

ORIGINAL RESEARCH**Analysis of correlation of serum parathyroid hormone levels with severity and duration of heart failure**

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Abstract

Background: The present study was conducted for assessing serum parathyroid hormone levels and its relation with severity and duration of heart failure.

Materials & methods: A total of 50 patients with heart failure and 50 age and gender-matched health controls were enrolled. Complete data in relation to demographic variables was recorded. Complete clinical and medical examination of all the subjects was carried out. ECHO and ECG were done in all the patients. Blood samples were obtained and serum PTH levels were evaluated. Classification of heart failure patients was done according to New York Heart Association (NYHA) classification. All the results were recorded and analysed by SPSS software.

Results: Mean PTH among the subjects of the study group and control group was 89.2 pg/ml and 31.1 pg/ml respectively. Significant results were obtained while comparing the mean PTH levels among the subjects of the study group and control group. Mean PTH levels among the patients with NYHA Class I HF, Class II HF, Class III HF and Class IV HF was 68.7 pg/ml, 76.1 pg/ml, 95.7 pg/ml and 102.7 pg/ml respectively. Mean PTH levels among HF patients with duration of less than 2 years and ≥ 2 years was found to be 78.5 pg/ml and 96.4 pg/ml respectively. Significant results were obtained while comparing the mean PTH levels among the patients of the heart failure group divided on the basis of severity and duration. 60% in the NYHA functional classification Grade III had elevated serum PTH levels. 60% of patients of more than 35 years age group have elevated PTH levels.

Conclusion: PTH might provide valuable information both in the diagnosis and staging of heart failure syndromes.

Key words: Parathyroid, Heart failure, Severity

Introduction

Heart failure (HF) is an important cardiovascular disease due to its increasing prevalence and high mortality rate. HF is associated with a diverse range of complications, such as hospitalization, lethal arrhythmia, and death during the disease progression. In addition, HF can be the terminal condition of many cardiovascular diseases, including myocardial infarction (MI), valvular heart disease, and various cardiomyopathies.^{1, 2} Heart failure can develop suddenly, for instance after a heart attack or due to certain heart rhythm problems.

This is known as acute heart failure. But it usually develops gradually over time as a result of a different medical problem, such as permanently high blood pressure. This is known as chronic heart failure.³

Parathyroid hormone (PTH) is secreted by the parathyroid glands that control calcium homeostasis. Excess of PTH may adversely affect cardiovascular health beyond the regulation of calcium and phosphate homeostasis. To date, many observational studies have examined the relationship between circulating level of PTH and subsequent risk of heart failure in the general population as well as adverse outcomes in patients with heart failure.⁴⁻

⁶Hence; the present study was conducted for assessing serum parathyroid hormone levels and its relation with severity and duration of heart failure.

Materials & methods

The present study was conducted at Medicine Ward and ICU at ABVIMS & Dr Ram Manohar Lohia Hospital, New Delhi for 1 year from 20 May, 2021 to 19 April, 2022. Study aimed to assess serum parathyroid hormone levels and its relation with severity and duration of heart failure.

The exclusion criteria

1. Clinically suspected primary hyperparathyroid states
2. Patients with renal failure, uremia
3. Lithium therapy, aluminium intoxication
4. Clinical suspicion of malignancy: Multiple myeloma, lymphoma, leukemia, tumours of lung, kidney, breast
5. Vitamin D related: intoxication, clinical suspicion of sarcoidosis & other granulomatous diseases
6. Associated with high bone turn over: hyperthyroidism, thiazides, immobilisation, vitamin A intoxication

A total of 50 patients with heart failure and 50 age and gender-matched health controls were enrolled. Complete data in relation to demographic variables was recorded. Complete clinical and medical examination of all the subjects was carried out. ECHO and ECG was done in all the patients. Blood samples were obtained and serum PTH levels were evaluated. Classification of heart failure patients was done according to New York Heart Association (NYHA) classification. All the results were recorded and analysed by SPSS software.

