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# High prevalence of Secondary Hyperparathyroidism in Patients Under Regular Hemodialysis in Brack-Alshati General hospital

*Aisha Basheer Faddel, Mabroukah Mohamed Alzwayi and Nasser Mohamed Alaswaad

Department of Medical Laboratory Science, Faculty of Engineering & Technology, University of Sebha, Brak Al-shati, Libya

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**ABSTRACT**

Scondery Hyperparathyrodism is a common complication of chronic kidney disease . we estimated serum parathyroid hormone and some minerals in 46 patients undergo hemodialysis treatment in dialysis center at Brack Alshati General hospital, during September 2021 to October 2021. Before dialysis blood sample was collected for assessment of PTH level and minerals including calcium, phosphorus, sodium and potassium. mean age of the patients was 45.37±17.14 years. The mean concentration of PTH for the study group was 826.77 ± 646.86 pg/ml. The prevalence of secondary hyperparathyroidism (SHPT) among the Patients was 73.91%. We conclude that SHPT is high prevalent in our hemodialysis population and with serious outcomes for the health of patients. If it is poorly overcome, this imbalance can result in the bone disease, calcification of soft tissue and vascular calcification, all of these are found to be influential on mortality and morbidity.

# ارتفاع معدل فرط نشاط جارات الدرق الثانوي في المرضى الخاضعين للغسيل الكلوي المنتظم في مستشفى العام براك الشاطي

*عائشة بشير فضل و مبروكة محمد الزوي و ناصر محمد ابراهيم الأسود

المختبرات الطبية، كلية العلوم الهندسية والتقنية، جامعة سبها، ليبيا

**الكلمات المفتاحية:**
المتحولة الحالة للنسج
الصفر الخراطيني
تلوث
خضروات
ليبيا

**الملخص**

نشاط هرمون الغدة الجار درقية هو احد المضاعفات الشائعة لأمراض الكلى المزمنة .تضمنت هذه الدراسة تقدير مستوى هرمون الغدة الجار الدرقية وبعض المعادن لمصل 46 مريضا خاضعين لعلاج الغسيل الدموي في مركز الكلى بمستشفى العام براك الشاطئ ، خلال الفترة من سبتمبر 2021 إلى أكتوبر 2021 م. قبل عملية الغسيل الدموي تم جمع عينات الدم من المرضى لتقييم مستوى الهرمون الجار درقي والمعادن بما في ذلك الكالسيوم والفوسفور والصوديوم و البوتاسيوم،حيث كان متوسط عمر المرضى الذين شملتهم الدراسة هو 45.37 ± 17.14 سنة وكان متوسط تركيز هرمون PTH لهم 826.77 ± 646.86 بيكو جرام/ مل، بلغ معدل انتشار فرط نشاط جارات الدرقية الثانوي ( SHPT) بين المرضى هو 73.91٪، مع وجود انخفاض في تركيز الكالسيوم وارتفاع في تركيز الفسفور. . نستنتج بأن فرط نشاط الغدة الجار درقية الثانوي منتشر بشكل كبير في مجتمع غسيل الكلى لدينا وله نتائج خطيرة على صحة المرضى. إذ لم يتم التغلب عليه بشكل جيد، يمكن أن يؤدي هذا الخلل إلى أمراض العظام وتكلس الأنسجة الرخوة وتكلس الأوعية الدموية ، وكل هذه العوامل لها تأثير على نسبة الوفيات بين المرضى.

