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Nailfold capillaroscopy findings for patients receiving hemodialysis treatment and patients with renal transplant

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Abstract

Cardiovascular diseases are the most common cause of death in hemodialysis patients. Early diagnosis of cardiovascular diseases has vital importance. The aim of our study is to use the NFC method to determine the importance of microcirculatory structure changes for early detection of increased cardiovascular disease risk in hemodialysis patients. The research was performed from april/2017 to july/2017. The study included 15 patients receiving hemodialysis treatment and 15 renal transplant patients followed by the nephrology department and 15 healthy volunteers attending the internal diseases clinic. Every patient were examined by videocapillaroscopy according to procedure and data were recorded. Statistical analyses were evaluated with SPSS 22.0. There was a significant difference in laboratory values between hemodialysis patients and both groups except uric acid ($p<0.05$). There was not a significant difference between the groups in terms of capillary density, capillary hemorrhage rate, tortuous capillary incidence, and giant capillary incidence ($p>0.05$). In conclusion, investigation of nailfold capillaroscopy in hemodialysis and renal transplant patients did not identify a significant disruption in microcirculation compared to the healthy control group. There is a need for nailfold capillaroscopy studies of hemodialysis and renal transplant patients with higher numbers of patients.

Keywords: vasculitis, microvascular changes, nailfold capillaroscopy, renal transplantation

1. Introduction

Hemodialysis (HD) and renal transplantation are frequently applied renal replacement treatment methods for treatment of end-stage renal disease (ESRD). Cardiovascular diseases are the most common cause of death in hemodialysis patients (1). Early diagnosis of cardiovascular diseases has vital importance.

In situations like diabetes mellitus (DM), hypertension and renal failure, initiation of the pathologic cascade involves changes to the microvascular structure and functions of the end organ (2). Functional and structural abnormalities at the microcirculation level may display easy transition to events occurring in larger arteries and coronary arteries (3). These types of changes were identified to correlate with development of cardiovascular disease (4). Measurement of capillary rarefaction, defined as reductions in the numbers of capillary veins in a tissue, allows the possibility for early assessment of microvascular functions and tissue perfusion in a variety of disease situations including chronic kidney disease (CKD) (5). Techniques developed to measure capillary rarefaction in skin were shown to accurately reflect central organ pathology like coronary artery disease and vascular calcification in dialysis patients (6,7). Very little is known about capillary rarefaction in hemodialysis and renal transplant patients and there is no study to date in adults.

Nailfold capillaroscopy (NFC) is an easily accessible, easily applied, inexpensive and non-invasive technique showing skin microcirculation (8). NFC is used to assist in diagnosis of rheumatic diseases like systemic sclerosis, systemic lupus erythematous and rheumatoid arthritis and provides an idea about microcirculation by investigating the vein bed (9).

The aim of our study is to use the NFC method to determine the importance of microcirculatory structure changes for early detection of increased cardiovascular disease risk in hemodialysis patients. At the same time, the aim was to investigate the effect of metabolic disorder, expected to ameliorate after transplant, on microvascular structure in renal transplant patients.

2. Materials and Methods

2.1. Patients

The research was performed from April/2017 to July/2017. The study included 15 patients (group A) receiving hemodialysis treatment and 15 renal transplant patients (group B) followed by the nephrology department. The control group (group C) included 15 individuals comprising

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healthy volunteers attending the internal diseases clinic for any reason. Patients were chosen from young age groups. The aim was to minimize venous abnormalities and structural diversity that may develop with age.

Inclusion in the research was based on volunteering. After patients who met the inclusion criteria were informed about the study, they were invited to participate and those who accepted were included in the study. All cases provided signed informed consent forms.

2.2. Inclusion and exclusion criteria

Inclusion criteria were for group A; patients from 18-65 years, patients receiving hemodialysis treatment, for group B; patients from 18-65 years, patients with renal transplant, for group C; individuals with similar age and sex features to Group A and Group B age from 18-65 years. Exclusion criteria (for groups A, B and C) were; damage to the fingers to be examined in recent times, chemicals which may affect the quality of investigation of the fingers, situations with probability of causing structural changes in microcirculation like DM, hypercholesterolemia, hypertension, rheumatic diseases, and smoking, cardiovascular disease.

