RHEUMATOLOGY RESEARCH JOURNAL

Vol. 1, No. 1, October 2016, 23-26
Webpage: http://rheumres.org
Email: editor@rheumres.org
ISSN: 2476-5856
doi: 10.22631/rr.2016.40687

Research Article **Open Access**

Musculuskeletal system involvement in hemodialysis patients

Mohammadhassan Jokar[1*] and Farzan Adle[2]

[1]Internal Medicine Ward, Imam Reza Hospital, Mashhad, Iran; [2]Khatam Al-Anbia Hospital, Zahedan University of Medical Sciences, Zahedan, Iran

Musculoskeletal problems remain among the main limitations of the quality of life of patients undergoing hemodialysis. This study was designed to evaluate the musculoskeletal system involvement in hemodialysis patients. This study was carried out on the all of the hemodialysis patients of Khatam-al Anbia Hospital, Zahedan, Iran. All patients underwent a precide physical examination. Venous blood samples were obtained for the measurement of calcium, phosphorous, alkaline phosphatase, and parathyroid hormone. An x-ray of the hand was taken from each patient. Thirty seven (37) patients completed the study. The most common symptoms were: carpopedal spasm 54.0%, symptoms of carpal tunnel syndrome 24.2%, arthralgia 21.6%, and bone pain 13.5%. The most common clinical findings were: a positive Phalen test 32.4%, muscle weakness 40.5%, bone deformity 21.6%, and bone tenderness 18.9%. The most common abnormal laboratory tests were: hypocalcemia 51.4%, hyperphosphatemia 43.2%, increased alkaline phosphatase 75.6%, and raised Parathyroid hormone 81.0%. Musculoskeletal involvement is common in our hemodialysis patients.

Keywords: hemodialysis, musculoskeletal, renal failure.

Introduction

Musculoskeletal problems are still one of the important determinants of the life quality in patients with chronic renal failure (CRF), especially in patients undergoing hemodialysis treatment [1,2]. Renal osteodystrophy was first applied by Liu and Chu [3] in 1943. Renal osteodystrophy is a term that covers a complex of musculoskeletal disorders in CRF. Hemodialysis first came about in the 1960s and after a short time its skeletal complications were defined. Around this time, Caner and Decker reported that 5 out of 6 patients who were undergoing hemodialysis in Seattle suffer from arthritis and periarthritis [4]. In later years these rheumatologic problems related to the sedimentation of apatite crystals. In the years following that, as a result of more effective treatment of hyperphosphatemia, the amount of inflammatory paroxysms in joints declined.

In 1975, carpal tunnel syndrome (CTS) was reported as one of the complications of hemodialysis and in 1980, Assent et al. found that amyloidosis is one of the common causes of the musculoskeletal system's involvement in patients undergoing hemodialysis [5]. In the early 1980s, chronic arthropathies (which was first considered due to hyperparathyroidism) in hemodialysis patients were interpreted and in the years that followed, it was found that such arthropathies were a result of amyloidosis. In 1985 Geiyo et al. [6] recognized β2 microglobulin in amyloidosis as a result of hemodialysis. In 2005, the Kidney Disease: Improving Global Outcomes (KDIGO) organization suggested new terminology containing the wide range of clinical syndrome-chronic kidney disease mineral and bone-related disorders (CKDMBD) [7]. Having considered the importance of musculoskeletal problems in hemodialysis patients, and with the absence of related studies in Iran, this study was designed to investigate the involvement of the musculoskeletal system in hemodialysis patients.

Materials and Methods

In this descriptive cross-sectional study, all patients with CRF who were undergoing hemodialysis in Khatam-al Anbiya Hospital, Zahedan, Iran were enrolled the study. All patients who had any musculoskeletal disorders before renal involvement were excluded. A detailed history was taken from all of the patients and they underwent a complete musculoskeletal examination by a rheumatologist.

* Corresponding Author: Mohammadhassan Jokar, Email: jokarmh@mums.ac.ir, Tel: +98 9155178351, Fax: +98 511 8598818
Received: 14 June 2016; **Accepted:** 16 September 2016

Blood samples were obtained before hemodialysis to measure calcium, phosphorus, alkaline phosphatase and parathyroid hormone (PTH). Radiography was carried out on the hand and other symptomatic parts of the body. After data gathering, based on the paraclinic data, patients were re-examined whenever it was necessary. This study was approved by the institutional ethics committee. Written consent from all patients was obtained before their entry into the study.

