

ORIGINAL PAPER

Correlation Between Parathormon and Sexual Hormones in Patients on Haemodialysis

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Introduction: Chronic renal failure is associated with endocrine abnormalities, which in some cases cause polyendocrinopathy responsible for the symptoms and complications. The consequence of secondary hyperparathyroidism is not only bone disease but may be cardiovascular disorders, peripheral nerve damage and impact on the level of sex hormones. **The aim** of this study was to evaluate the interactions between parathyroid hormone and sexual hormones and the effect of elevated levels of parathyroid hormone secretion on various sexual hormones. The study included 72 patients who were undergoing chronic hemodialysis program 3 times a week at the Clinic for hemodialysis. Patients were divided into two groups according to parathyroid hormone values and child-bearing age. The study is a retrospective-prospective and lasted for 1 year. At the beginning, after 6 months, and at the end of the study were determined the PTH, FSH, LH, progesterone, testosterone, β -estradiol, prolactin. **Results:** During the study period followed are the values of sexual hormones and PTH in 72 patients of which 41 men and 31 women. Of these 33.3% (24) men were in the reproductive age, and 23.6% (17) were women in the reproductive age. The mean age of patients was 53.2 ± 12.16 , and the average duration of hemodialysis was 7.57 ± 4.0 . PTH showed a slight tendency to increase 274.45 ± 220.74 pg/dL at baseline, at the end of study 383 ± 313.2 also increased during the study was recorded and the values progesterone. Statistically significant effect of PTH showed the FSH $p < 0.01$ LH $p < 0.05$ and prolactin $p < 0.01$. On average, patients who have elevated PTH levels have lower values of FSH and LH, but higher prolactin values. Parathormone also shows the effect on β estradiol at level $p < 0.01$, patients with higher PTH values have lower levels of β estradiol. **Conclusion:** The increase in the number of younger people with terminal renal insufficiency treated by repeated hemodialysis, often have endocrine disorders and elevated PTH. Normalization of PTH levels affects the normalization of sexual hormone levels and improves quality of life of patients on hemodialysis. **Key words:** hemodialysis, parathormone, sexual hormone.

pecially important and are covered by the term bone osteodystrophy. Clinical signs of pronounced bone dystrophy are present in 45-50% of patients on hemodialysis and discrete signs exist in almost all renal osteodystrophy patients. The term includes changes of bone and other systems, and numerous endocrine changes in patients on chronic hemodialysis program. Within wide spectrum of morphological changes that indicate osteopathy, or there is this increased bone metabolism in hyperparathyroidism or its reduced metabolic activity in adynamic bone disease and basic histomorphological changes based on this division:

- Increased bone metabolism (high bone turnover);
- Decreased bone metabolism (low bone turnover);
- Mixed form of bone metabolism (mixed bone turnover).

Metabolic bone disease is one of the most common complications in chronic renal disease caused by the high value of parathyroid hormone, and a low calcium, high phosphorus and low levels of vitamin D (1). Block et al. observed that elevated levels of parathyroid hormone and high levels of phosphorus increases the risk of death (2). Kestenbaum and colleagues in their research have proven connection between parathyroid hormone, phosphorus, hormonal disorders with increased mortality rate among dialysis patients (3). Anemia that occurs in chronic renal disease is also an endocrine disorder as it occurs due to lack of synthesis of the erythropoietin hormone. In addi-

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1. INTRODUCTION

Chronic kidney disease causes disturbances of calcium, phosphorus, vitamin D and parathyroid hormone and the consequent development of bone osteodystrophy. Changes in bone mineral

metabolism occur early in the course of renal impairment and whose are the main factor in structural changes in the skeletal system of patients with end-stage disease. These changes are es-

tion, vascular changes as characteristic of uremic patients is more pronounced calcification in media, Mockenberg sclerosis with increased rigidity of blood vessels, reduced elasticity, ability of distension, divergent blood pressure and increased risk for cardiovascular disease which leads to arteriosclerosis (additively to remodeling due to anemia) (4) frequent complication in patients on hemodialysis are endocrine disorders. One of the most common endocrine disorders is a disorder of sexual hormones in this group of patients associated with elevated levels of parathyroid hormone (5). Increased concentration of prolactin is a most pronounced hormone disorder in terminal renal failure both in men and women. Bogicevic and colleagues registered hyperprolactemia in 52% of men and 80% of women on hemodialysis (6). Fioretti and colleagues in their study found ten-fold increase in concentration of this hormone in patients on hemodialysis (7). One of the most important agents for the prolactin secretion is PHT and consequential bone osteodystrophy. One study has shown a direct relationship between the injection of parathyroid extract which leads to a rapid increase in prolactin concentration in serum of healthy people and in patients with hyperparathyroidism there is an increased concentration of prolactin. Possible role of parathormone in causing sexual dysfunction suggests finding on the correlation between the degree of secondary hyperparathyroidism and the impotence of men and improvement of sexual function after reduction of the concentration of parathyroid hormone treatment with active vitamin D metabolite (8). The research of Greenberg and colleagues demonstrated an association between secretion of parathyroid hormone, estradiol and progesterone (9).

