

CORRELATIONS BETWEEN THE LEVEL OF THE PARATHYROID HORMONE AND THE RADIOLOGICAL BONE CHANGES IN CHRONIC HAEMODIALYSIS PATIENTS

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Abstract: Renal dialysis is a procedure that is applied to people who lost a kidney, have kidney problems due to birth defects, or who have chronic renal failure. Osteodystrophy caused by secondary hyperparathyroidism in chronic renal failure is a clinical anatomical form of renal bone disease. It derives from the alteration of various mediators of bone metabolism, which in physiological conditions ensure and maintain the ratio of bone remodelling, reabsorption of already formed trabeculae and mineralization of new ones, the so-called „bone turnover”. Impairing of calcium phosphorus balance, of vitamin D metabolism and parathyroid function, together with changes in the skeleton, is one of the constant manifestations of uraemia. Plasma parathyroid hormone level is a good index of bone remodelling. The criterion for assessing the severity of renal osteodystrophy is the measurement of biochemical markers of bone turn-over: PTH, serum calcium, phosphate, alkaline phosphatase, osteocalcin.

Keywords: parathyroid hormone, renal osteodystrophy, radiological changes, chronic hemodialysis patients

Rezumat: Dializa renală este o procedură care se acordă persoanelor care au pierdut un rinichi, au probleme de rinichi din cauza malformațiilor congenitale, sau care au insuficiență renală cronică. Osteodistrofia renală determinată de hiperparatiroidismul secundar din insuficiența renală cronică reprezintă o formă anatomo-clinică a bolii osoase renale. Derivă din alterarea diversilor mediatori ai metabolismului osos, care în condiții fiziologice asigură remodelarea osului și păstrează raportul dintre rezorbția trabeculelor gata formate și mineralizarea trabeculelor noi, așa numitul „turnover osos”. Afectarea echilibrului fosfo-calcic, a metabolismului vitaminei D, a funcției paratiroidiene, concomitent cu modificări ale scheletului, reprezintă una din manifestările constante ale urmiei. Nivelul plasmatic al parathormonului este un bun index al remodelării osoase. Criteriul de apreciere al severității osteodistrofiei renale îl reprezintă măsurarea marker-ilor biochimici ai turn-over-ului osos: PTH, calcemia, fosfatemia, fosfataza alcalină, osteocalcina.

Cuvinte cheie: parathormon, osteodistrofie renală, modificări radiologice, pacienți hemodializați cronic

INTRODUCTION

Renal dialysis is a procedure that is applied to people who lost a kidney, have kidney problems due to birth defects, or who have chronic renal failure. Osteodystrophy caused by secondary hyperparathyroidism in chronic renal failure is a clinical anatomical form of renal bone disease.

PURPOSE OF THE STUDY

The aim of this study was to highlight and find the main pathological bone changes that occur in hemodialysis patients.

MATERIAL AND METHOD

The study of bone lesions developed in patients with chronic renal failure was prospectively randomized to a group of 45 patients integrated into the dialysis programme - haemodialysis in the department of nephrology of Sibiu County Hospital during the period between 2002-2008. Radiographs were made usually targeted to areas of pain and where there were no painful symptoms pelvic AP radiographs (radiographic film 30/40) where performed and bilateral comparative hands AP radiographs (radiographic film 24/30) . Biochemical parameters were studied in dynamics: blood parathyroid hormone level, seric calcium, phosphate, FAS. The evaluation which was made consisted in correlation of biochemical parameters of bone turn-over.(PTH, serum calcium, phosphate, FAS) with occurred radiological bone modifications.

RESULTS AND DISCUSSION

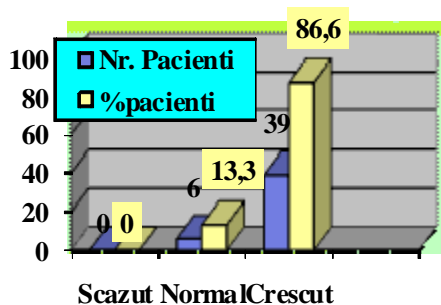
The main types of found bone lesions and lesions associated with them were:

- diffuse bone demineralization
- endostal erosions especially in the proximal and middle phalanges of the hands
- subperiostale erosion especially in the ischiopubic areas
- osteolytic-like lesions with values below and above 5 mm (bone cysts)
- calcification in the soft parts (periarticular)
- osteocondensations (rarely)
- artery calcifications (medicocalcosis)

CLINICAL ASPECTS

- compact fascicularisation
- spontaneous fractures.

