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ORIGINAL ARTICLE

Pan-American League of Associations for Rheumatology (PANLAR) capillaroscopy study group consensus for the format and content of the report in capillaroscopy in rheumatology

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Abstract

Objective The aim of this work was to produce a consensus-based report for capillaroscopy in rheumatology to be used in daily clinical practice.

Methods A written Delphi questionnaire regarding capillaroscopy report was developed from a literature review and expert consensus. The Delphi questionnaire was sent to an international panel including 25 rheumatologists experts in capillaroscopy, asking them to rate their level of agreement or disagreement with each statement. The exercise consisted of three online rounds and a face-to-face (live meeting) that took place in the PANLAR 2018 congress held in Buenos Aires, Argentina.

Results The participants to the first, second, third, and face-to-face round were 22, 21, 21, and 16 rheumatologists, respectively. Fifty-five items were discussed in the first round, 58 in the second, 22 in the third, and 9 in the face-to-face meeting. At the end of the exercise, 46 recommendations for the capillaroscopy report in rheumatology reached a consensus.

Conclusion This is the first consensus-based report in capillaroscopy. It will be useful in daily clinical practice and to address the effort of the standardization in the technique.

Key Points

- *The current lack of consensus for the capillaroscopy report makes difficult the interpretation of findings as well as follow-up of rheumatic diseases.*
- *This study produced the first international consensus for the format and content of the naifold capillaroscopy report in rheumatology.*
- *The report is an integral part of the capillaroscopy examination and its use in a homogeneous form can help in the correct interpretation of findings in daily practice.*

Keywords Capillaroscopy · Delphi process · Report · Rheumatology

Introduction

Nailfold capillaroscopy (NFC) has progressively gained a central role in daily rheumatology clinical practice thanks to its intrinsic characteristics (non-invasiveness, well accepted by patients) and to the increasing evidence regarding its role in the diagnosis and assessment of Raynaud's phenomenon, systemic sclerosis, and other rheumatic and not rheumatic disorders [1–8]. However, to

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date, there are neither guidelines nor consensus for the format and content of the NFC report in rheumatology, which represents an integral and crucial aspect of the NFC examination.

This issue has emerged from the first meeting attended by the recently founded Capillaroscopy Study Group of the Pan-American League of Associations for Rheumatology (GECAP), held in Panama in 2016 when the members discussed the current lack of consensus for the NFC report. The group agreed that this would negatively influence the reproducibility of NFC findings between different specialists and would make difficult the interpretation of findings by readers as well as NFC follow-up of rheumatic diseases. Moreover, the current use of multiple modalities of image documentation in the NFC report was considered an additional aspect of crucial importance in the completion of the report and the need for obtaining unanimous points of view was underlined. So, from 2016, all members of the group decided to work on this problem developing a project with the aim of drawing up a set of a consensus document for the format and content of the NFC report in rheumatology.

Methods

The project was based on three stages. First, a content analysis of the literature was undertaken by senior experts in NFC members of international panels, to identify existing proposals of report, definitions, and methods of quantification of capillaroscopy abnormalities to structure the report statements and the labels currently used to denote them. Second, the results from such analysis provided a framework for the subsequent Delphi exercise used to achieve a consensus agreement on the recommended labels for each item. Third, we held a subsequent face-to-face consensus meeting with the aim to reach agreement on any labels that had not achieved a consensus through the Delphi exercise.

Content analysis of the literature

A systematic search in the literature was performed: the articles focusing on the reporting modalities of NFC in the field of rheumatic diseases as well as methods of quantification of capillaroscopy abnormalities were eligible for inclusion. The criteria presented for scrutiny were assembled from PubMed and Medline literature search as well as from highly cited manuscripts on capillaroscopy in rheumatology, internal medicine, dermatology, and microvascular journals and were limited to English-language articles (according to the 2015 Thomson-Reuters Journal Citation Reports) from 1st January 1990 to the 31st January 2017.

Delphi exercise

The principles of the Delphi process have been described in detail elsewhere [9]. The exercise in this project was based on three rounds, each one conducted as an online survey. Experts in NFC were invited by email to participate in the first survey. The number of years performing capillaroscopy (> 8) and the number of exams/years (> 250) were identified. Members were invited to participate in subsequent rounds if they had completed the first survey.

