

# MUSCULOSKELETAL ULTRASOUND ABNORMALITIES IN PATIENTS ON DIALYSIS, COMPARED TO PATIENTS WITH PRE-DIALYSIS STAGE CHRONIC KIDNEY DISEASE

Raluca-Daniela Decianu<sup>1</sup>, Mihai Bojinca<sup>2,4</sup>, Cristina Capusa<sup>3,4</sup>, Adrian Zugravu<sup>3,4</sup>,  
Violeta-Claudia Bojinca<sup>1,4</sup>

<sup>1</sup>Department of Internal Medicine and Rheumatology, Sf. Maria Clinical Hospital, Bucharest

<sup>2</sup>Department of Internal Medicine and Rheumatology, Ion Cantacuzino Clinical Hospital, Bucharest

<sup>3</sup>Department of Nephrology, Carol Davila Clinical Hospital, Bucharest

<sup>4</sup>Carol Davila University of Medicine and Pharmacy, Bucharest

## Abstract

**Background.** The musculoskeletal system is deeply involved in patients with CKD on dialysis. The studies that were done by now with regarding this subject mostly aimed the bone metabolism. So far, there is few data on the subject concerning the articular and abarticular abnormalities in dialysed patients(1).

**Objectives.** To identify the musculoskeletal soft tissue abnormalities associated to dialysis and to evaluate whether or not they are more frequent. Also, we set ourselves to point out the importance of detecting these anomalies early in the evolution, in order to preserve the joint function and the quality of life, in a category of patients already severely affected.

**Materials and methods.** This is a prospective study, ran on a period of 4 months. We included 55 patients ( 32 in the study group – on dialysis, 23 in the control group – late stage pre-dialysis chronic kidney disease). For each patient, we evaluated 68 joints using ultrasonography. Also, a visual analogue scale for pain was applied for each patient.

**Results.** The findings vary from median nerve entrapment and tendon calcifications, to usual degenerative abnormalities, synovitis and tenosynovitis. The type of abnormalities does not vary between the two groups, but the percent of the affected patients was much higher in the study group.

**Conclusions.** A great number of patients from the study group presented important articular and mostly abarticular abnormalities, sometimes with no correlation with the algofunctional symptoms.

**Keywords:** musculoskeletal abnormalities, ultrasonography, chronic kidney disease, dialysis

## Abbreviations

**CKD** – Chronic Kidney Disease

**CKD-MBD** – Chronic Kidney Disease-Mineral and Bone Disorder

**CRP** – C Reactive Proteine

**DIP** – Distal InterPhangeal

**ESR** – Erythrocyte Sedimentation Rate

**Ex** – example

**HD** – HemoDialysis

**MCP**–MetaCarpoPhalangeal

**MSK** – MusculoSkeletal

**MTP** - MetaTarsoPhalangeal

**N** – normal

**PD** – Peritoneal Dialysis

**PIP** – Proximal InterPhangeal

**PTH** – ParaTHormone

**RRT** – Renal Replacement Therapy

**US** –UltraSonography

**VAS**– Visual Analogue Scale

## INTRODUCTION

Late-stage CKD is one of the most frequent causes of morbidity and mortality worldwide, which leads to a great economic burden related to RRT (2). The higher the prevalence of CKD, the greater the importance of understanding the associated condi-

tions becomes, in order to personalize management approaches for this category of patients (1,2).

It is a known fact that patients with late stage CKD and all the more so, patients on dialysis, have some particularities regarding the MSK abnormalities, such as an increased frequency and/or an earlier debut, in comparison to the general population (3,4).

Correspondence address:

Raluca-Daniela Decianu, Department of Internal Medicine and Rheumatology, Sf. Maria Clinical Hospital, Bucharest

E-mail: ralucaecianu@gmail.com

## MATERIALS AND METHODS

### Study design

We elaborated a prospective study on 55 patients. On each patient was performed musculoskeletal ultrasonography, evaluating 68 joints, in two perpendicular planes. For the upper limb, the evaluated joints were: shoulder, elbow, wrist, MCP I-V, PIP I-V, DIP II-V, bilateral. For the lower limb, the evaluated joints were: hip, knee, ankle, MTP I-V, PIP I-V, DIP II-V, also bilateral.

All evaluations have been made by the same ultrasonographer, so there would be no inter-observer variations.

The ultrasonography machine used for examining all patients was a Samsung HM70A, from the equipment of the “Dr. Carol Davila” Clinical Hospital.