Statistical analysis

Results were reported as mean ± standard deviation (SD) for quantitative variables and percentages for categorical variables. The groups were compared using the Student's t-test for continuous variables and the chi-square test for categorical variables. Statistical significance was based on two-sided design-based tests where 0.05 was considered to be statistically significant. All of the statistical analysis was performed using SPSS version 16 (SPSS Inc, Chicago, IL, USA) for Windows.

Results

A total number of 43 patients were selected for the study. After the exclusion of 3 patients because of death and 3 further patients because of renal transplants, 37 remained in the study. Among them, 20 patients (54.0%) were female and 17 (45.9%) were male. Ages ranged between 13 and 70 years. Hemodialysis duration ranged between 1 month and 14 years (mean: 2.6 ± 3.1 years). The most common age group was those in their thirties, which consisted of 12 patients (32.4%) (Fig. 1). The causes of CRF were: hypertension in 9 patients (24.3%), glomerulonephritis in 8 patients (21.6%), diabetes in 5 patients (13.5%), pregnancy and labor complications in 4 patients (10.8%), and analgesic nephropathy in 1 patient (2.7%). In 10 patients (27.0%), the causes of renal failure were not detected.

Musculoskeletal symptoms were carpopedal spasm in 20 (54.0%) cases, CTS symptoms (pain or paresthesia in a distribution that includes the median nerve territory) in 9 cases (24.2%), joint pain in 8 cases (21.6%), and bone pain in 5 cases (13.5%).

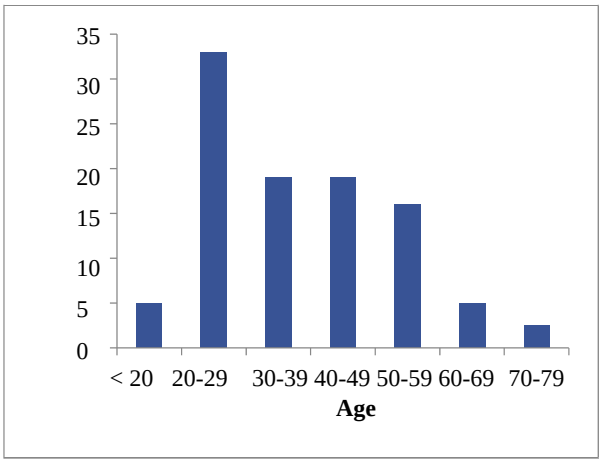

Fig. 1. Age distribution of patients

Clinical findings in musculoskeletal examinations were muscle weakness in 15 cases (40.5%), a positive Phalen test in 12 cases (32.4%), bone deformity in 8 cases (21.6%), bone tenderness in 7 cases (18.9%), and walking dysfunction in 3 cases (8.1%).

Laboratory findings

Calcium: the mean serum level was 8.4 ± 1.8 mg/dl (range: 5.9-12.7 mg/dl). In 19 cases (51.4%) there was hypocalcemia (Ca < 8 mg/dl).

Phosphorus: the mean serum level was 5.3 ± 2.2 mg/dl (range: 2.3-11.2 mg/dl). In 16 cases (43.2%) hyperphosphatemia (P > 5.5 mg/dl) was seen.

Alkaline phosphatase: the mean level was 758±1414 IU/l (3 times more than upper limit of the normal range: 103-7520 IU/l). In 28 cases (75.6%) the level was above reported in 9% to 34% of patients [13]. Another radiologic the norm) (range: 100-270 IU).

Parathormone: the mean value was 510 ± 448 Pg/ml (10 times more than higher limit of the norm) (range: 15.8-1522 Pg/ml). In 30 patients (81.0%), value was above than normal range (9-55Pg). The serum levels of calcium, phosphorus, alkaline phosphatase and PTH were compared in two groups with without muscle weakness and summarized in Table 1.

Table 1. Comparison of serum levels of calcium, phosphorus, alkaline phosphatase, parathyroid hormone and hemodialysis duration in two groups

Variables	With muscle weakness	Without muscle weakness	P value
Serum Calcium (mg/dl)	8.7 ± 1.6	8.3 ± 2	0.583
Serum Phosphorus (mg/dl)	4.8 ± 1.9	5.6 ± 2.3	0.342
Alkaline phosphatase (IU/l)	1018 ± 2049	527 ± 326	0.352
Parathyroid hormone (pg/ml)	434 ± 418	575 ± 477	0.40
Hemodialysis duration(years)	4.2 ± 4	1.5 ± 1.8	0.009

Radiography: in 28 patients (75.6%) the imaging of the hand was abnormal. The most important findings were: osteopenia in 16 cases (43.2%), subperiosteal bone resorption in 13 cases (35.1%), calcification of the vessels 2 cases (5.4.0%) and osteosclerosis 1 case (2.7%).