Respondents were asked to select and rank their preferred labels for each element. The statements were derived from the content analysis of the literature and represented the most commonly identified labels. Shortly, the first round included 55 statements divided in the following sections: patient data, Raynaud's phenomenon, antibodies, visibility, visibility of subpapillary venous plexus (SPVP), architecture, density, giant capillaries, avascular areas, bushy capillaries, microhaemorrhages, ectasia (dilated capillaries), other abnormalities, capillaroscopy diagnosis, suggestions, and images (Table 1).

In accordance with the principles of the Delphi process, panelists could comment on labels, and the second and third rounds included feedback consisting of previous results and thematic summaries of comments provided. The statements were progressively refined depending on the achievement of a consensus or other selection criteria. The answers from each Delphi questionnaire were summarized with mean scores by a facilitator and re-sent with a revised questionnaire to the panel for the next round. The second and third rounds consisted of new surveys and excluded both, the items that had achieved an agreement and that had scored as low relevance on the basis of obtained percentage. Additional criteria suggested by the panel during the previous interaction, as well as items that required rewording for definitions, were included in every new survey.

The names of the panelists were kept confidential, and all responses were re-identified prior to releasing them to the group. This allowed each member to answer questions without being influenced by the opinions of the other panelists. The panel was asked to rate each item using a level of agreement or disagreement for each statement according to a 1 to 5 Likert scale [10].

Group agreement for each item was defined as total cumulative agreement ≥ 75%. Only sentences that achieved a score ≥ 75% have been considered as a consensus reached, and the item was considered as appropriate. When a particular sentence achieved approval ≤ 25%, it was considered irrelevant and eliminated. For items with scores between 25 and 75%, the sentences were reformulated according to the suggestions of the panel of experts.

Face-to-face consensus meeting

The face-to-face meeting was held on April 9th, during the PANLAR 2018 Congress at Buenos Aires, Argentina. Invitations to attend were extended to all participants.