Also, for each patient, we applied a VAS for MSK pain or other type of discomfort (ex. paresthesia). We explained to each patient that they must relate only to the MSK symptoms and not to others, such as headaches or stomach pain.

### Patients and data

All 55 patients are on a dialysis programme at the “Dr. Carol Davila” Clinical Hospital. The study group included 32 patients with CKD stage G5D (on dialysis), amongst whom 29 were on HD (3 sessions per week) and 3 on PD (hospitalized for an acute episode of the CKD). The control group included patients with late-stage CKD (G5 – eRFG < 15 ml/min/1.73 m<sup>2</sup>), in a pre-dialysis state.

The inclusion criteria were over 18 years of age, the informed consent for entering the study and at

least 6 months on dialysis. The only exclusion criteria was the existence of an autoimmune rheumatic disease with articular or abarticular involvement, at the moment of the examination.

The laboratory evaluation included the renal status (creatinine, urea), PTH and inflammatory markers (ESR, CRP).

## RESULTS

The spectre of abnormalities found, from the most to the least frequent, were median nerve entrapment within the carpal tunnel, tendinous calcifications, osteophytes, synovitis, tenosynovitis, bursitis, partial tendinous rupture and joint space narrowing (probably age related).

In the study group, the aspect of median nerve entrapment within the carpal tunnel was discovered in 66% of the patients, compared to 17% in the control group.

The tendinous calcifications were also found in 66% of the patients, compared to 43% in the control group. In most of these patients (63%) the calcification were found in multiple sites. The most frequent unique location was the supraspinatus tendon at its insertion on the greater tuberosity (16%), followed by the quadriceps femoris tendon at the insertion on the patella (9%), the infraspinatus tendon, also inserted on the greater tuberosity (6%) and the triceps tendon at its insertion on the olecranon process (6%).

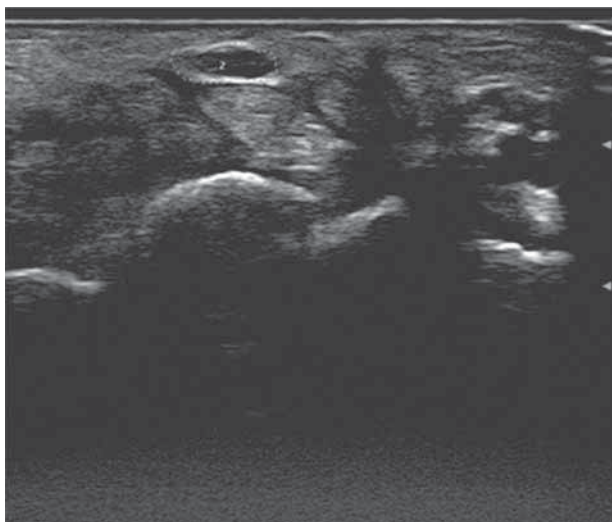
The VAS gives numeric results, which we divided in 3 groups: 0-3 (low), 4-6 (moderate) and 7-10 (high). In the study group, most patients presented low VAS results (41%), 37% declared moderate pain and/or paresthesia and only 22% accused a high lev-

