THE IMPLICATION OF VIDEOCAPILLAROSCOPY IN RHEUMATOID ARTHRITIS AND PSORIATIC ARTHRITIS

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Abstract

Videocapillaroscopy is an easy, noninvasive examination method that detects morphological microvascular abnormalities, such as nailfold capillaries. This method has a low cost, has high sensitivity and specificity, has reproductibility and the results can be easily interpreted.

Besides its importance in the evaluation of Raynaud's phenomenon and systemic sclerosis, nailfold capillaroscopy may play an important role in the diagnosis, evaluation and prognosis of other rheumatic diseases, such as rheumatoid arthritis and psoriatic arthritis. Because there are not enough data, currently, capillaroscopy is not routinely used in these patients.

The aim of this review is to present the implications of the videocapillaroscopy in rheumatic diseases, other than systemic sclerosis, in order to promote this method as a routine investigation in rheumatic patients.

Keywords: *nailfold capillaroscopy, capillary density, rheumatoid arthritis, psoriatic arthritis.*

Rezumat

Videocapilaroscopia este o metodă facilă, non-invazivă ce permite vizualizarea „in vivo" a capilarelor de la nivel unghial. În plus, această metodă este ieftină, are sensibilitate și specificitate ridicată, este reproductibilă și repetabilă, iar rezultatelor pot fi ușor interpretate.

În afară de importanța sa în scleroza sistemică și fenomenul Raynaud, capilaroscopia unghială poate aduce beneficii în diagnosticul, evaluarea și prognosticul altor boli reumatologice, precum artrita reumatoidă și artropatia psoriazică. Deoarece nu sunt suficiente date, actual, capilaroscopia nu este folosită de rutină la acești pacienți.

Scopul acestui review este de a prezenta implicațiile videocapilaroscopiei în alte boli reumatice, în afară de scleroza sistemică și de a încuraja utilizarea acestei metode ca o investigație de rutină la pacienții cu boli reumatologice autoimune.

Cuvinte cheie: *capilaroscopia unghială, densitatea capilarelor, artrita reumatoidă, artropatia psoriazică.*



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Introduction

It is a well known fact that, in rheumatic diseases, systemic inflammation affects the microvascular morphology. Videocapillaroscopy is a simple method that can be used as an easy tool for differential diagnosis in early stages of arthritis. A careful examination of the nailfold capillaries can detect the transition from primary Raynaud's phenomenon (RP) to secondary RP, indicating the need for further diagnostic procedures in order to identify specific autoimmune disease[1].

In addition, nailfold microvascular abnormalities can determine the severity and prognosis of the disease. A notable negative correlation was determined between C-reactive protein (CRP) levels and the arterial diameter of the capillaries[2]. Moreover, it may be used in the future to determine cardiovascular risk in patients with rheumatic diseases[3].

Multiple devices can be used, but the videocapillaroscope is the best method for the inspection of microcirculation because it provides a better magnification[4]. In nailfold area, the capillaries are parallel to the skin surface, and not perpendicular, as they are in other skin surfaces.

Standard technique: before examination, the patients should be acclimatized for 15 minutes, at a room temperature of 20-24°C. The patient should not smoke or drink coffee 4 hours before examination, neither should undergo any nail cosmetic procedures, due to the fact that it can lead to false-positive results. Because of its higher viscosity, the use of cedar oil can improve image resolution. The magnification of choice is 200x and the analyzed parameters are such as capillary density, tortuosity, length, width, architectural structure, presence of angiogenesis, microbleeding.

A normal capillaroscopic pattern should consist in capillaries that have an open “hairpin shape/ reverse U-shape”, are homogenous in size, shape, colour, with small morphological variations. The afferent limb diameter varies between 6-19 µm and the efferent limb diameter between 8-20 µm, but the size doesn't exceed a ratio of 2:1. If the capillary loop diameter exceeds 20 µm, that capillary is considered enlarged. If it exceeds 50 µm it is defined as giant or megacapillary. The capillary length is between 200-300 µm. When it exceeds 300 µm, it is considered an elongated loop. The average capillary density is considered to be 9 from 13 capillaries per mm. If the number of loops is lower than 30 per 5mm length or if 2 or more contiguous capillaries are lost, the density is considered low[5,6].