2.3. Parameters examined

Individuals included in the study had physical examination and blood pressure measurements performed, with routine blood tests requested (hemogram, albumin, calcium, phosphorus, parathormone, ferritin, transferrin saturation, bicarbonate level, uric acid, blood urea nitrogen and creatinine). Nailfold capillaroscopy was performed by experienced clinician team. Investigations were performed with a VideoCap 3.0 videocapillaroscope.

Necessary permission for the study was obtained from Ankara Numune Education and Research Hospital Clinical Research Ethics Committee.

2.4. Statistical analysis

Normal distribution of continuous variables was examined with the Shapiro Wilk test. Comparisons of the means in three independent groups used the one-way analysis of variance (ANOVA) test, with post hoc Tukey test applied to significant results. Analysis of categoric variables used the chi-square test. For all analyses, statistical significance value was taken as 0.05.

3. Results

3.1. Demographic characteristics

The ages of patients included in Group A were from 18 to 57 years (39.07±11.14; mean ± SD) with 9 males and 6 females. The ages of patients included in Group B were from 20 to 58 years (36.87±11.34) with 7 males and 8 females. The ages of patients included in Group C were from 26 to 61 years (33.27±11.27) with 8 males and 7 females. There was no statistically significant difference between the mean ages in the patient group and control group ($p>0.05$). There was no statistically significant relationship between the groups for gender; the distribution was homogeneous ($p=0.765$) (Table 1).

3.2. Laboratory parameters

There was a significant difference between the groups in terms of mean hemoglobin, creatinine, bicarbonate, albumin, calcium, phosphorus, ferritin, transferrin saturation and parathyroid hormone levels ($p<0.05$). Accordingly, the differences were between the control-hemodialysis ($p<0.05$) and transplant-hemodialysis ($p<0.05$) groups. There was no significant difference between the groups in terms of mean uric acid ($p>0.05$) (Table 2).

3.3. Nailfold video capillaroscopy findings

There was not a significant difference between the groups in terms of capillary density, capillary hemorrhage rate, tortuous capillary incidence, and giant capillary incidence ($p>0.05$) (Table 3).

Table 1. Demographic data

	HD patients N=15	Patients with renal transplantation N=15	Control group N=15	P value
Age (years)	39.07±11.14	36.87±11.34	33.27±11.27	>0.05
Gender: N (%)	Female: 6 (40)	Female: 8 (53.3)	Female: 7 (46.7)	>0.05

Table 2. Laboratory and metabolic parameters

Parameter	HD patients N=15	Patients with renal transplantation N=15	Control group N=15	P value
Hemoglobin (g/dL)	10.85±0.96	13.79±1.48	14.01±1.17	<0.001
Creatinine (mg/dL)	2.78±0.79	0.83±0.20	0.91±0.16	<0.001
Uric acid (mg/dL)	5.25±0.71	4.89±1.02	5.12±1.51	>0.05
Bicarbonate (mEq/L)	20.34±3.47	23.67±2.08	23.73±1.54	<0.001
Albumin (g/dL)	3.76±0.28	4.28±0.43	4.35±0.48	<0.001
Calcium (mg/dL)	8.76±0.86	9.82±0.69	9.53±0.53	<0.001
Phosphorus (mg/dL)	5.00±1.32	3.26±0.63	3.84±0.75	<0.001
Ferritin (ng/mL)	393.80±305.38	100.73±58.52	96.07±71.74	<0.001
Transferrin saturation (%)	29.80±10.09	38.13±8.62	30.73±9.32	<0.05
Parathyroid hormone (mg/dL)	686.53±457.67	38.53±15.99	49.40±16.07	<0.001

Table 3. Nailfold capillaroscopy findings

	HD patients N=15	Patients with renal transplantation N=15	Control group N=15	P value
Giant capillary, n (%)	3 (20)	2 (13.3)	2 (13.3)	>0.05
Tortuous capillary, n (%)	3 (20)	4 (26.7)	2 (13.3)	>0.05
Reduced capillary density, n (%)	3 (20)	3 (20)	0 (0)	>0.05
Capillary hemorrhage, n (%)	3 (20)	3 (20)	4 (26.7)	>0.05

4. Discussion

Hemodialysis is the most frequently performed renal replacement treatment method. The most frequent cause of death among hemodialysis patients is cardiovascular diseases (10). This situation is accepted because of the association between renal and cardiovascular pathologies.

