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Chronical Occupational Exposure of Hands

Multiparametric Capillaroscopy: a Precursor surveillance Technique ?

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The cutaneous capillary network of the nailfold regions represents a very sensitive marker of alterations induced by ionising radiation.

The authors propose to use this vascular characteristic to ensure surveillance of the hands of workers occupationally exposed to repeated low doses of radiation over many years throughout their career.
They report an easy-to-use, inexpensive, and safe method of radio-pathological monitoring, in inquiring the significant parameters during the capillarometric observation.

Material and Method

This study of cutaneous nailfold capillaries requires:

- a microscope with low magnification (10 to 100).
- a powerful light by focal fibre optics.
- a transparisation of the skin with a drop of immersion-oil for microscopy.

Nineteen radiation-exposed workers from medical fields, volunteers, were examined for radioprotection aiming.

Our sample divided into 11 females, 8 males.

Mean age: 52.7 ± 13.5 years (24 – 80)

Occupational seniority: 20.9 ± 10.3 years (3 – 36)
A cutaneous capillary network of the nailfold region is always very rich in micro-vascular information. These one were summarized by 10 parameters regrouped in 3 anatomo-functional criteria.

1. Extravasation (œdema)

- 1a – Length of capillary loops.
- 1b – Number of visible rows.
- 1c – Edge of nailfold region.
- 1d – Colour of ground.

2. Morphological Dystrophies

- 2a – Number of capillary loops visible /mm.
- 2b – Capillary neogenesis.
- 2c – Morphological characters.
- 2d - Distribution of capillaries.

3. Circulatory Dynamic

- 3a - Ratio of arterialo-veinular diameters.
- 3b - Capillary circulation.

The participants were questioned. A scrupulously detailed investigation about the occupational past-work, the environment, and habit of life must be made before the examination of radio-exposed workers. The age is an important factor. It causes natural effects on the aspect and the circulatory function. It is the same for some metabolic troubles or vascular pathologies. The generalizing to all fingers avoids any confusion with a radiation origin, always localized to only exposed fingers.

Results

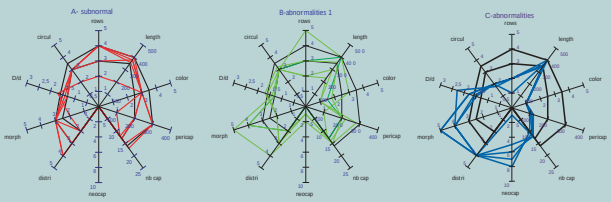
Pictures below are examples of different types of abnormalities on direct photographic documents



Each patient has been assessed. The number of modified or damaged parameters for each criterion has been reported in table below.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Criterion I Extravasation	0	2	2	0	0	1	4	2	2	2	1	4	4	1	3	3	4	4	0
Criterion II Morphology	1	2	2	0	0	1	4	2	1	2	1	4	4	0	2	0	4	2	0
Criterion III Kinetics	0	2	2	0	1	0	2	0	0	1	1	2	2	0	2	0	2	2	0
Total	1	6	6	0	1	2	10	4	3	5	3	10	10	1	7	3	10	8	0

The individual representative diagram of the whole values retained for each parameter on circular section allows quick-reading control, collecting and comparison of abnormalities. This diagram promotes the surveillance (radioprotection) (a, b, c)



The normal values in each graph are drawn in a black straight line, the individual values being respectively noted in red (subnormal), green (minor alterations) or blue (major alterations) straight lines.

Statistical Analysis

Statistical analysis has been performed using Student test. It appears that descriptive analysis and comparative analysis by Student test for a = 0.05 warrants the choice of defined parameters. The most parameters are significantly discriminated, except lengthening of capillaries and edge. The multiparametric analysis corroborates the good discrimination of parameters bounded to the morphology and the presence of oedema. Some parameters present an higher variability than others. Such analysis induces to grade the relative importance of parameters to adjust or select them.

Discussion - Conclusion

The number of abnormalities increases with the duration of exposure (occupational seniority).
The results confirm widely the abnormalities usually observed during chronicle irradiation.

- a systematic œdema, limited to exposed zones.
- an heterogeneous and irregular distribution, well visible and evident.
- a local morphological heterogeneity (paradoxal alterations).
- only alterations to radio-exposed fingers.
- a neovascularisation in cluster typical-form.

These first observations could induce to determine several useful attitudes according to the severity of characteristic microcirculatory alterations, only limited to the most exposed fingers.

- Keeping in exposed zone with single surveillance with nailfold capillaroscopy for patients without other significant abnormalities.
- Severe surveillance with occasional keeping away from dangerous exposed zone for subjects showing significant radiation alterations without involving clinical cutaneous marks.
- Directing to Hospital Specific Department (Radio-pathology) and suppressing all radio-exposed risk for other cases with maximum significant alterations specially with neocapillaries in cluster typical form.

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