## Introduction:

chronic kidney disease (CKD) is a worldwide public health problem, affects between 8% and16% of the population worldwide and is often under recognized by patients and clinicians. It is defined by a glomerular filtration rate (GFR) of less than 60 mL/min/1.73 $m^2$, albuminuria of at least 30 mg per 24 hours, or markers of kidney damage (eg, hematuria or structural abnormalities such as polycystic or dysplastic kidneys) persisting for more than 3 months[1, 2]. CKD exhibits multiple endocrine and metabolic effects. One of the most common is on bone metabolism, causing CKD mineral bone disorder (CKD-MBD) and secondary hyperparathyroidism[3]. Mineral and bone disorders (MBDs) are associated with accelerated atherosclerosis, which is an important cause of cardiovascular death in long term dialysis patients, in patients with CKD. However, treatment of MBD improves the survival of patients on maintenance dialysis[4]. Secondary hyperparathyroidism (SHPT) is a common complication of (CKD) and has been linked to higher cardiovascular

*Corresponding author:
E-mail addresses: aesh.fadel@sebhau.edu.ly , (M. Alzwayi) m.alzwayi@wau.edu.ly , (N. Alaswaad) nas.alaasswad@sebhau.edu.ly
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morbidity and mortality in patients on maintenance hemodialysis[5]. It is an adaptive and, in many cases, ultimately maladaptive process that develops in response to declining kidney function, impaired phosphate excretion, and failure to bioactivate vitamin D. Dysregulation of calcium and phosphorous homeostasis leads to decreased renal phosphate excretion, increased serum phosphorous, and reduced synthesis of calcitriol, the active form of vitamin D. These changes result into increased synthesis and secretion of parathyroid hormone (PTH) and parathyroid hyperplasia [6, 7].

The earlier study found prevalence of SHPT in CKD patients was 55.2%, occur early and independently associated with hypocalcaemia, hyperphosphatemia and elevated alkaline phosphatise[8]. Study in Menoufia, Egypt found the prevalence of MBD among the heamodialysis patients was 85%depending on abnormal PTH levels (55% patients with high PTH level and 30% with low PTH )[9].

This study was designed to evaluate the prevalence of SHPT in hemodialysis patients in general hospital Brack Alshati, Libya and to investigate if there is any relation between concentration calcium and phosphorus in blood, dialysis duration, age and the prevalence of parathyroid disorders

**Material and Methods**

The study was carried out in Dialysis centre at Brack Alshati general hospital, from September 2021 to October 2021. Blood samples were collected from all the patients at the centre, whose were 46 patients (26 males and 20 females) undergo haemodialysis treatment. Demographic information (name, age, gender, duration of CKD and dialysis) were recorded for them. Their ages were arranged from 15 to 85 years. Serum samples were separated from blood cells by centrifugation at 3000 RPM for 10 minutes, and divided into two parts, one used for measurement of parathyroid hormone using iFlash Immunoassay Analyzer kit, the second one used for assessment of serum calcium and phosphorus by using Selectra pro M chemistry system and Sodium, potassium and chloride by using Automatic biochemistry analyser DRI-CHEM NX500 .

**Statistical Analysis**

Data analysis was conducted in statistical package for social sciences (SPSS) version 20.0. Means and standard Deviations were calculated for variables (age, duration of CKD, PTH level, calcium and phosphorus level. One sample t- test used to compare means and Person correlation to show the relation between variables.

**Results**

The results of this study show that the mean age of the study group was 45.37±17.14 years with the mean BMI was 23.75 ± 6.23 kg/m$^2$ and mean duration of CKD of study group was 3.3 ± 1.42 years. The mean concentration of PTH for the study group was 826.77 ± 646.86 pg/ml (mean ± SD) which was significantly higher than the mean level of the hormone for the kidney disease patients 150-450 pg/ml [10]. The prevalence of secondary hyperparathyroidism among the study group was 73.91%, , it is 80% in females and 61% in males.

The mean concentration of electrolytes (Na, Ca, Ph and Cl) in study group were respectively 137.26 ± 3.14 mmol/l, 9.01 ±1.2 mg/dl, 5.96 ± 2.40 mg/dl, 102.61 ± 3.82 mg/dl. One sample t test demonstrated significant difference between calcium and phosphorus level of the patients and normal level (p- value 0.034 and 0.00 respectively), as calcium was lower and phosphorus higher than the normal level, as shown in table (1).