**TABLE 1.** Baseline characteristics of the study population

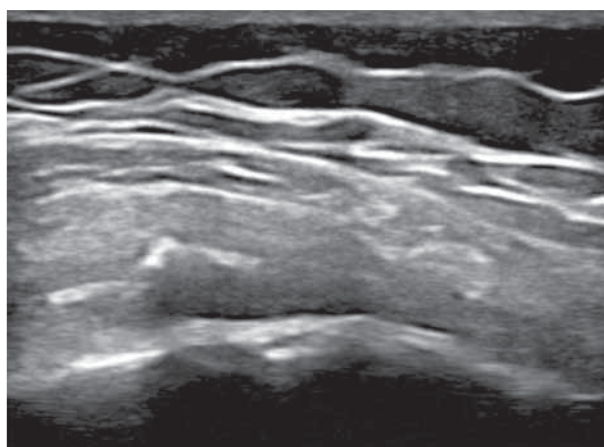
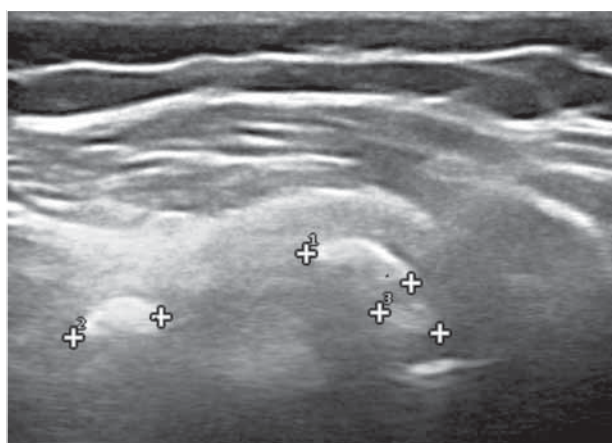
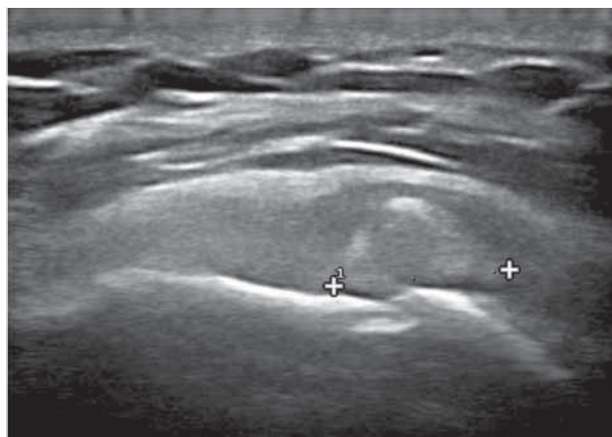
	Study group		Control group	
	M: 19 (59%)	F: 13 (41%)	M: 13 (57%)	F: 10 (43%)
Sex distribution				
Age distribution (yrs)	61,94 (31-81)		66,25 (41-84)	
HD/PD	HD: 28 (87%)	PD: 4 (13%)	-	
Time on dialysis (yrs)	5,47 (0,5-22)		-	
Creatinine (mg/dl) N: 0,6-1,2 (M); 0,5-1,1 (F)	8,44 (1,08-11,73)		7,64 (4,42-10,76)	
Urea (mg/dl) N: 10-50	133,42 (40-158)		120,29 (46-169)	
Inorganic phosphate (mg/dl) N: 2-5	6,18 (4,2-7,7)		5,88 (4,3-7,3)	
PTH (mg/dl) N: 15-68,3	616,03 (97-1509)		412,77 (103-978)	
CRP (mg/l) N: 0-5	8,81 (2-17)		11,74 (3,5-21)	

F – female, M – male, yrs – years.

el of pain and/or paresthesia. In the control group, the proportions of the 3 VAS groups are about the same. 54% of patients presented low VAS results, 32% were in the moderate group and 14% declared a high level of pain and/or paresthesia.



**FIGURE 1.** Median nerve enlargement in the carpal tunnel



**FIGURE 2,3,4.** Calcifications of supraspinatus tendon

## DISCUSSIONS

The percentage of US aspect of median nerve entrapment within the carpal tunnel was much higher in the study group (66%), in comparison to the control group (17%). Still, knowing that there are only 5% reported in the general population, it is clear that not only the dialysis process, but the CKD itself, by CKD-MBD, is responsible for these alterations in this category of patients (5,6,7).

Setting as standard the percentage of tendinous calcifications in the general population (13-47%), the results of our study situate the control group (17%) at the same level as the general population, while the numbers in study group rise significantly over that percentage, up to 66% (8). It is known that the tendinous calcifications could also be age related (8,9). The median age in our study is 64.09, so one could say that some of the calcifications are age related. However, the percentage of calcifications is much higher in the study group than in the control group, although the median age in the study group (61.94) is even a little smaller than in the control group (66.25). This proves that tendinous calcifications could be related either to a usually longer evolution of CKD-MBD in patients on dialysis, or to the process of dialysis itself.

The VAS results do not correspond to the high frequency of abnormalities found, so we couldn't help but wonder why. The answer to our question probably stands in the fact that CKD also causes uremic neuropathy. The prevalence of uremic neuropathy rises up to 83% in patients with CKD and it could prevent patients from feeling pain to its fullest (10).

## Study limitations

In this phase of our study, we have a relatively small number of patients included, but we plan to

keep evaluating more patients, in both groups. Also, in this phase of the study, we didn't separate the patients with diabetes in a different group, so some abnormalities might superpose.

The paraclinical evaluation was made during the last hospitalization (difference of 2 months at most), so the biomarkers might vary at the moment of the examination.