Microhemorrhages occur due to the rupture of the capillary wall. They appear as a dark area, due to hemosiderin deposits. The

subpapillary venous plexus (in which the efferent limb incorporates) can be observed in almost 30% of healthy individuals, but is frequently found in patients with rheumatoid arthritis[7].

Angiogenesis (neoformation) can be defined by extremely tortuous, "bushy/coiled" capillaries, more than 4 capillaries within a dermal papilla, branched, thin and interconnected capillaries, or capillaries with extremely elongated loops. Andrade et al reported morphological anomalies in almost 35% of the healthy subjects. The normal density should be between 9-13 capillaries/mm[8].

Minor morphological abnormalities such as tortuosity can be found in approximately 10-20% of healthy subjects (more frequent in smokers and after repetead microtrauma).

A study found that patients with coronary heart disease had a significantly lower density of nailfold capillaries compared to healthy subjects. In order to determine the maximum capillary density, they calculated basal capillary density and the density after arterial and venous occlusion[9].

Data collection

Studies published in English from 1990 up to January 2022 from Medical data bases (PubMed, NCBI, ScienceDirect) using key words such as "capillaroscopy," "nailfold capillaroscopy," "capillaroscopy in rheumatoid arthritis", "capillaroscopy in psoriatic arthritis". The articles found were checked for relevancy and analyzed by the reviewers.

Psoriatic arthritis (PsA)

PsA is a chronic inflammatory spondyloarthritis that occurs in 1/3 of the patients with psoriasis. This auto-immune disease causes bone erosions, destruction of the joints and irreversibile deformities. There are no specific laboratory findings available for psoriatic arthritis. The differential diagnosis between RA and PsA is very difficult in patients without cutaneous signs and negative anti-citrullinated peptide antibodies.

Microvascular dysfunction is considered to play a major role in the pathogenesis of psoriasis. Patients with psoriasis have a significantly altered microcirculation compared to healthy individuals.

Abnormalities such as edematous dermal and epidermal papillae, dilated and coiled capillaries are present. Vascular changes precede skin lesions[10,11].

A study performed on 44 patients with psoriasis, with or without psoriatic arthritis, found that there was an overall decrease in the capillary loop density compared to normal individuals. The diameter of arterial and venous capillary limbs was significantly decreased in patients with psoriatic arthritis. There were no findings regarding capillary dimensions compared with controls[12]. However, a study from 2012 concluded that the mean capillary length in psoriatic arthritis patients is significantly lower in comparison with healthy subjects. Moreover, they observed tight terminal convolutions in approximately 60% of the subjects[13].

Graceffa D. et all concluded that the venous (efferent) and arterial (afferent) limb and loop diameter were notable greater in rheumatoid arthritis patients than control, psoriatic arthritis and psoriatic groups. This expansion was found to be more evident in the efferent limb of the capillary and might indicate an early manifestation of vascular deterioration in the microvasculature[14]. Moreover, Graceffa et all concluded that the capillary density is lower in subjects with psoriatic arthritis than subjects with rheumatoid



arthritis. In support of these findings, another study observed the same results, psoriatic arthritis patients having a decrease in capillary density[6].

Other abnormalities found in PsA were: a visible subpapillary venous plexus, dilated venular branches, tortuous and coiled capillaries, lower mean length and meandering capillaries with tight terminal convolutions[15].

Avascular areas were significantly more frequent in patients with affected nails. Capillary density appears to be lower in patients with nail and joint involvement. Moreover, the presence of coiled capillaries appears to be more frequent in these patients. This may suggest trophic disruptions in the periungual area of these subjects[16].

Rheumatoid arthritis (RA)

Rheumatoid arthritis is a chronic rheumatic disease which is associated with immune system abnormalities. In addition to joint involvement, RA can affect the vascular (microvascular and macrovascular) system, which increases morbidity and mortality. The involvement of the microvascular system is present from the early stage of RA and can be present even in the absence of macrovascular disease[17]. In severe forms of the disease, rheumatoid vasculitis can occur.