**Table 1: Characteristic parameters of the study group.**

| Characteristics | Study Group (Mean ± SD) | p-value |
|---|---|---|
| Gender(M/F) | 26/20 | |
| Age (years) | 45.37 ± 17.14 | |
| Body Mass Index(kg/m²) | 23.73 ± 6.23 | |
| Duration of CKD (years) | 3.3 ± 1.42 | |
| Parathyroid hormone(pg/ml) | 826.77 ± 646.86 | 0.00 |
| Calcium(mg/dl) | 9.0 ± 1.22 | 0.034 |
| Phosphorus(mg/dl) | 5.96 ± 2.39 | 0.00 |
| Sodium(mmol/l) | 137.26 ± 3.14 | 0.00 |
| Potassium (mmol/l) | 5.15 ± 0.82 | 0.00 |
| Chloride(mmol/l) | 102.61 ± 3.82 | 0.28 |

Pearson correlation analysis was done to demonstrate the relation between calcium, phosphorus, duration of CKD and parathyroid hormone and demonstrated no statistically significant correlation between them as shown in table (2). On the other hand, a significant negatively correlation was found between PTH level and age (r=-0.369; p=0.012) as shown in fig (1).

**Table 2: Correlation between PTH and other parameters.**

| Variables | Parathyroid hormone | |
|---|---|---|
| | R | p |
| Age(years) | -0.369 | 0.012* |
| BMI(kg/m²) | -0.264 | 0.084 |
| Duration of hemdialysis(years) | -0.001 | 0.994 |
| Calcium(mg/dl) | -0.154 | 0.308 |
| Phosphorus (mg/dl) | -0.064 | 0.674 |
| Potassium (mmol/l) | 0.000 | 0.99 |
| Sodium (mmol/l) | 0.000 | 0.99 |
| Chloride (mmol/l) | -0.177 | 0.24 |

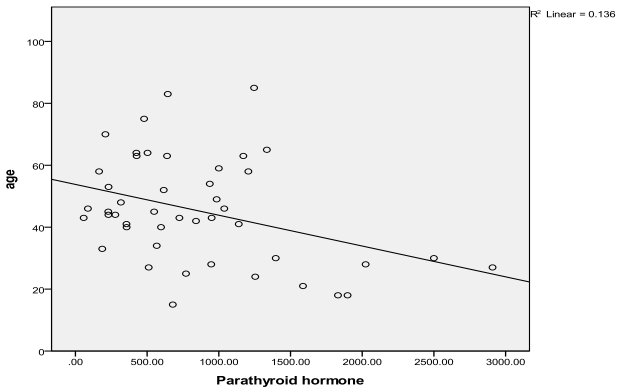


**fig .1**: Pearson correlation between parathyroid hormone and age.

In the present study, there were 26 males (56.52%), and 20 females (43.48%) shown in Figure (2), both genders exhibited similar pattern of PTH concentration and biochemical parameters, as the results demonstrated no difference between them using two sample t-test in all parameters, P- value was more than 0.05 as shown in table (3).