Results

Mean age of the patients of the study group and control group 53.2 years and 55.1 years respectively. Out of 50 patients studied, 60% (n=30) were males and 40% (n=20) were females. Mean PTH among the subjects of the study group and control group was 89.2 pg/ml and 31.1 pg/ml respectively. Significant results were obtained while comparing the mean PTH levels among the subjects of the study group and control group. Mean PTH levels among the patients with NYHA Class I HF, Class II HF, Class III HF and Class IV HF was 68.7 pg/ml, 76.1 pg/ml, 95.7 pg/ml and 102.7 pg/ml respectively. Mean PTH levels among HF patients with duration of less than 2 years and ≥ 2 years was found to be 78.5 pg/ml and 96.4 pg/ml respectively. Significant results were obtained while comparing the mean PTH levels among the patients of the heart failure group divided on the basis of severity and duration.

Table 1: Comparison of PTH levels among study group and control group

PTH levels (pg/ml)	Study group	Control group
Mean	89.2	31.1
SD	22.7	5.7

p- value	0.000 (Significant)
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Graph 1: Comparison of PTH levels among HF patients divided on the basis of duration of symptoms

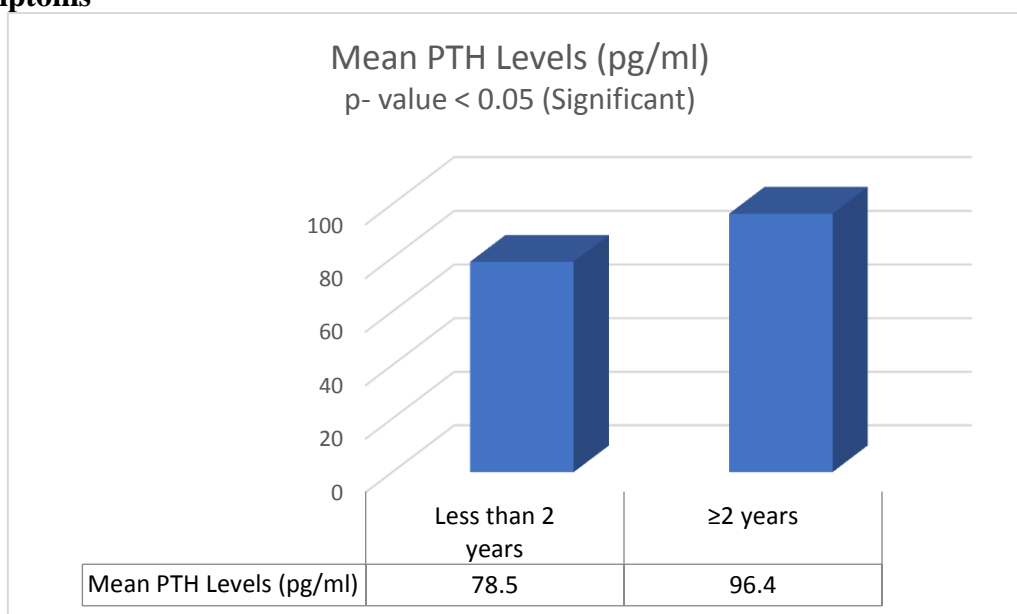


Table 2: Relation of serum PTH with duration of symptoms

Duration	Number of patients with serum PTH (>72 pg/ml)	Number of patients with serum PTH (≤72 pg/ml)
1-2 years (n= 24)	0 (0%)	24 (100%)
≥ 2 years (n=16)	12 (75.0%)	4 (25%)

Table 3: Comparison of serum PTH between NYHA grades

NYHA	Number of patients with serum PTH (>72 pg/ml)	Number of patients with serum PTH (≤72 pg/ml)
Grade II (n=25)	0 (0.0%)	25 (100.0%)
Grade III (n=25)	15 (60.0%)	10 (40.0%)

Table 3: Comparison of Ejection Fraction and Serum Parathyroid Hormone among the study population

Ejection fraction (%)	Number of patients with serum PTH (>72pg/ml)	Number of patients with serum PTH (≤72pg/ml)
<35 (n=25)	15 (60.0%)	40(44%)
35-40 (n=14)	0 (0.0%)	14(100%)
>40 (n=11)	0 (0.0%)	11(100%)

