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ASSESSMENT OF MICROVASCULAR ABNORMALITIES BY NAILFOLD CAPILLAROSCOPY IN CHRONIC HEMODIALYSIS PATIENTS

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ABSTRACT

Nailfold capillaroscopy is a simple, non-invasive technique for evaluating microcirculation. While its utility is well established in systemic diseases, its application in chronic hemodialysis patients remains insufficiently explored. This study aimed to assess microvascular abnormalities in chronic hemodialysis patients and to identify associated influencing factors. A single-center prospective study was conducted on 60 patients at Ibn Rochd University Hospital in Casablanca. The results showed that 67% of patients exhibited microvascular abnormalities, with a significant association between these abnormalities and longer duration on hemodialysis, disturbances in calcium-phosphate metabolism and Chronic anemia. These findings highlight the potential role of capillaroscopy in the monitoring and management of microvascular complications in patients undergoing chronic hemodialysis.

KEYWORDS: Capillaroscopy, Microvascular abnormalities, End-stage renal disease, Nailfold microcirculation.

INTRODUCTION

Nailfold capillaroscopy is a non-invasive, accessible, and cost-effective technique that allows for both qualitative and quantitative assessment of microcirculation in the proximal nailfold, providing valuable insights into tissue perfusion. With recent technological advances, its diagnostic performance has significantly improved, making it an essential tool for the early detection of systemic sclerosis. It also offers supportive diagnostic value in conditions such as systemic lupus erythematosus and rheumatoid arthritis. Despite its clinical utility, few studies have investigated peripheral microcirculation using capillaroscopy in patients undergoing chronic hemodialysis.

The objective of this study is to evaluate distal microcirculatory alterations in chronically hemodialyzed patients and to identify potential influencing factors.

MATERIALS AND METHODS

This was a single-center, prospective, descriptive, and analytical study conducted over a three-month period, from November 2022 to January 2023, in the Department of Nephrology at Ibn Rochd University Hospital in Casablanca.

Patients with acute kidney injury requiring dialysis and those recently initiated on chronic hemodialysis (less than 6 months) were excluded from the study.

Inclusion criteria comprised patients undergoing chronic hemodialysis for more than 6 months. Statistical analysis was performed using SPSS software (version 25).

RESULTS

A total of 60 patients with end-stage renal disease (ESRD) undergoing chronic hemodialysis were enrolled. The study population showed a slight male predominance (sex ratio: 1.06), with an average age of 50 years (range: 19–67).

Patients had been on hemodialysis for a median duration of 192 months (range: 18–372). The first arteriovenous fistula (AVF) was created at a median age of 27 years (range: 13–49). The mean body mass index (BMI) was 21 kg/m² (range: 14–31). Among the patients, 8% had a proximal AVF, while 92% had a distal AVF. Three patients had previously been on peritoneal dialysis before transitioning to hemodialysis, and one patient had returned to hemodialysis following kidney transplantation.

Regarding comorbidities, 10% of patients had hypertension, 1.6% had diabetes mellitus, and none had dyslipidemia. The average number of AVF reconstructions due to complications was 2 per patient (range: 1–11). All patients underwent three hemodialysis sessions per week, each lasting four hours. Following vascular access cannulation, 20% of the cohort experienced intradialytic hypotension. The average

hemostasis time after needle removal was 6 minutes (range: 2–15).

Laboratory analyses revealed a mean hemoglobin level of 9.2 g/dL, parathyroid hormone (PTH) concentration of 1023 pg/mL, serum calcium of 2.05 mmol/L, serum phosphate of 1.82 mmol/L, and C-reactive protein (CRP) level of 15.7 mg/L.

Capillaroscopic assessment focused on three key parameters: capillary density, presence of capillary hemorrhages, and occurrence of megacapillaries.

Distal microvascular abnormalities were observed in 67% of patients (n = 40). Among these, severe avascular areas were noted in 43%, while moderate alterations were identified in 24% of cases.

In patients with altered distal microvascularization, all had been on hemodialysis for more than 10 years. In 90% of these cases, the vascular access was an arteriovenous fistula (AVF), and 85% exhibited significant biological disturbances, including chronic anemia and mineral metabolism disorders. Conversely, in the subgroup with normal capillaroscopic findings (33% of the cohort, n = 20), the duration of hemodialysis did not exceed 10 years. The predominant vascular access in this group was a central venous catheter, and biochemical abnormalities were generally less pronounced.

Capillaroscopic abnormalities were significantly associated with the following parameters:
– Hemodialysis duration > 10 years ($p = 0.02$)
– Disturbances in calcium-phosphate metabolism ($p = 0.01$)
– Chronic anemia ($p = 0.03$)

DISCUSSION

In the study by Edward *et al.* (1), which included 19 end-stage hemodialysis patients and 20 healthy controls, capillary density (capillaries/mm²) was found to be significantly lower in the hemodialysis group compared to controls.

In contrast, the study by Küçük *et al.* (2) reported no significant differences in capillaroscopic parameters between hemodialysis patients and healthy subjects.

In our cohort, a significant proportion of patients (67%) exhibited impaired distal microvascularization, while 33% had normal findings. This discrepancy may be explained by several contributing factors, the most prominent being prolonged duration of hemodialysis and disturbances in calcium-phosphate metabolism observed consistently among affected individuals at the time of the study.

In the absence of a specific therapeutic approach, the presence of such vascular abnormalities warrants further investigation to rule out underlying systemic or vascular diseases, particularly systemic sclerosis. In such cases, treatment may include systemic and distal vasodilators such as angiotensin-converting enzyme inhibitors (ACE inhibitors), prostacyclin analogues, angiotensin II receptor blockers (ARBs), and omega-3 fatty acids (3).

CONCLUSION

Capillaroscopy represents a powerful, reproducible, non-invasive, and cost-effective diagnostic tool that provides valuable insights into the characterization of distal microvascular profiles. It may serve as a useful adjunct for risk stratification, particularly with regard to cerebrovascular and cardiovascular involvement.

Conflict of Interest

The authors declare no conflict of interest.

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