Early detection of cardiovascular diseases has vital importance. Many studies have found a positive correlation between skin microcirculation disorders and other vascular diseases and an increased risk of development of heart disease was identified with disrupted microcirculation (11). Many studies were performed to early assess for cardiovascular system diseases which are not yet clinically significant with identification of changes in microcirculatory structure using the nailfold videocapillaroscopy method (12, 13).

A study of the pediatric age group researched the capillary density, biochemical markers, cardiovascular risk factors and capillary function assessment tests in 19 end-stage hemodialysis patients and 20 healthy controls. Capillary density (capillary/mm^2) of hemodialysis patients was identified to be significantly low compared to the control group. There was an inverse correlation between serum calcium and parathormone levels with capillary density with no correlation found for cardiac risk determinants and serum phosphorus levels (14).

Another study investigated the microcirculatory changes in the upper extremities of hemodialysis patients with arteriovenous fistula. The patient group comprising 43 patients was assessed without a control group and no difference was observed in terms of morphological microcirculation parameters between the shunt arm and contralateral side (13). Due to limitations of the research, the arteriovenous fistula route, most frequently used for the dialysis entry route in hemodialysis patients, was shown not to disrupt capillary morphologic structure and this is important in terms of supporting the measurements in our study from this aspect.

A study compared 17 predialysis patients, 35 ESRD patients (20 HD and 15 PD patients) with 19 healthy controls and found capillary density in predialysis patients and ESRD patients were lower compared to the control group. They identified that the high serum phosphorus and bicarbonate levels associated with advanced CKD caused structural and functional capillary density disruption (12).

In our study, there was no significant difference between the groups in terms of capillary parameters. When both groups are compared with the hemodialysis group, apart from uric acid, all laboratory findings were significantly different. This situation complies with the literature. Our study has limited case numbers in terms of more advanced assessments.

There are a few studies performing videocapillaroscopy assessment of non-rheumatologic cases. A study of migraine patients included 50 participants as a healthy control group. Among these, 26% were identified to have tortuous capillary and 22% were identified to have giant capillary (15). In our study, in 15 healthy volunteers the incidence of tortuous capillary was 13.3% and the incidence of giant capillary was 13.3%.

Another study assessed 82 healthy individuals and mean value for capillary density was 11/mm^2, with capillary hemorrhage incidence 0%, tortuous capillary incidence 4.9% and giant capillary incidence 0% (16). In our study, the mean capillary density value was 10.5/mm^2, the reduction in capillary density was 0%, capillary hemorrhage rate 26.7%, tortuous capillary incidence 13.3% and giant capillary incidence 13.3%.

In all two studies, the capillary values in the control groups were identified to be different. For this reason, it is clear there is a need to perform studies with higher case numbers about this topic.

One of the secondary results of our study is that when both groups are compared with the hemodialysis patient group, apart from uric acid, all laboratory findings were significantly different. This is important in terms of recording the success of the effect on correctable laboratory values of renal transplantation, a renal replacement treatment with definite effect on mortality, in our case group.

In conclusion, investigation of nailfold capillaroscopy in hemodialysis and renal transplant patients did not identify a significant disruption in microcirculation compared to the healthy control group. There is a need for nailfold capillaroscopy studies of hemodialysis and renal transplant patients with higher numbers of patients.

There was not a significant difference between the groups in terms of capillary density, capillary hemorrhage rate, tortuous capillary incidence, and giant capillary incidence.