Discussion

Heart failure is a clinical syndrome characterized by typical symptoms (e.g., dyspnoea, ankle swelling, fatigue) that may be accompanied by signs (e.g., elevated jugular venous pressure, pulmonary crackles, peripheral oedema) caused by a structural and/or functional cardiac abnormality, leading to a reduced cardiac output and/or elevated intracardiac pressures at rest or during stress. Heart failure is present only when symptoms are apparent.⁵ A wide range of cardiac conditions, hereditary defects, and systemic diseases can result in HF. Patients with

HF can have mixed aetiologies, which are not mutually exclusive, and HF aetiologies vary considerably between high-income and developing countries.⁶⁻⁸

The parathyroid glands are unique organs responsible for maintaining the critical function of calcium homeostasis. There are commonly four parathyroid glands that weigh approximately 40 grams each and are generally located posterior and inferior to the thyroid in the neck. These organs secrete parathyroid hormone (PTH), which controls calcium regulation. Secretion of PTH is modulated not only by serum calcium but also phosphorus and vitamin D through negative and positive feedback loops. Both the direct action of PTH on the heart and alterations of calcium homeostasis (e.g., hypercalcemia or hypocalcemia) comprise the two primary mechanisms by which diseases of the parathyroid affect the cardiovascular system.⁹⁻

¹¹Hence; the present study was conducted for assessing serum parathyroid hormone levels and its relation with severity and duration of heart failure.

In the present study, mean PTH among the subjects of the study group and control group was 89.2pg/ml and 31.1pg/ml respectively. Significant results were obtained while comparing the mean PTH levels among the subjects of the study group and control group. Our results were in concordance with the results obtained by previous authors who also reported similar findings. In a study conducted by Bezgin T et al, authors investigated the association of serum PTH levels and measures of disease severity in patients with heart failure with preserved ejection fraction (HFpEF). PTH, NT-proBNP, troponin I, and CRP levels were significantly higher in patients with HFpEF when compared with control group. Left atrium was found to be more enlarged in HFpEF patients. Most indices of left ventricular diastolic function were more severely impaired compared to controls. There was no correlation between PTH and CRP, troponin I, LVMI, LV volumes, LV diameters, E/E', age, and BMI in both groups. There was strong positive correlation between PTH and NT-proBNP levels in all study participants.¹²

In the present study, mean PTH levels among the patients with NYHA Class I HF, Class II HF, Class III HF and Class IV HF was 68.7 pg/ml, 76.1 pg/ml, 95.7 pg/ml and 102.7 pg/ml respectively. Mean PTH levels among HF patients with duration of less than 2 years and ≥ 2 years was found to be 78.5 pg/ml and 96.4 pg/ml respectively. Significant results were obtained while comparing the mean PTH levels among the patients of the heart failure group divided on the basis of severity and duration. Wu GY et al evaluated the serum PTH levels in patients with chronic right HF. A total of 154 patients with chronic right HF were enrolled in the present study. A binary logistic regression analysis model was used to assess the independent predictive value of PTH levels in chronic right HF. Partial correlative analysis was used to demonstrate the relevance of PTH levels on the parameters of assessment of right heart function. A multiple linear regression analysis model was used to evaluate the independent factors of PTH levels in patients with right HF. The results showed that the serum PTH levels in the right HF group were significantly higher compared with the control group. After adjusting for predictors of right HF, serum PTH levels were associated with right HF.¹³ Secondary hyperparathyroidism in heart failure results in an inflammatory state with adverse effects on myocardial remodeling and systemic complications. Recent literature has suggested that elevated parathyroid hormone predicts adverse outcomes in patients with heart failure independent of serum calcium and phosphate, vitamin D deficiency, and renal insufficiency. Parathyroid hormone has been correlated with elevated brain natriuretic peptide levels, an established biomarker of heart failure severity. There are several limitations to the utilization of parathyroid hormone as a biomarker for heart failure, and further prospective studies need to be conducted to assess the value of multiple parathyroid hormone measurements over time and elucidate the role of parathyroid hormone in diastolic dysfunction.¹⁴

Conclusion

From the above results, the authors concluded that PTH might provide valuable information both in the diagnosis and staging of heart failure syndromes.

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