Discussion

In patients undergoing hemodialysis, all parts of the musculoskeletal system (bone, joint, muscle, tendon and bursa) may be involved. A change in metabolism of minerals and bone structure is seen in all CRF patients [8].

In 2005, the Kidney Disease: Improving Global Outcomes (KDIGO) organization suggested new terminology containing the wide range of clinical syndrome-chronic kidney disease mineral and bone-related disorders (CKDMBD) [7]. CKDMBD often is asymptomatic, and symptoms appear late. Many of the symptoms are nonspecific. The most common symptoms are: bone pain and predisposition to fracture, arthralgia, spontaneous tendon rupture, and proximal muscle weakness [7, 9]. In our study, bone pain and tenderness were seen in 13.5% and 18.9% of the patients, however, of osteodystrophy [10]. We did not perform a bone biopsy in inexistence of bone symptoms is not a sign of inexistence any patients for the determination of frequency and types of bone involvement, but we did perform radiography on all the patients. In 24 cases (75.6%) bone radiography was abnormal. Subperiosteal bone resorption is one of the most common findings in imaging and has been reported at rates of 6%-66% in various studies [11, 12]. Inour study, there was subperiosteal resorption in 35% of the patients. Osteosclerosis was detected in only one case 2.7%), while in other studies osteosclerosis has been reported in 9% to 34% of patients [13]. Another radiologic (the prevalence of which has been reported from 0% to finding in the patients with osteodystrophy is osteopenia, 83% [14]. In our study, osteopenia was seen in 43.2% of the patients. Soft tissue and vessel calcification were its found in 8.1% of our patients, while its prevalence has been reported between 0% and 52% in various studies [14].

More than 70% of hemodialysis patients have and rheumatologic symptoms. The frequency of rheumatologic symptoms increases with the dialysis years [14]. Beta2 microglobulin is a protein structural unit of amyloidosis and is as a result of prolonged hemodialysis. Most of the patients with this kind of amyloidosis had been under in hemodialysis for several years. Prevalence of this kind of amyloidosis increases with hemodialysis duration. The most important symptoms of β2 microglobulin amyloidosis are: shoulder pads, CTS, flexion contracture of the fingers, destructive spondyloarthropathy, bone cysts, and pathologic bone fractures 1. Symptoms of CTS were found in 24.3% of our patients and the Phalen test was positive in 32.4% of them. The prevalence of CTS increases with dialysis duration (2%-31%) [14], however, this syndrome may be a sign of β2 microglobulin amyloidosis in our patients. Shoulder pads and other musculoskeletal symptoms of amyloidosis (except CTS) were not found in any of this study's patients. Perhaps this is because of short duration (about 2.6 years) of hemodialysis in most of our cases (only one of our patients had been undergoing hemodialysis for more than 10 years).

All kinds of crystal arthropathies (calcium pyrophosphate, sodium monourate, calcium hydroxyapatite and calcium oxalate) may be seen in these patients. Clinical features of these crystals are mostly the same and synovial fluid puncture and investigation for the crystal is necessary for their differentiation [1]. However, joint pain was one of the most common musculoskeletal complaints in our patients, no patient with symptomatic crystal arthritis was detected. Patients did not declare any arthritis in their history.

Septic arthritis and bursitis are somewhat frequent among hemodialysis patients who received needle sessions in their arteriovenous fistula. The most common organism is Staphylococcus aureus [12]. We did not find any patient with septic arthritis (since renal failure to the time of the study).

The prevalence of osteonecrosis increases in hemodialysis patients compared to the healthy individuals and its most common site is the head of the Femur [12]. We could not detect anything for osteonecrosis in patients` history or the physical examinations.

Some of the tendons can be ruptured spontaneously in patients with CRF. Olecranon bursitis is one of the common types of bursitis in these patients [12]. At the time of our study and in the history of the patients, there was no evidence of these disorders.

