic stroke. NeuroReport. 2015 Jan 7;26(1):33-7. doi: 10.1097/WNR.0000000000000298, PMID 25426828.