Our study included 72 patients for 1 year. The aim of this study was evaluation of the relationship between reproductive hormones and parathyroid hormone. In addition to these levels during the study were also followed CBC, age, sex, duration of survival on HD.

Large percentage of patients on HD has a number of endocrine disorders. The most common disorders of endocrine glands especially due to the in-

	Number of patients	Mean	Median	Std. deviation
Age	72	53.2	53	12.16
Hemodialysis duration (in years)	7.2	7.57	7	4

TABLE 1. Mean age and duration of hemodialysis (expressed in years)

creasing number of young people in fertile age who are on the definition of terminal renal failure is a disorder of reproductive hormone.

2. GOAL

The goal of this study was to evaluate the interactions between parathyroid hormone and sexual hormones and the effect of elevated levels of parathyroid hormone secretion of various sexual hormones.

3. MATERIAL AND METHODS

The study is of retrospective character and included 72 patients who were on chronic dialysis 3 times a week at the Clinic for hemodialysis. Patients were followed for 1 year. During periods of controlled studies of reproductive hormones are hormones and parathyroid hormone were performed 3 times (at baseline, after 6 months and at the end of study). The following data were recorded age, gender, duration of HD, the value of hormone (PTH, FSH, LH, β estradiol, progesterone, testosterone, and prolactin), blood count, phosphorus, calcium.

For data processing was used software package (SPSS) with which they calculate descriptive statistics, inferential statistical analysis, mixed mode and multivariate analysis of variance. From these analyzes were obtained variability within and between groups, F ratios and significance levels of p, with Pearson correlation coefficient.

The average age of patients was 53.2 ± 12.16 , and the average duration of hemodialysis was 7.57 ± 4.0 .

Patients were divided into two groups depending on the value of parathyroid hormone under 200 pg/ml, and the second group of PTH values over 200 pg/ml.

4. RESULTS

In recent years several studies were conducted which aimed to evaluate the

impact of sexual hormones (particularly PTH) associated with the metabolism of hormones on sexual function in patients with chronic renal failure. Into account should be taken specific populations and also topic that is processed. Our study involved 72 subjects with average life age of 53 years and the average duration of hemodialysis of 7.5 years (Table 1).

Table 2 and Figure 1 show the distribution of patients according to sex within baseline (72) from which 41 was male, or 56.9%, and 31 females or 43.1%.

Overall sample size is $N=72$

	No. of patients	Percent (%)
Male	41	56.9
Female	31	43.1
Total	72	100

TABLE 2. Distribution of patients by sex

In the survey we classify patients according to fertile age so there was 24 (33.3%) males younger than 50 years of age, and 17 (23.6%) over 50 years of age, while 17 (23.6%) patients were in the category of fertile individuals, and 14 (19.4%) were not included in the category of fertile (Table 3, Figure 2).

Category	Frequency	%
Males under 50 years	24	33.3
Males over 50 years	17	23.6
Women in fertile age	17	23.6
Women outside category of fertile age	14	19.4
Persons in fertile age (Total)	31	43.1
Persons not in fertile age (Total)	41	56.9
Total	72	100

TABLE 3. Distribution of patients according to the fertile age

One of the main characteristics of long-term treatment of terminal renal insufficiency by repeated dialysis is the development of bone osteodystrophy and changes in the values of parathyroid hormone (10, 11). Elevated concentrations of prolactin are one of most pronounced hormonal disorders in end stage renal disease. Our study showed a correlation between PTH and prolactin. By analyzing obtained data of our study reveals a positive correlation between

Sample N=72		Period for data collection		
Sexual hormones	Parathormone	At the beginning of therapy	6 month after begging of therapy	12 months after beginning of therapy
Follicle stimulating hormone	<200	73.43±117.57	56.9±73.7	59.94±73.86
Luteinizing hormone	<200	55.24±69.34	49.5±61.2	50.64±51.56
B-estradiol	<200	256.57±384.31	179.3±112.7	218.72±175.58
Progesterone	<200	6.91±6.61	8.36±6.2	9.15±9.72
Prolactin	<200	450.6±245.3	585.75±615.2	380.6±208.47
Testosterone	<200	8.5±7.6	8.33±7.42	8.77±8.82

TABLE 4. Mean values of hormones during the tests according to the value of parathormone