Table 1 Statements of the first round of Delphi process

1st ROUND (22 participants)			
Number	Statement	Consensus	Agreement (%)
1	In the capillaroscopic report, the reason for sending the test (diagnostic suspicion, clinical manifestation, presence of positive antibodies, etc.) should be mentioned.	OBTAINED	81.8
2	In the capillaroscopic report, the occupation of the patient should be mentioned.	REFORMULATED	59.1
3	In the capillaroscopic report, the comorbidities of the patient should be mentioned.	REFORMULATED	63.6
4	In the capillaroscopic report the possible rheumatological diagnosis of the patient and the time of its evolution should be mentioned.	OBTAINED	81.8
5	The capillaroscopic report should mention the current pharmacological therapy.	REFORMULATED	54.6
6	In the capillaroscopic report the patient's habits (smoking, manicure, onicophagy, caffeine, activities that produce local trauma) should be mentioned.	OBTAINED	81.8
7	The presence of Raynaud's phenomenon should be mentioned in the capillaroscopic report.	OBTAINED	100
8	In the capillaroscopic report, the time of evolution of the Raynaud's phenomenon should be mentioned.	OBTAINED	86.4
9	In the capillaroscopic report positive antibodies should be mentioned	REFORMULATED	59.1
10	In the capillaroscopic report, antibodies linked to capillaroscopic alterations should be indicated in a list.	ELIMINATED	22.7
11	In the capillaroscopic report the visibility should be mentioned in terms of description as good, poor and none.	OBTAINED	95.5
12	In the capillaroscopic report, the probable cause of poor visibility (e.g., skin color, hyperkeratosis, oedema) should be mentioned.	OBTAINED	81.8
13	In the capillaroscopic report, the visibility of the PVSP should be mentioned.	REFORMULATED	72.7
14	In the capillaroscopic report, the visibility of the PVSP should be mentioned in a dichotomous way: VISIBLE/NOT VISIBLE.	REFORMULATED	72.7
15	In the capillaroscopic report, the visibility of the PVSP should be mentioned through a SEMIQUANTITATIVE SCALE (0 = not visible, 1 = doubtful visibility, 2 = venous plexus visible only in some areas and 3 = prominently visible in a large area).	REFORMULATED	72.2
16	In the capillaroscopic report architecture should be mentioned.	OBTAINED	95.5
17	In the capillaroscopic report, architecture should be mentioned in a dichotomous way: NORMAL/ALTERED.	REFORMULATED	63.6
18	In the capillaroscopic report, architecture should be mentioned using a SEMIQUANTITATIVE SCALE (0 = normal, 1 = slight disorganization: < 33% of altered capillaries of the total capillaries, 2 = moderate disorganization: 33–66% of altered capillaries of the total capillaries, 3 = severe disorganization: > 66% of altered capillaries of the total capillaries).	REFORMULATED	63.6
19	In the capillaroscopic report capillary density should be mentioned.	OBTAINED	100
20	In the capillaroscopic report, the capillary density should be mentioned in a dichotomous way: NORMAL/DECREASED.	REFORMULATED	68.2
21	In the capillaroscopic report, the capillary density should be mentioned using a semiquantitative scale (0 = very good density: > 9 capillaries/mm, 1 = good density: 7–9 capillaries/mm, 2 = reduced density: 4–6 capillaries/mm; 3 = very low density: < 4 capillaries/mm).	REFORMULATED	63.6
22	In the capillaroscopic report capillary density should be mentioned as AVERAGE VALUE among the 8 fingers analyzed.	REFORMULATED	50
23	In the capillaroscopic report, the presence of giant capillaries (capillaries with loop diameter > 50 μ) should be mentioned in a dichotomous form: PRESENT/ABSENT.	OBTAINED	81.8
24	In the capillaroscopic report, the presence of giant capillaries (capillaries with loop diameter > 50 μ) should be mentioned as TOTAL NUMBER in the 8 fingers analyzed	REFORMULATED	36.4
25	In the capillaroscopic report, the presence of giant capillaries(capillaries with loop diameter > 50 μ) should be mentioned as AVERAGE VALUE of the 8 fingers examined	REFORMULATED	54.6
26	In the capillaroscopic report, the presence of giant capillaries (capillaries with loop diameter > 50 μ) should be mentioned by means of a SEMIQUANTITATIVE SCALE (0 = absent, 1 = giant capillaries < 33% total capillaries/mm, 2 = giant capillaries between 33% and 66% of total capillaries/mm, 3 = giant capillaries > 66% total capillaries/mm). The scale refers to the average of the 8-finger test.	REFORMULATED	59.6
27	In the capillaroscopic report the presence of avascular areas (loss of 2 or more contiguous capillaries) should be mentioned in a dichotomous form: PRESENT/ABSENT.	REFORMULATED	72.7
28	The capillaroscopic report should mention the presence of avascular areas (loss of 2 or more contiguous capillaries) through a SEMIQUANTITATIVE SCALE (0 = absence of avascular areas, 1 = 1 or 2 discontinuous avascular areas, 2 = > 2 discontinuous avascular areas, 3 = extensive and confluent avascular areas). The scale refers to the presence of avascular areas in the examination of the 8 fingers.	OBTAINED	77.3
29	The capillaroscopic report should mention the presence of avascular areas (loss of 2 or more contiguous capillaries) as TOTAL NUMBER in the 8 fingers analyzed.	REFORMULATED	36.4

Table 1 (continued)

