

Original Article

# Analysis of the parathyroid function in maintenance hemodialysis patients from Changchun, China

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## Abstract

**Objective:** To evaluate the parathyroid function in maintenance hemodialysis patients from 4 hemodialysis centers and to analyze the cause of the dysfunction.

**Methods:** This cross-sectional study included patients with chronic renal disease undergoing maintenance hemodialysis treatment at 4 hemodialysis centers in Changchun, China, between March 2014 and August 2015. A total of 337 patients were asked to complete a questionnaire including their name, gender, age, hemodialysis duration, the use of calcium carbonate and vitamin D3 supplements, health education status, hemofiltration frequency, appetite, and education level. Serum intact parathyroid hormone (iPTH), phosphorus, total calcium, blood urea nitrogen (BUN), and creatinine (Cre) levels were obtained from clinical information. Patients with iPTH data were divided into 2 groups: Normal group: the patients with an iPTH level < 100 pg/ml (28 subjects); Abnormal group: the patients with an iPTH level > 100 pg/ml (136 subjects). Intergroup differences were analyzed using the *t*-test. The enumeration data were analyzed by the  $\chi^2$  test.

**Results:** The iPTH levels were not monitored for 173 maintenance hemodialysis patients (51.3%) but for 164 patients (48.7%). Of the 164 patients, 28 (17.1%) had a normal serum iPTH level, while the other 136 (82.9%) had an abnormal iPTH level. The maintenance hemodialysis duration and phosphorus levels in the Abnormal group were higher than those in the Normal group ( $P < 0.05$ ). The appetites of patients in the Abnormal group were better than those of patients in the Normal group ( $P < 0.05$ ).

**Conclusions:** A lower proportion of patients on hemodialysis had a normal iPTH level. The phosphorus levels of patients on hemodialysis should be controlled via dietary interventions.

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**Keywords:** Maintenance hemodialysis; Intact parathyroid hormone; Serum phosphorus

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## Introduction

The incidence and prevalence of maintenance hemodialysis is rapidly increasing in Changchun, the capital of Jilin province in Northeast China. The number of maintenance hemodialysis patients has increased sharply in the past few years due to the high morbidity of end-stage renal disease, population aging, medical insurance coverage, and the increased number of hemodialysis centers. There are approximately 5000 maintenance hemodialysis patients in the main districts of Changchun city.

Hypocalcemia, one of the most frequent complications of maintenance hemodialysis, is directly related to patient quality of life. In fact, hypocalcemia is the typical clinical syndrome induced in cases of secondary hyperparathyroidism. The morbidity of secondary hyperparathyroidism is high in patients on maintenance hemodialysis. Many patients with chronic kidney disease develop elevated intact parathyroid hormone (iPTH) levels or secondary hyperparathyroidism, which further adds to their disease burden.<sup>1</sup> Secondary hyperparathyroidism results in imbalances in serum calcium and phosphorous level as well as alternations in vitamin D metabolism and can lead to renal osteodystrophy, fractures, cardiovascular disease, and even death. Accordingly, we tested the serum iPTH levels of 337 maintenance hemodialysis patients from hemodialysis centers. We then analyzed the cause of the parathyroid dysfunction and the calcium and phosphorous levels.

## Materials and methods

### *Patient selection and characteristics*

This cross-sectional study included patients with chronic renal disease who were undergoing maintenance hemodialysis treatment in Changchun, China, between March 2014 and August 2015. All patients had been on regular bicarbonate hemodialysis for >1 month, consisting of a polysulfone dialyzer membrane with a dialysis fluid of 3.0 mEq/L calcium. The patients received hemodialysis 3 times per week for 4 hours per episode. Hemofiltration was routinely received in some of the patients. A total of 337 adults from 4 hemodialysis centers in Changchun, China, were enrolled in this study. These centers were Jilin Province People's Hospital (147 subjects), Changchun Central Hospital (36 subjects), Changchun Nanguan District Hospital (118 subjects), and Jilin Xinhua Hospital (36 subjects).

### *Questionnaire and parameters*

All patients were asked to fill in the questionnaire by providing their name, gender, age, hemodialysis duration, calcium carbonate supplementation (Yes/No), active vitamin D3 (1- $\alpha$ -[OH]D3) supplementation (Yes/No), health education received (Yes/No), hemofiltration frequency, appetite (good/medium/poor), and education level (>9 years/ $\leq$ 9 years).

The most recent levels of the following biochemical indicators were obtained from the clinical information system: serum iPTH, phosphorus, total calcium, blood urea nitrogen (BUN), and creatinine (Cre). The blood samples were obtained before hemodialysis was started. The iPTH level (normal range, 14–72 pg/ml) was then tested using the electrochemical luminescence method. Serum BUN, Cre, calcium, and phosphorus levels were determined using an auto biochemistry analysis system.

### *Secondary hyperparathyroidism diagnosis*

The 2009 version of the Improving Global Outcomes (KDIGO) guidelines suggested an iPTH goal of 2–9 times the upper limit of normal (130–600 pg/ml).<sup>2</sup> According to the internal medicine textbook in China and guidelines and published data of other Asian countries,<sup>3–5</sup> we regarded the tangent point of iPTH level of >100 pg/ml.

Patients with iPTH data were divided into 2 groups: Normal group: patients with an iPTH level <100 pg/ml; and Abnormal group: the patients with an iPTH level >100 pg/ml.

### *Statistical analysis*

The data are summarized as mean  $\pm$  standard deviation (SD). Intergroup differences were analyzed by the *t*-test, while enumeration data were analyzed by the  $\chi^2$  test. For all comparisons, values of  $P < 0.05$  were considered statistically significant.

## Results

A total of 337 patients on maintenance hemodialysis were enrolled in this study. Among them, serum iPTH level was not monitored in 173 (51.3%) but monitored in 164 (48.7%) patients. Of the monitored patients, 28 (17.1%) had a normal serum iPTH level, while the other 136 (82.9%) had an abnormal level.

The patients in the Normal group (10 men, 18 women) were  $60 \pm 16$  years of age, while those in the

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