Sample N=72		Period for data collection		
Sexual hormones	Parathormone	At the beginning of therapy	6 month after begging of therapy	12 months after beginning of therapy
Follicle stimulating hormone	>200	35.77±56.73	42.7±62.7	52.6±6.9
Luteinizing hormone	>200	39.52±56.47	42.41±56.41	44.62±57
B-estradiol	>200	244.44±320.83	232.63±225.87	193.9±94.34
Progesterone	>200	7.1±4.84	7.56±4.81	14.97±33.24
Prolactin	>200	1222.47±1812	1118.51±1517.9	1029.39±1174.4
Testosterone	>200	10.71±7.08	8.33±7.42 10.1±7.3	8.77±8.82 9.57±7.23

TABLE 5. Mean values of hormones during the tests according to the value of parathormone

PTH and prolactin (Table 4). Table 4 shows that PTH has a significant relationship to the level of prolactin at the level of specificity of $p < 0.01$. FSH is another reproductive hormone which has great influence on hemodialysis treatment, and in addition to hemodialysis its values are affected by the value of parathyroid hormone. From Table 4 is statistically visible specificity between parathyroid hormone and FSH. LH was also covered by our study and has been proven its interaction with PTH values (Table 4). (From the table it is evident that PTH has a significant effect on the levels of FSH, LH and prolactin ($p < 0.01$))

Based on the results of the final table multivariate analysis for an initial period of therapy can be concluded

Factor levels of parathyroid hormone showed a significant effect on the following hormones:

- FSH with statistical significance of $p < 0.01$;
- LH with statistical significance of $p < 0.05$;
- Prolactin $p < 0.01$

5. DISCUSSION

Patients undergoing chronic hemodialysis are a risk group for endocrine disorders. Since during recent years there is increased number of younger patients on hemodialysis in reproductive age in particular, there is very com-

plex problem of sexual hormone disorder among other endocrine disorders. One of the most important endocrine disorders is PTH, which is often elevated in long-term treatment with intermittent hemodialysis, and its importance is very great with the other hormones and is also called "uremic toxin" especially emphasizes its relationship with prolactin (12, 13, 14). The results of our study suggest that long-term patients on chronic hemodialysis program comes in a large percentage to the development of secondary hyperparathyroidism, as a result of these hyperfunctioning of parathyroid glands leads to the increase in the value of certain reproductive hormone.

Numerous studies have examined the effect of PTH on other hormones. The strong effect in terms of stimulation of prolactin secretion during infusion of PTH in healthy men was evaluated in the study by Roland et al.

The study by Raymond et al. demonstrated the association of parathyroid hormone and prolactin secretion.

Bogicevic and Stefanovic in their study showed a positive correlation between serum prolactin and PTH. We performed a study in a significant percentage of the healthy volunteers which included a total of 15 subjects (8 men and 7 women) who received the infusion of parathyroid hormone

while their previous findings of prolactin were in reference values, a half-hour after infusion there was increase in PTH values and a maximum value reached 2–6 hours after application, which has shown a link between the secretion of parathyroid hormone and prolactin (15).

Our study confirmed the correlation between PTH and prolactin in patients undergoing chronic hemodialysis who had a value of PTH at level of secondary hyperparathyroidism and with elevated levels of prolactin. Suppressive effect PTH has on secretion of testosterone (16). Possible role of PTH in causing sexual dysfunction suggests finding the correlation between the degree of secondary hyperparathyroidism and impotence in men (17) and improvement of sexual function after reduction of its concentration. PTH treatment with an active metabolite of vitamin D in combination with Ca mimetics (18).

Some studies have shown that elevated levels of prolactin leads to inhibition increase in FSH and LH and in another was found reduction in concentrations of FSH, LH and testosterone with increased concentration of prolactin (19, 20). In our study we found similar results, patients with increased prolactin concentrations had lower values of FSH and LH.

Our research has shown a positive correlation between PTH and testosterone, patients who had elevated PTH concentrations also had decreased levels of testosterone.

6. CONCLUSION

Increase in the number of young people on chronic hemodialysis program gives special significance for the common endocrine disorders and elevated parathyroid hormone (bone osteodystrophy) in this population. Value of PTH is in positive correlation with prolactin. PTH has influence on level of LH. Value of FSH also is on correlation with PTH. Level of progesterone doesn't show as correlation with level of PTH. Value of PTA doesn't have influence on level of testosterone. Normalization of the level of parathyroid hormone values or prevent the development of bone osteodystrophy with all its consequences on the cardiac, hemato-

logic, and endocrine system of patients, or if these measures were not successful to parathyroidectomy. Elevated PTH levels have a direct connection with the development of anemia in patients on chronic hemodialysis. With increasing values of PTH and an increase in the value of sexual hormones in hemodialysis patients.

Normalization of PTH levels is a prerequisite for the prevention of anemia and the consequent development of heart failure as well as for baseline sex hormone patients on chronic hemodialysis.

Conflict of interest: none declared.

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