1st ROUND (22 participants)			
Number	Statement	Consensus	Agreement (%)
30	The capillaroscopic report should mention the presence of bushy capillaries (small branches in different directions).	OBTAINED	100
31	In the capillaroscopic report, the presence of bushy capillaries (small branches in different directions) should be mentioned in a dichotomous form: PRESENT/ABSENT.	OBTAINED	77.3
32	In the capillaroscopic report, the presence of bushy capillaries (small branches in different directions) should be mentioned by means of a SEMIQUANTITATIVE SCALE (0 = absent, 1 = < 33% of capillaries of the total capillaries, 2 = 33% to 66% of bushy capillaries of the total capillaries, 3 = > 66% bushy capillaries of the total of the total capillaries.	REFORMULATED	50
33	In the capillaroscopic report, the presence of microhaemorrhages (dark spot due to hemosiderin deposit) should be mentioned.	OBTAINED	100
34	In the capillaroscopic report, the presence of microhaemorrhages (dark spot due to hemosiderin deposit) should be mentioned in a dichotomous way: PRESENT/ABSENT.	OBTAINED	81.8
35	In the capillaroscopic report, the presence of microhaemorrhages (dark spot due to hemosiderin deposit) should be mentioned by means of a SEMIQUANTITATIVE SCALE (0 = no hemorrhages, 1 = 1–2 hemorrhages per finger, 2 = > 2 hemorrhages per finger or confluent areas, 3 = pericapillary hemorrhages).	REFORMULATED	63.6
36	The capillaroscopic report should mention the presence of ectasia (dilated capillaries between 4 and 10 times the normal size).	OBTAINED	95.5
37	The capillaroscopic report should mention the presence of ectasia (dilated capillaries between 4 and 10 times the normal) in a dichotomous way: PRESENT/ABSENT.	OBTAINED	77.3
38	In the capillaroscopic report the presence of ectasia (dilated capillaries between 4 and 10 times the normal) should be described in a SEMIQUANTITATIVE SCALE (0 = absent, 1 = < 33% ectasia of total capillaries, 2 = between 33% and 66% of ectasia of the total capillaries, 3 = > 66% of ectasia of the total capillaries).	REFORMULATED	45.5
39	In the capillaroscopic report the presence of thrombosed capillaries should be mentioned	REFORMULATED	68.1
40	The capillaroscopic report should mention the presence of tortuous capillaries (serpentine branches that do not cross).	OBTAINED	86.4
41	The capillaroscopic report should mention the presence of tortuous capillaries (serpentine branches that do not cross) in a dichotomous way: PRESENT/ABSENT.	OBTAINED	81.8
42	In the capillaroscopic report tortuous capillaries (serpentine branches that do not cross) should be described by means of a SEMIQUANTITATIVE SCALE (0 = absent, 1 = tortuous capillaries < 33% total capillaries/mm, 2 = tortuous capillaries between 33% and 66% of total capillaries/mm, 3 = tortuous capillaries> 66% total capillaries/mm). The scale refers to the average of the examination of the 8 fingers.	REFORMULATED	40.9
43	The capillaroscopic report should mention the presence of crossed capillaries (branches that cross 1 or more times).	OBTAINED	77.3
44	The capillaroscopic report should mention the presence of crossed capillaries (branches that cross 1 or more times) in a dichotomous way: PRESENT/ABSENT.	REFORMULATED	85.7
45	The capillaroscopic report should mention the presence of crossed capillaries (branches that cross 1 or more times) by means of a SEMIQUANTITATIVE SCALE (0 = absent, 1 = < 33% of crossed capillaries of the total capillaries, 2 = between 33% and 66% of crossed capillaries of the total capillaries, 3 = > 66% of crossed capillaries of the total capillaries).	REFORMULATED	27.3
46	The capillaroscopic report should mention the presence of bizarre capillaries (capillaries of rare form, which are not classified as hairpin, tortuous, or crossed)	OBTAINED	77.3
47	The capillaroscopic report should mention the presence of bizarre capillaries (capillaries of rare form, which are not classified as hairpin, tortuous, or crossed) in a dichotomous way: PRESENT/ABSENT	REFORMULATED	59
48	The capillaroscopic report should mention the presence of bizarre capillaries (capillaries of rare form, which are not classified as hairpin, tortuous, or crossed) by means of a SEMIQUANTITATIVE SCALE (0 = absent, 1 = < 33% of bizarre capillaries of the total capillaries, 2 = between 33% and 66% of bizarre capillaries of the total capillaries, 3 = > 66% of bizarre capillaries of the total capillaries).	REFORMULATED	18.1
49	In the capillaroscopic report it is important to include the capillaroscopic diagnosis (a final judgment of the pattern found: e.g., normal picture, nonspecific abnormalities, specific pattern)	OBTAINED	95.5
50	In the capillaroscopic report it is important to inform about the presence of the varieties of the normal pattern: NORMAL, NORMAL PERFECT AND UNUSUAL NORMAL.	REFORMULATED	40.9
51	In the capillaroscopic report it is important to report the presence of a pattern of nonspecific abnormalities	OBTAINED	90.9
52	In the capillaroscopic report it is important to inform about the scleroderma pattern	OBTAINED	90.9
53	In the capillaroscopic report it is important to inform the type of scleroderma pattern: EARLY, ACTIVE, LATE.	OBTAINED	95.5

Table 1 (continued)

1st ROUND (22 participants)			
Number	Statement	Consensus	Agreement (%)
54	In the capillaroscopic report, you should have a space to write a comment about the capillaroscopic diagnosis	OBTAINED	100
55	In the capillaroscopic report one or more representative images should be included.	OBTAINED	90.9

Participation in all the previous Delphi rounds was a prerequisite for attendance. The meeting was conducted by a facilitated discussion on a list of specific questions. First, the group discussed and voted on those elements that had not achieved a consensus through the precedent Delphi process. All attendees were given the opportunity to express their opinion on the remaining statements; however, the introduction of new statements was not permitted. Voting rounds, conducted by 'show of hands', were held for each of these statements.

