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"Capillary band width", the "nail (band) sign": A clinical marker of microvascular integrity, inflammation, cognition and age. A personal viewpoint and hypothesis

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ABSTRACT

The nail provides a window of a person's wellbeing and the "nail (band) sign" provides an opportunity for the clinician to conveniently posit the state of the microcirculation of a person. Changes noted in the "capillary band" include splinter haemorrhages as an acute phenomenon. Changes in capillary band "width" and "prominence" indicate chronicity. "Capillary band width" and "prominence" may permit the differentiation of Alzheimer's from vascular causes of cognitive decline. Splinter haemorrhages and onycholysis alert clinicians to the presence of periodontal disease, and provide an indication of end organ "risk". "Capillary band width" widening and prominence is seen in chronic smokers. Nail changes not only reflect generalised disease or inflammation but also localised peripheral conditions that affect the microcirculation. The fourth finger on the left or right hand is usually used, or the middle finger, to measure "band width", but all fingers show the sign which is also present in the toes. Examination of "band width" and "prominence" together with other "nail signs" of wellbeing, such as the presence of the lunule at the base of the nail and smoothness of the convexity of the nail bed at its distal edge beneath the nail permit wellness evaluation and can be incorporated into standard medical practice before blood pressure measurement as a fundamental part of the clinical examination. Further evaluation will establish its importance as the most convenient yet reliable clinical sign of microvascular integrity and together with other nail signs determine its value in assessing wellness, as well as being a pointer to the presence of microvascular disease in investigative and epidemiological research and in patient management.

1. Introduction

Capillaries play a critical role in sodium and water homeostasis and diastolic blood pressure regulation [1]. Capillaries are the breaking point in circuit delivery [2]. Integrity of the capillary network ensures healthy tissues can function, whereas capillary pruning characterises hypertensive disease [3], itself a precursor of cardiovascular disease, in which capillary integrity not only determines morbidity but could be primarily affected in the development of sodium sensitive hypertensive disease [4,5].

Lifespan is determined by the cumulative effects of loss (including epigenetic effects [6]) over time of the number of genetically endowed functional capillaries present at birth, while change in capacity and decline in functional reserve capacity as a function of time define the ageing process; and impact on function at any one time on the integrity of organs they supply determines disease, while recoverability is dependent on the functional reserve capacity of the microcirculation and of the organs they supply at any point in time. Therefore microcirculatory integrity before and after birth has significant impact on lifespan, ageing, health and wellbeing and disease as well as recoverability from disease.

The nail fold under microscopy and the retina provide opportunities to view capillaries that allow assessment of the microcirculation directly and estimation of micro-albuminuria provides indirect evidence of the state of the glomerular microcirculation.

While investigative efforts continue to probe micro-anatomical structure and function clinical examination is the mainstay of diagnosis and treatment. Therefore the discovery of a new sign, which reveals the microcirculation conveniently and with relative ease, could add considerable information and advantage to clinical diagnosis and the assessment of health and disease.

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2. Personal opinion

The personal opinion raised in this report is that the nail bed provides an under-assessed, previously unharnessed or undiscovered, opportunity to assess the integrity of the microcirculation by examination of the capillary band at its distal end, the "nail band sign" or "capillary band sign", which can be used as a quantitative and qualitative measure at the bedside. In addition to this, the dynamic physiology and pathophysiology involving the nail and the nail bed permits the clinician to decide whether a person is basically healthy or whether to suspect that generalised effects of disease are present. Identification of inflammatory processes elsewhere in the body, such as periodontal disease, bronchiectasis and chronic inflammation in addition to conditions or diseases that are known to alter the microcirculation, e.g. Raynaud's disease, or scleroderma, as is known, is possible, but the additional information gained by examination of the "nail band sign" may also be proven to be of value in other conditions thought to be not directly linked to nail bed anatomy or pathology e.g. differentiating neurodegenerative disorders such as Alzheimer's disease from vascular causes of cognitive impairment, the presentation of which is often clinically indistinguishable. Ability to distinguish this even in some cases would be useful in order to direct treatment towards the causes of either or both.

2.1. Hypothesis

The hypothesis is that the "nail capillary band" provides a convenient method to assess the integrity of the microcirculation. It may provide a sign of the presence of inflammatory processes and it may therefore be used together with other "nail signs" as a marker of health and wellbeing and in the clinical diagnosis of the effects of ongoing inflammation in the body, such as periodontal disease or chronic infection, such as bronchiectasis. The "nail capillary band" may be used to determine cardiovascular risk as it reflects the condition of the microcirculation. It is also possible that it could be used in treatment as a marker of improvement or recovery and in research along with other markers, both clinical and biochemical, of wellbeing or disease. It may provide a method to help determine the basic abnormality in functional brain syndromes in older age as to whether these are primarily neurodegenerative or due to microvascular disease.