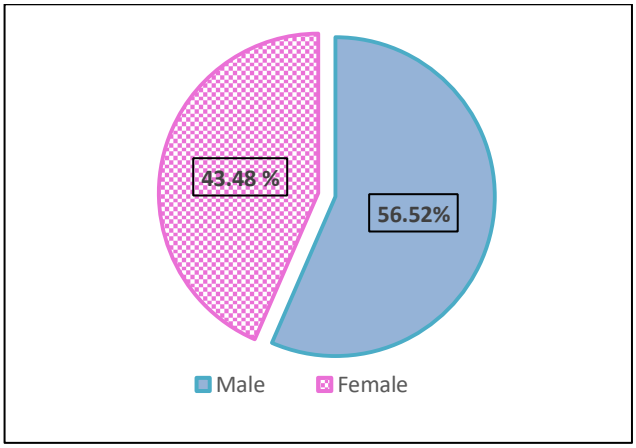


**Fig. 2** Distribution of patients according to gender

**Table 3: Characteristic parameters with respect to gender.**

| Variables | Female (20) | Male (26) | p- value |
|---|---|---|---|
| | Mean ± SD | | |
| Age | 42.7 ± 20.56 | 47.42 ± 14.07 | 0.36 |
| BMI (kg/m$^2$) | 23.41 ± 6.19 | 23.99 ± 6.38 | 0.76 |
| Parathyroid hormone(pg/ml) | 912.63 ± 534.46 | 795.44 ± 706.63 | 0.41 |
| Calcium (mg/dl) | 9.13 ± 1.42 | 8.91 ± 1.07 | 0.54 |
| Phosphorus (mg/dl) | 6.06 ± 1.88 | 5.89 ± 2.77 | 0.81 |
| Sodium (mmol/l) | 137.60 ± 3.50 | 137.0 ± 2.88 | 0.53 |
| Potassium (mmol/l) | 4.99 ± 0.79 | 5.28 ± 0.85 | 0.23 |
| Chloride (mmol/l) | 102.15 ± 4.01 | 102.96 ± 3.70 | 0.48 |

**Discussion**

In this study, the mean age of the studied population was 45.37 ± 17.14 years, with the common age group being the fourth decade. With male to female sex ratio was 1.3:1, sex ratio and age distribution were like other studies [11].

In our study, we found high prevalence of SHPT in haemodialysis patients with 73.91%.,which is similar to that of Owda et al., who reported a prevalence of 78% among CKD patients in the United States of America[12],and higher than the prevalence rate of 55% that was found by Hassan et al[9], and Mohamed et al who demonstrated the prevalence by 66 % [13] but this difference can be explained by the difference in the time on dialysis and the difference in the stages of CKD patients. SHPT is an important complication of CKD and is characterized by elevated blood PTH levels. SHPT develops in CKD as a consequence of abnormalities in several biochemical parameters, including increases in serum phosphorus and reductions in serum calcium and vitamin D [13], previous studies also suggested that vitamin D deficiency is the major cause of SHPT and is frequently observed in obese individuals [14]. In our study we found increase in phosphorus level and decrease in calcium compare with the normal level however; no correlation observed between PTH level with calcium and phosphorus levels, which not in agreement with results reported by Mahmoud, and Arora [13, 14]. Although Silver et al., reported small decreases in serum Calcium and more prolonged increases in serum phosphate they stimulate the parathyroid gland to secrete PTH [16].

In our study, we did not observe a significant correlation between PTH level with duration of haemodialysis. Our results are in agreement with results reported by Rahimian et al[17], but in disagreement with study of Owada how found strong relation between them [12],

In the present study we found no significant correlation between PTH level with sodium and potassium levels, which agreement with results reported by Owiredu et al[18]. On the other hand, we found a negative significant correlation between PTH level and age, these results agree with study conducted by Janno et al [19], but in disagreement with Rahimian et al how found no correlation between PTH and age. Some of differences in PTH measurements maybe due to secretion of two hormones from parathyroid gland; One of them stimulates bone turnover, while the other suppresses it [20]. Secondary hyperparathyroidism (SHPT) is a common complication of chronic kidney disease (CKD) and has been linked to higher cardiovascular morbidity and mortality in patients on maintenance hemodialysis[21]. With declining kidney function ,the production of PTH in the parathyroid increases ,leading to various clinical problems. One of the most serious clinical problems is cardiovascular disease (CVD) because it is a major cause of death in patients with CKD[22].

**Conclusion**

We conclude that secondary hyperparathyroidism is highly prevalent in our haemodialysis population and with serious outcomes for the health of patients. With reduction in calcium and increase in phosphorus level. If it is poorly overcome, this imbalance can result in the bone disease, calcification of soft tissue and vascular calcification, all of these are found to be influential on mortality and morbidity.

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