After, a consensus had been achieved for all statements. The definitions for each element were addressed using the same facilitated discussion approach. Attendees could express their views on each element with the aim of constructing an accurate, yet concise, definition for each item. Key concepts raised were documented and incorporated into sequentially modified definitions that were then put to a 'show of hands' vote. This process continued until a consensus agreement was achieved, defined as at least 75% agreement with each proposed definition.

Results

Content analysis of the literature

Twelve papers describing proposals of the report, definitions, and methods of quantification of NFC abnormalities were included in the analysis of the literature [11–23]. Further details on this topic are represented in the Fig. 1.

Delphi exercise

Three complete rounds of online surveys were performed. Twenty-two out of 25 invited experts agreed to participate (91.6%). The response rate was 100% (22/22) for the first round, 95.5% (21/22) for the second and third rounds. The respondents included experts in NFC from 7 countries (Argentina, Bolivia, Brazil, Colombia, Ecuador, Mexico, Peru). All respondents were rheumatologists.

The percentage of agreement for each item proposed in the three online rounds and the consensus meeting are showed in Table 1 and Supplementary file 1.

Of the initial 55 statements, 27 obtained agreement after the first round. The remaining statements were re-worded according to the comments suggested in the first interaction. Then, they were presented in the second round to the participants. The panel mainly suggested to add semiquantitative and quantitative methods for the assessment and the description of capillary abnormalities. The statements of the second round are detailed in the Supplementary file 1. In this round, five items reached a consensus. The third and final round included 22 items. From those, eight items obtained agreement. So, they were re-worded according to the comments and were presented at the face-to-face meeting. The statements that had not reached a consensus were mainly related to the topics of "antibodies", "capillary architecture", "giant capillaries", "branching capillaries", "microhaemorrhages", and "ectasias".

Face-to-face meeting

Sixteen participants of the Delphi process attended also the face-to-face consensus meeting (72.7% of the initial panel members). According to the dynamic described previously, the moderator

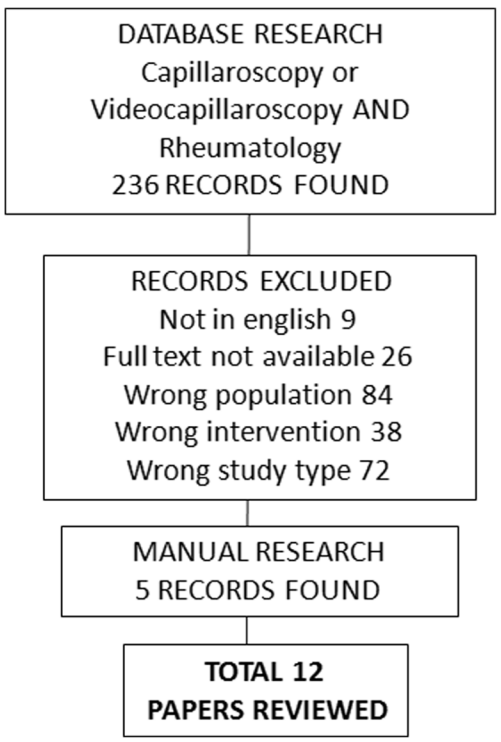

Fig. 1 Graphic of research strategy

Table 2 Final consensus for the format and content of the report of capillaroscopy

PATIENT DATA

1. In the capillaroscopic report, the reason for sending the test (diagnostic suspicion, clinical manifestation, presence of positive antibodies, etc.) should be mentioned.
2. In the capillaroscopic report, the occupation of the patient should be mentioned, taking into account that the occupation can generate lesions that alter the capillaroscopic picture.
3. In the capillaroscopic report the patient's habits (smoking, manicure, onicophagy, caffeine, activities that produce local trauma) should be mentioned.
4. In the capillaroscopic report, the comorbidities of the patient should be mentioned because some of them may cause microvascular damage and be responsible for capillaroscopic alterations.
5. The capillaroscopic report should mention the medications that the patient takes and that can act at the microvascular level.
6. In the capillaroscopic report, the possible rheumatologic diagnosis of the patient and the time of its evolution should be mentioned.