A study on 80 patients with rheumatoid arthritis evaluated the relationship between capillaroscopic findings and immunological alterations (serum levels of cluster of differentiation- CD4, CD8, tumor necrosis factor alpha- TNF-α, interleukin-6 -IL-6). This study concluded that all subjects with signs of extra-articular manifestations had moderate to severe abnormalities on nailfold capillaroscopy. Moreover, the study found a correlation between soluble CD4 levels and the capillaroscopic changes. The CD4s levels were significantly higher in patients with severe vasculitis compared to patients with mild vascular abnormalities[18].

A study found a significant correlation between protein C levels and the diameter of the capillaries. But no significant correlation between nailfold capillaroscopy findings and Disease activity Score (DAS28) was found[19].

A blind study leaded by Mc Gill observed patients with systemic lupus erythematosus, rheumatoid arthritis and systemic sclerosis. They acquired nailfold capillaroscopic photographs that were showed to various rheumatologist. In the end, they concluded that nailfold capillaroscopy had a specificity of 89% and a sensitivity of 80% in differentiating the patterns of these diseases[20].

The main abnormalities found in rheumatoid arthritis patients are elongated, small and tortuous capillaries. In patients with antinuclear antibodies (ANA), higher

	Long loop	Enlarged loop	Giant loop	Tortuosity	Low density or avascular areas	Micro hemorrhage	Angiogenesis (neoformation)	Subpapillary venular plexus
Normal subject	+/-	+/-	-	+/-	-	+/-	+/-	+/-
Rheumatoid arthritis	++	+	-	+	-	+/-	+/-	++
Psoriatic arthritis	+/-	+	+/-	++	+	++	+	+

Table 5. *Approved treatment strategies in first-line DAA failure*
**Ribavirin is added*

subpapillary venous plexus was observed. This finding can be caused by the endothelial damage from antinuclear antibodies[21].

Another study confirms these findings. Elongated capillaries were found in approximately 60% of the subjects, approximately 80% had dilated capillaries and 70% had prominent subpapillary plexus. Scleroderma-like patterns were found in 11% of the subjects[22]. To corroborate these findings, Lee et all found that tortuosity and subpapillary venous plexus are the most common findings in RA[23].

Through a study on 430 patients with rheumatoid arthritis, it was concluded that a normal pattern was observed in 7% of the subjects, a scleroderma pattern in 21% and nonspecific morphological abnormalities were found in 72% of the patients. Most of the morphological abnormalities consisted of tortuosity (99.5% of patients) and angiogenesis (74.7%). Most of the patients with scleroderma patterns (isolated enlarged loops, tortuosity, angiogenesis, architectural derangement) were women (82%) and slightly older than subjects with normal patterns[24].

An Egyptian study concluded that patients with RA had organized capillaries in 100% of the cases, while psoriatic patients had disorganized capillaries in 35% of the cases. Moreover, hemorrhage was more frequent in PsA (65% of the cases). Tortuous capillaries were found in 100% of PsA patients while in RA patients they were found in only 25% of cases[25].

Discussions

Videocapillaroscopy may play a very important role in the differential diagnosis in patients with early arthritis. This is a simple and inexpensive tool to determine the severity of the disease. Nailfold area is easily accessible and capillaries can be inspected in a noninvasive way. Patients tend to be more open to this procedure, because it causes no harm or discomfort.



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Clinical manifestations of seronegative rheumatoid arthritis and psoriatic arthritis are similar, both of them can present with symmetrical articular involvement. A specific pattern can ease the differential diagnosis between these diseases. More data are needed in order to determine a specific pattern.

Psoriatic patients can be monitored regularly trough videocapillaroscopy. Changes such as “bushy”, ramified, irregular capillaries and decreased density can help alert the progress of a psoriasis to psoriatic arthritis.

Conclusions

Videocapillaroscopy is a noninvasive, easy and inexpensive method to determine microvascular changes in rheumatic patients. Although it lacks specificity, this tool can be used to differentiate rheumatic diseases, as well as to determine the response to treatment.

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