CRF patients under hemodialysis may have generalized muscle weakness. Type 2 fibers atrophy is a dominant histological feature in the biopsy. Various causes that can lead to muscle weakness in these patients are: peripheral neuropathy, abnormal vitamin D metabolism, hyperparathyroidism, carnitine

deficiency, aluminum intoxication, hypo and hyperkalemia, acidosis, iron overload, and severe hypophosphatemia 1. In our study there was muscle weakness in 15 cases (40.5%). This weakness ranged from mild weakness, which was only detectable by examination, to total immobility. There was no statistically significant difference between the two groups with and without muscle weakness for serum levels of calcium, phosphorus, alkaline phosphatase, and PTH. However, the duration of hemodialysis was greater in the group with muscle weakness, and this difference was statistically significant (P= 0.009). The main limitation of our study was the small number of patients studied. The other limitations were: not doing carrying out a bone biopsy, not carrying out bone densitometry, and the short duration of the hemodialysis.

The musculoskeletal system involvement is still common in our hemodialysis patients and required more attention in its prevention and treatment by the physicians.

Conflict of interests

Authors have no conflict of interests.

Acknowledgment

The authors would like to respectfully thank the vice-chancellor of research at Zahedan University of Medical Sciences for the financial support.

References

1. El-Najjar AR, Amar HA, El wahab Selim HA, El sherbiny EM, Ibrahem M, Fouad M. Musculoskeletal disorders in hemodialysis patients and its impact on physical function. ***Egypt Rheumatol Rehabil*** 2014; 41:152-9. doi: 10.4103/ 1110-161x.147356.
2. Fidan F, Alkan BM, Tousun A, Altunoglu A, Ardicoglu O. Quality of life and correlation with musculoskeletal problems, hand disability and depression in patients with hemodialysis, ***International Journal of Rheumatic Diseases***, 2013; doi: 10.1111/1756- 185X.12171.
3. Liu SH, Chu HI. Studies of calcium and phosphorus metabolism with special reference to pathogenesis and effects of dihydrotachysterol (AT10) and iron. ***Medicine*** 1943; 22: 103-61. doi: 10.1097/00005792-194305000-00002.
4. Caner JEZ, Decker JL. Recurrent acute arthritis in chronic renal failure treated with periodic hemodialysis. ***Am J Med*** 1964; 36: 571-82. doi: 10.1016/0002-9343(64)90105-6.
5. Assenat H, Calemard E, Charra B, Laurent G, Terrat JC, Vanel T. Hemodialyse. Syndrome du canal carpien et substance amyloide. ***Nouv. Presse méd***. 1980; 9:1715.
6. Gejyo F, Yamada T, Odani S, Nakagawa Y, Arakawa M, Kunitomo T, Kataoka H, Suzuki M, Hirasawa Y, Shirahama T, Cohen AS, Schmid K. A new form of amyloid protein associated with hemodialysis was identified as β2-microglobulin. ***Biochem. Biophys. Res. Commun*** 1985; 129: 701-706. doi: 10.1016/0006-291x(85)91948-5.
7. Moe S, Drueke T, Cunningham J, et al. Definition, evaluation, and classification of renal osteodystrophy: a position statement from Kidney Disease: Improving Global Outcomes (KDIGO). ***Kidney Int*** 2006; 69: 1945e53. doi: 10.1038/sj.ki. 5000414.
8. Martin KJ, Gonzalez EA. Metabolic bone disease in chronic kidney disease. ***J Am Soc Nephrol*** 2007; 18: 875-85. doi: 10.1681/asn.2006070771.
9. Bardin T. Musculoskeletal manifestations of chronic renal failure. ***Current Opinion in Rheumatology*** 2003; 15: 48-54. doi: 10.1097/00002281-200301000-00009.
10. Pham PC, Toscano E, Pham PM, Pham PA, Pham SV, Pham PT. Pain management in patients with chronic kidney disease. ***NDT Plus*** 2009 Apr; 2(2): 111-8. doi: 10.1093/ ndtplus/sfp001.
11. Hruska KA, Teitelbaum SL. Mechanisms of disease: Renal osteodystrophy. ***N Engl J Med*** 1995; 333: 166-74
12. Murphey M, Sartoris D, Quale J, Pathria M, Martin N. Musculoskeletal manifestation of chronic renal insufficiency. ***Radiographics*** 1993; 13: 357-379. doi: 10.1148/radiographics. 13.2.8460225.
13. Hsu HJ, Yen CH, Hsu KH, et al. Factors associated with chronic musculoskeletal pain in patients with chronic kidney disease. ***BMC Nephrology***. 2014; 15:6. doi: 10.1186/1471- 2369-15-6.
14. Lim CY, Ong KO. Various musculoskeletal manifestations of chronic renal insufficiency. ***Clinical Radiology*** 2013; 68: e397ee411. doi: 10.1016/j.crad. 2013.01.025.