RAYNAUD'S PHENOMENON

7. The presence of the Raynaud's phenomenon should be mentioned in the capillaroscopic report.
8. In the capillaroscopic report, the evolution time of the Raynaud's phenomenon should be mentioned.

VISIBILITY

9. In the capillaroscopic report the visibility should be mentioned in terms of description as GOOD, POOR AND NONE.
10. In the capillaroscopic report, the probable cause of poor visibility (e.g., skin color, hyperkeratosis, edema) should be mentioned.

VISIBILITY OF SUBPAPILLARY VENOUS PLEXUS (SPVS)

11. In the capillaroscopic report, the visibility of the SPVP should be mentioned as VISIBLE or NOT VISIBLE

ARCHITECTURE

12. In the capillaroscopic report architecture should be mentioned.
13. The architecture should be reported as NORMAL or ALTERATED

DENSITY

14. In the capillaroscopic report, the capillary density should be mentioned.
15. In the capillaroscopic report, the capillary density should be mentioned as NORMAL or DECREASED
16. In the case that the density is DECREASED, the report should be supplemented using a semiquantitative scale (0 = very good density: > 9 capillaries/mm, 1 = good density: 7–9 capillaries/mm, 2 = reduced density: 4–6 capillaries/mm; 3 = very low density: < 4 capillaries/mm).

GIANT CAPILLARIES

17. In the capillaroscopic report, the presence of giant capillaries (capillaries with loop diameter > 50 μ) should be mentioned in a dichotomous way: PRESENT/ABSENT.
18. In the event that the presence of giant capillaries is detected, the report should be complemented by a SEMIQUANTITATIVE SCALE (1 = giant capillaries in less than 33% of total capillaries, 2 = giant capillaries between 33% and 66% of the total capillaries, 3 = giant capillaries in more than 66% of the total capillaries)

AVASCULAR AREAS

19. The presence of avascular areas (loss of 2 or more contiguous capillaries) should be mentioned in the capillaroscopic report
20. In the capillaroscopic report the presence of avascular areas should be mentioned in a dichotomous way: PRESENT/ABSENT.
21. In the case of presence of avascular areas, the report should be completed through a SEMIQUANTITATIVE SCALE (0 = absence of avascular areas, 1 = 1 or 2 discontinuous avascular areas, 2 = > 2 discontinuous avascular areas, 3 = extensive and confluent avascular areas). The scale refers to the presence of avascular areas in the examination of the 8 fingers.

BUSHY CAPILLARIES

22. In the capillaroscopic report the presence of bushy capillaries (small branches in different directions) should be mentioned.
23. In the capillaroscopic report, the presence of bushy capillaries should be mentioned in a dichotomous way: PRESENT/ABSENT.
24. In the event that the presence of bushy capillaries is detected, the report should be complemented by a SEMIQUANTITATIVE SCALE (0 = absent, 1 = < 33% of bushy capillaries of the total capillaries, 2 = 33% to 66% of bushy capillaries of the total capillaries, 3 = > 66% of bushy capillaries of the total capillaries.)

MICROHAEMORRHAGES

25. In the capillaroscopic report, the presence of microhaemorrhages (dark spot due to hemosiderin deposit) should be mentioned.
26. In the capillaroscopic report, the presence of microhaemorrhages should be mentioned in a dichotomous way: PRESENT/ABSENT.
27. In the case of presence of microhaemorrhages, the report should be completed indicating the average value of microhaemorrhages in the 8 fingers examined

ECTASIA

28. The capillaroscopic report should mention the presence of ectasia (dilated capillaries between 4 and 10 times the normal size).
29. In the capillaroscopic report, the presence of ectasia should be mentioned in a dichotomous way: PRESENT/ABSENT.