The personal history was declarative or taken from the file from the last hospitalization (in patients lacking medical documents, also declarative), so there could be cases of undeclared MSK diseases.

## CONCLUSIONS

CKD-MBD lead to ectopic calcifications, not only vascular, but with multiple other locations, such as tendons.

The MSK abnormalities detected in this study lead to pain, paresthesia, limited function of the joints and altered quality of life.

The treatment options for these alterations and for the pain they cause are limited in CKD, but these

patients could benefit from kinetotherapy or from other rehabilitation techniques (11). In order for this benefit to be greater, the alterations must be discovered as early as possible (12).

This is a first step to elaborating a programme of medical gymnastics, which the patients could benefit from during the long hours of the dialysis sessions.

It is a known fact that sports and physical activities in general reduce the risk of depression, so this type of programme could also influence the depression rate, which reaches very high levels among patients on dialysis (13,14).

## Acknowledgements

The authors would like to thank the management and the physicians from the "Carol Davila" Nephrology Clinical Hospital, Bucharest, for providing access to patients on dialysis programme and also to the ultrasonography machine.

## REFERENCES

1. Gheita T.A., Sayed S., Al-ghitany A., Ezzad H. Musculoskeletal Manifestations in Renal Hemodialysis Patients. *Ann Rheum Dis.* 2016; 75(2): 1260.
2. Liyanage T., Ninomiya T., Jha V. et al. Worldwide access to treatment for end-stage kidney disease: a systematic review. *The Lancet.* 2015; 385(9981): 1975-1982.
3. Isakova T., Xie H., Wei Yang W. et al. Fibroblast Growth Factor 23 and Risks of Mortality and End-Stage Renal Disease in Patients With Chronic Kidney Disease. *JAMA.* 2011; 305(23): 2432-2439.
4. Thomas B., Wulf S., Bikbov B. et al. Maintenance Dialysis throughout the World in Years 1990 and 2010. *J Am Soc Nephrol.* 2015; 26(11):2621-2633.
5. Yamazaki T., Kawahara N., Arai K. et al. Utility of Ultrasonography of the Median Nerve With a High-Frequency Probe for the Diagnosis of Dialysis-Related Carpal Tunnel Syndrome. *Ther Apher Dial.* 2016; 20(5): 483-491.
6. Zyluk A., Puchalski P., Nawrot P. The usefulness of ultrasonography in the diagnosis of carpal tunnel syndrome – a review. *ChirNarzadowRuchuOrtop Pol.* 2010; 75(6): 385-391.
7. Mani B., Sarawagi R., Cherian R.A. Review of the dimensions of the median nerve and carpal tunnel using sonography in asymptomatic adults. *J Med Imaging Radiat Oncol.* 2011; 55(2):126-131.
8. Kachewar S.G., Kulkarni D.S. Calcific Tendinitis of the Rotator Cuff: A Review. *J Clin Diagn Res.* 2013; 7(7): 1482-1485.
9. Hussein D.A., El-Azizi N.O., Meged A.H.A. et al. Ultrasonographic Tendon Alteration in Relation to Parathyroid Dysfunction in Chronic Hemodialysis Patients. *Clin Med Insights Arthritis MusculoskeletDisord.* 2015; 8: 9-14.
10. Wittmann I., Stirban A., Tesfaye S. et al. Neuropathy in chronic kidney disease. *Diabetes, Stoffwechsel und Herz.* 2015; 24(4): 251-255.
11. Katayama A., Miyatake N., Nishi H. Evaluation of physical activity and its relationship to health-related quality of life in patients on chronic hemodialysis. *Environ Health Prev Med.* 2014; 19: 380.
12. Bessa B., de Oliveira Leal V., Moraes C. et al. Resistance Training in Hemodialysis Patients: A Review. *RehabilNurs.* 2015; 40(2): 111-126.
13. Farrokhi F., Abedi N., Beyene J. et al. Association Between Depression and Mortality in Patients Receiving Long-term Dialysis: A Systematic Review and Meta-analysis. *Elsevier.* 2014; 63(4):623-635.
14. Lopes A.A., Lantz B., Morgenstern H. et al. Associations of Self-Reported Physical Activity Types and Levels with Quality of Life, Depression Symptoms, and Mortality in Hemodialysis Patients: The DOPPS. *Clin J Am Soc Nephrol.* 2014;9(10):1702-1712.