2.2. Nail anatomy and telltale signs

The nail arises from a growth point at the base of the nail bed at which there is a moon-like structure termed the "lunule" which is evident in good health. The distal edge of the nail bed is rounded, convex outward with a smooth border indicative of health. The "nail capillary band" lies just proximal to the distal convexity of the nail bed. It may be visible, but if not evident or if just visible, it becomes more defined by applying light touch pressure to the end of the nail. The subungual nail bed ends precipitously distally where at its base it connects to the skin of the terminal phalanx forming a furrow.

At the proximal end or base of the nail "the nail fold" extends from the skin of the terminal digit onto the nail surface to cover the base of the nail. The subungual lunule usually protrudes beyond the line of the nail fold on the surface. The lunule at the base of the nail is a crescent shaped structure lighter in colour than the nail bed. The lunule is the growth portion of the nail.

The nail fold offers protection to the base of the nail from water entry or seepage of liquid and bacteria. It is adjoined to the skin at the sides of the nail where the skin folds in to form medial and lateral gutters extending from the proximal nail fold to the furrow in the dermis at the distal end of the nail.

Each structure provides information on the state of a person's health and wellbeing; whether the lunule at the base of nail is present as in good health or not, whether there is a smooth convexity of the distal end of the nail bed as in good health or not which may indicate inflammatory processes that have been or are ongoing; the width of the "nail capillary band" and the prominence of it; and whether it is visible without pressure applied to the nail edge, just visible without pressure or not visible: and whether the edge of the nail is unkempt or not, or bitten or not; and the state of the skin, whether the furrow between the nail bed and adjoining skin is visible or not, i.e. whether the nail bed is foreshortened; or whether the end of the nail covers the nail bed and the demarcating furrow as it does in health. Note is also made of the skin adjoining the nail bed; its texture as to whether this is supple or flaking or not, which is affected by conditions such as Scleroderma, Raynaud's disease, and whether the finger pad is well padded or not and has elasticity or not as occurs in old age.

The surface and shape of the nail, as is well known, provide clues as to the diagnosis of systemic conditions such as iron deficiency and Psoriasis, as do changes in the nail bed that indicate hypoproteinaemic states when the lunule is not present. Other telltale nail signs have been described that indicate the clinical presence of disease.

The "nail capillary band" has not been previously noted, so its importance as a clinical sign together with the other nail signs as a marker of wellbeing, health and disease and of the microcirculation in particular has not been evaluated, nor has the prominence of the lunule been highly regarded as an important marker of general health.

3. Method

Clinical examination begins, after an introduction, with an examination of the hands and the presence or absence of clubbing, pallor, cyanosis and jaundice and pulse and blood pressure measurement. It is possible to examine the "nail bed" even before blood pressure is measured at the bedside or conveniently after blood pressure measurement with relative accuracy and ease.

The "capillary band" or "nail band sign" is elicited by lightly compressing the edge of the nail to reveal the darker capillary band at the subungual edge against a lighter background. Magnification may be required to see the capillary band more clearly but when pressure is lightly applied to the edge of the nail the band is usually visible without magnification. Although the sign may be elicited in all fingers and in the toes, the fourth finger of the left hand or the left third finger, or third finger or fourth finger on the right has been predominantly used for standard measurement.

The width of the capillary band at the terminal subungual region of the nail can then be compared to MRI, PET or CT findings that highlight tissue loss that may be due to microcirculatory changes in regions elsewhere such as the brain.

4. Preliminary observations and assumptions

Preliminary and anecdotal observation in people of different age indicates that the "capillary band" is present in infants where it can be seen quite readily. In young adults the hue of the nail bed obscures the band, which fades into the background and can only be seen by applying light pressure to the terminal end of the nail (see Fig. 1a and b). The "capillary band" appears to be less visible and narrower in younger adults than in older patients. However, in patients who have evidence of vascular disease or vascular compromise, as in older people with vascular diseases, vascular cognitive impairment and lacunar strokes, "capillary band width" (CBW), appears to be increased, so the significance of a finding of nail capillary band prominence or widening in young people remains to be determined. Increase in "capillary band width" may be accompanied by "capillary band prominence", where the capillary band is visible without the need to apply pressure to the nail. The significance of this needs to be determined but it may indicate more severe capillary dysfunction. It was noticeable and was found to be associated with loss of the lunule