Table 2 (continued)

30. In the event that the presence of ectasia is detected, the report should be complemented by a SEMIQUANTITATIVE SCALE (0 = absent, 1 = < 33% ectasia of total capillaries, 2 = between 33% and 66% of ectasia of the total capillaries, 3 = > 66% of ectasia of the total capillaries
OTHER ABNORMALITIES
31. In the capillaroscopic report, the presence of thrombosed capillaries (deposits of hemosiderin that emphasize the shape of the capillary loop of origin of the thrombosis) should be mentioned.
32. The capillaroscopic report should mention the presence of tortuous capillaries (serpentine branches that do not cross).
33. The capillaroscopic report should mention the presence of tortuous capillaries in a dichotomous way: PRESENT/ABSENT
34. The capillaroscopic report should mention the presence of crossed capillaries (branches that cross 1 or more times).
35. In the capillaroscopic report, a dichotomous description PRESENT/ABSENT should be used to indicate the crossed capillaries.
36. The capillaroscopic report should mention the presence of bizarre capillaries (capillaries of rare form, which are not classified as hairpin, tortuous, or crossed)
37. In the capillaroscopic report a dichotomous description should be used PRESENT/ABSENT to indicate the bizarre capillaries.
CAPILLAROSCOPY DIAGNOSIS
38. In the capillaroscopic report it is important to include the capillaroscopic diagnosis (a final judgment of the pattern: e.g., normal picture, nonspecific abnormalities, specific pattern)
39. In the capillaroscopic report it is important to report the presence of a pattern of nonspecific abnormalities
40. In the capillaroscopic report, in case the study is normal, it should be described simply as NORMAL
41. In the capillaroscopic report it is important to inform about the scleroderma pattern
42. In the capillaroscopic report it is important to inform the type of scleroderma pattern: EARLY, ACTIVE, LATE.
SUGGESTIONS AND IMAGES
43. In the capillaroscopic report, you should have a space to write a comment about the capillaroscopic diagnosis
44. In the capillaroscopic report one or more representative images should be included
45. The capillaroscopic examination report should consider the findings of the complete periungueal margin of the 8 fingers (excluding the thumbs)
46. The capillaroscopic report should include information about elements that do not allow to evaluate the 8 fingers (for example, amputations, fingers with injuries or others).

conducted the discussion of the list of statements that had not achieved a consensus through the Delphi exercise. Nine statements were object of face-to-face discussion (the items regarding the same abnormalities were merged in a single statement with multiple options) (supplementary file 1). At the final of the face-to-face process, six statements reached a consensus. They were added to the previous statements agreed, resulting in a final set of 46 items to guide NFC report in rheumatology. The final consensus for the format and content of the report in capillaroscopy is represented in Table 2. The relative Spanish and Portuguese versions are illustrated in the supplementary file 2 and 3. The supplementary files 4, 5, and 6 include proposal formats for the report of capillaroscopy in the daily practice (English, Spanish, and Portuguese relatively).

Discussion

The GECAP group initiative has produced the first expert consensus for the format and content of the report of NFC in rheumatology. The building of a consensus report in NFC responded to a need expressed by teachers and experts to have a clinical instrument to use in daily practice.

General recommendations on the correct reporting of imaging examinations have been previously published, and it has been concluded that a 'good' report of medical imaging should be described by the eight Cs: clarity, correctness, confidence, concision, completeness, consistency, communication and consultation [24]. In addition, two features that are attributes to a 'good' imaging report are timeliness and standardization.

Studies on the efficacy of the report and attempts at standardization, in other sectors of imaging, have been carried out concluding that the reporting of imaging was poorly standardized but also independent of performing/reporting doctor, type of study and indication [25].

Based on these prerogatives, standardization of the NFC report is a real challenge for the rheumatologists. Interesting preliminary attempts have been emerged, especially for the definitions and reliability of capillary findings by European colleagues [16, 26–30], but still too much remain to be done.

Standardization of NFC report is hard to obtain because of the paucity of literature in this topic. In fact, lack of both literature and technique standardization was the principal critical issues emerged and reported by the panelist during the overall exercise.

From a detailed analysis of our results, the following considerations could be made. First, in general, the experts reached an easy consensus (first round) on the types of abnormalities to be reported in the format. On the contrary, different rounds were necessary to define how to report the single capillary abnormalities; if it is sufficient to refer only the presence or absence or it is necessary to introduce quantitative or semiquantitative scales to report the capillary abnormalities.