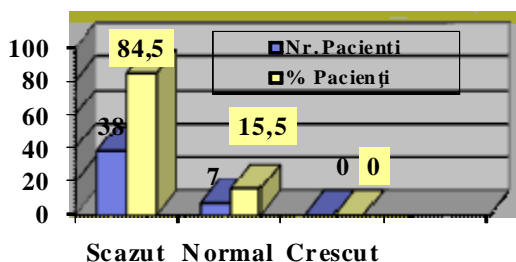
Picture no. 1. Percentage distribution of the number of patients according to PTH levels



In the studied group, 39 patients representing 86.6% had high levels of parathyroid hormone blood plasma. The cause of parathyroid hormone hypersecretion- is represented by hypocalcaemia induced in the following causes:

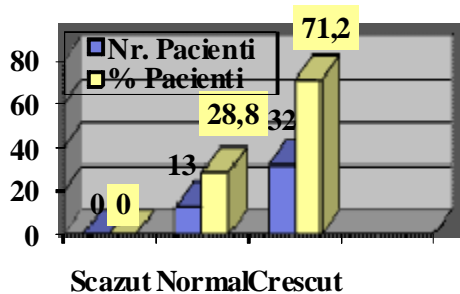
- reduced elimination of phosphates with secondary hyperphosphatemia
- reduced synthesis of active vitamin D form (1,25 (OH) 2D3
- increased skeletal resistance to parathyroid hormone effect

Picture no. 2. Percentage distribution of the number of patients according to total serum calcium values



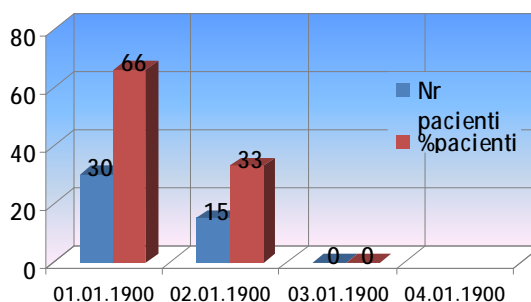
The situation is similar in patients who presented hypocalcaemia ,84.5%, the percentage being considerably close to the one in which patients had high levels of plasmatic parathyroid hormone.

Picture no.3. Percentage distribution of the number of patients according to phosphatemia values



We note that 71.2% of patients included in the study had hyperphosphatemia. Increased serum phosphate is due to reduction in the glomerular filtrate rate below 25ml/min. It is known that an increase of phosphatemia leads to transient lowering of seric calcium ion and, secondary to increased secretion of parathyroid hormone.

Picture no. 4. Percentage distribution of the number of patients based on alkaline phosphatase levels



Most patients (66%) had high levels of alkaline phosphatase. Alkaline phosphatase measures activity of osteoblasts and it is usually increased in fibrous osteitis, osteomalacia and mixed lesions. The highest values are found in fibrous osteitis but it is useful to note that normal levels of alkaline phosphatase do not exclude renal osteopathy.

Table no. 1. Percentage distribution of bone and osteoarticular lesions according to values of seric PTH (pg / ml)

Type of lesion	<70 pg/ml	70 – 250 pg/ml	250 – 450 pg/ml	450 – 1000 pg/ml	>1000 pg/ml
bone demineralization	60%	80%	100%	100%	100%
Endosteal erosion	91%	95%	90%	77%	92%
subperiostale erosions	85%	90%	60%	77%	66%
Osteolisis (<5mm)	16%	12,5%	30%	44%	33%
Osteolisis (>5mm)	33%	-	-	33%	33%
soft parts calcifications	5%	12%	15%	22%	16%
Fractures	-	12%	10%	11%	-
Scoliosis	16%	-	10%	11%	16%
Osteoarticular lesions	-	25%	40%	33%	41%
Osteolisis of distal phalanges	33%	12,5%	-	-	-
Mediocalcosis	50%	87,5%	10%	33%	16%
Osteocondensations	50%	12,5%	40%	11%	16%

CONCLUSIONS

- Most patients have bone demineralization, however, we note that starting with values above 450 pg / ml of serum parathyroid hormone (high bone turnover), virtually all patients develop osteoporosis. Radiological changes are subjective and are difficult to identify and quantify through visual interpretation of radiographs, because it becomes visible when the

CLINICAL ASPECTS

- loss of bone mineral matrix reaches values of 30-50%. Quantitative and more accurate assessments can be made by bone osteodensitometry.
- Endostal erosion occurs in a large number of patients, approximately equal to the patients with subperiosteal erosions. Normally, peripheral edges of the bone are smooth; in hyperparathyroidism with subperiosteal resorption fine irregularities are observed along the external edge, similar to lace.
 - Osteolysis of distal phalanges usually occurs after 11 to 13 years of haemodialysis with normal or slightly elevated PTH levels.
 - Vascular calcifications (medicocalcosis) and soft parts calcifications are an indication of osteoarticular beta2microglobuline pathology, correlated with brown tumors and with the presence of geode. We encountered medicocalcosis in 1 / 3 of patients included in the study with a peak within 60 to 250 pg / ml.
 - I found bone osteocondensations in a higher percentage in patients with normal levels of PTH (50%)
 - Pathological fractures (the most dangerous complication for chronic hemodialysis patients) were found in 10-12% of patients with parathyroid hormone values between 70-1000 pg/ml
 - Small areas of osteolysis develop gradually in a directly proportional fraction to the level of PTH
 - Large areas of osteolysis appear above values of 450 pg / ml.
 - Bone deformations (scoliosis) specific to lesions like osteomalacia were seen in 10-16% of patients regardless of serum parathyroid hormone levels, except between 70 and 250 pg/ml
 - Osteoarticular lesions were found in varying proportions between 25-41% starting with levels of parathyroid hormone above 70 pg / ml
 - It would have been useful to undertake bone biopsy studies but it was not possible, nor have it been insisted on this method because of its invasiveness, under-equipped clinical laboratories, lack of some reagents and appropriate equipment.
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