In our study, in 15 healthy volunteers the mean capillary density value was 10.5/mm^2, the reduction in capillary density was 0%, capillary hemorrhage rate 26.7%, tortuous capillary incidence 13.3% and giant capillary incidence 13.3%.

There is a need for nailfold capillaroscopy studies of hemodialysis and renal transplant patients with higher numbers of patients.

Conflicts of interest

The authors have no conflicts of interest to declare.

References

1. Charles A Herzog, J Michael Mangrum, Rod Passman. Sudden cardiac death and dialysis patients. Semin Dial. Jul-Aug 2008;21(4):300-7.
2. Secomb TW, Pries AR. The microcirculation: physiology at the mesoscale. J Physiol. 2011; 589:1047–1052.
3. Khan, Faisel; Dean Patterson; Belch, Jill J.F.; Hirata, Kumiko; Lang, Chim C., Relationship between peripheral and coronary function using laser Doppler imaging and transthoracic echocardiography. 2008.
4. IJzerman RG, De Jongh RT, MA Beijk, et al., Individuals at increased coronary heart disease risk are characterized by an impaired microvascular function in skin. Eur J Clin Invest 2003; 33:536-542.
5. Chade AR. Renal vascular structure and rarefaction. Compr Physiol. 2013; 3:817–831
6. Antonios TF, Kaski JC, Hasan KM, et al. Rarefaction of skin capillaries in patients with anginal chest pain and normal coronary arteriograms. Eur Heart J. 2001; 22:1144–1148.
7. Holowatz LA, Thompson-Torgerson CS, Kenney WL. The human cutaneous circulation as a model of generalized microvascular function. J Appl Physiol (1985) 2008; 105:370–372.
8. Mahnaz Etehad Tavakol, Alimohammad Fatemi, and Björn-Erik Erlandsson,Nailfold Capillaroscopy in Rheumatic Diseases: Which Parameters Should Be Evaluated?Hindawi Publishing CorporationBioMed Research InternationalVolume 2015, Article ID 974530.
9. Yüksel S, Yüksel EP, Soylu K, Zengin H, Gülel O, Meriç M, Aydın F, Şentürk N, Şahin M. Abnormal nail fold capillarospoic findings in patients with coronary slow phenomenon. Int J Clin Exp Med. 2014;7(4):1052-1058.
10. Mario Cozzolino, Michela Mangano, Andrea Stucchi, Paola Ciceri, Ferruccio Conte, Andrea Galassi. Cardiovascular disease in dialysis patients Nephrol Dial Transplant. 2018 Oct; 33(Suppl 3): iii28–iii34. Published online 2018 Oct 3.
11. Eduardo Tibiriçá, Andrea De Lorenzo, Gláucia Maria Moraes de Oliveira. Microcirculation and Cardiovascular Diseases Arq Bras Cardiol. 2018 Aug; 111(2): 120–121.
12. Thang OH, Serné EH, Grooteman MP, Smulders YM, ter Wee PM, Tangelder GJ, Nubé MJ. Capillary rarefaction in advanced chronic kidney disease is associated with high phosphorus and bicarbonate levels. Nephrol Dial Transplant. 2011 Nov;26(11):3529-36.
13. Hirschl M, Kundi M, Hirschl MM. Microcirculation of nailfold capillaries in chronic hemodialysis patients with and without diabetes mellitus. Clin Nephrol. 1993 Sep;40(3):179-84.
14. Edwards-Richards A, DeFreitas M, Katsoufis CP, et al. Capillary rarefaction: an early marker of microvascular disease in young hemodialysis patients. Clin Kidney J. 2014;7(6):569-574.
15. Akkiraz, Zehra Ozde. Establishment of peripheral vascular alteration with videocapilleroscopy method in migraine patients. Master's thesis. İzmir Katip Çelebi University, 2016.
16. Erol MK, Balkarli A, Toslak D, Dogan B, Durmaz D, Süren E, et al. Evaluation of nailfold videocapillaroscopy in central serous chorioretinopathy. Graefes Arch Clin Exp Ophthalmol. 2016 Oct;254(10):1889-1896.