Two exceptions to the easy agreement on the type of abnormality to report are represented from SPVP visibility and avascular areas, which were object of a large debate. For the SPVP visibility, the experts observed that the relevance of the finding is not clear or well defined in the literature. For avascular areas,

some experts underlined that the definition in literature is also not clear, and the capillary density may be a good surrogate indicator.

Second, the experts have been suggested to introduce different types of quantification systems to report the capillary abnormalities. The consensus was very hard to obtain on this topic probably due to the personal preference of the panelists and partially to lack of unequivocal indications in literature. Indeed, the methods of quantification of abnormalities are not well defined, and the available semi-quantitative scales, which often quantify in a different way the same abnormality, are still poorly described. Overall, most of the authors reached an agreement in adopting both dichotomous and semi-quantitative scores to report some abnormalities (density, giant capillaries, avascular areas, bushy capillaries, ectasias), especially for the follow-up of patients. Moreover, other authors underlined that a semi-quantitative scale would be more useful to define the variants of scleroderma pattern proposed by Cutolo [14]. In particular, the authors found the semi-quantitative scale proposed for microhaemorrhages hard to interpret, so, during the face-to-face discussion the experts decided to adopt a dichotomous way indicating the average value of microhaemorrhages including the 8 fingers examined. A lack of clarity of the semi-quantitative scale proposed from the literature for microhaemorrhages was the main reason declared for the experts for not including a scoring. It is possible that this form is time consuming but it was object of agreement among the experts. From the other hand, the agreement with respect to how report the architecture was difficult. At the final of the third round, the agreement was very low, but during the face-to-face meeting discussion the experts decided finally for a dichotomous description (presence or absence). Third, other point of discussion was the opportunity to include in the report the positive autoantibodies of the patient. In general, the panelists expressed that the information related to clinical aspects is useful for the capillaroscopy interpretation whereas the antibodies may be influencing the NFC diagnosis. Some panelists argued that it would be important to include this data in the report while others argued that is not a duty of this type of report to resume the serological characteristics of the patients. So, the antibodies have not been included in the final report. Finally, the facilitators decided not to include in the report the "scleroderma-like pattern" as a capillaroscopy diagnosis. This, due to the fact that it is reported, but not well defined in the literature.

We are aware that our study had some limitations. These are linked to the nature of the adopted method that is substantially a comparison of the expert's opinion, in the absence of a strong background of evidence. The necessary presence of facilitators introduces a degree of arbitrariness to the procedure. In this case, the compilation of the list of items for the first round of exercise, i.e., the abnormalities to propose to vote, the definitions, the scales to use, was a process partially based on the experience of the facilitators, also it was literature-based as possible, as well as the formulation of new items in the successive rounds on the basis of commentaries. Also, the Spanish and Portuguese translation of the definitions was literature-drifted but was obviously partially an arbitrary process. However, none of the panelists raised a question on this point. Furthermore, for the paucity of literature, the experts had to reach a consensus based more on their own experience than on scientific evidence. For this reason, it has not been possible to calculate the strength of the propositions. Other limitation include the fact that different aspects such as type and name of machine, denomination of elongation capillary and additional definitions for avascular areas (i.e., severe capillary loss or the distance between 2 capillaries more than 500 μm) were not included as statements for the expert agreement. However, this is only a preliminary version of the report that must be tested and implemented in the routine practice. We are sure that future revisions and corrections of the problems that will exhibit with the use will be necessary. This will be an ideal scenario to implement and search a consensus on emerging topics.

Finally, it is clear to us that NFC reporting is a very challenging issue. This project was meant to provide general recommendations on the contents of the NFC report in clinical practice, which should contain certain information that is useful in describing the various pathologic findings and provide information to the clinician. We believe that the adoption of a shared form of reporting NFC findings could be a relevant step towards NFC standardization.

In conclusion, the GECAP has produced the first international consensus for the format and content of the NFC report in rheumatology. The report is an integral part of the NFC and its uniform use can help in the correct interpretation of the findings in daily practice. We know that the exercise is only the first effort in the standardization of technique of execution and interpretations on NFC. Further testing of our reports in daily clinical and NFC practice could help us to understand their real applicability and usefulness in NFC reporting in rheumatology.

Compliance with ethical standards

Disclosures None.

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