Eur J Vasc Endovasc Surg (2016) ■, 1–9

Ultrasonography of Skin Changes in Legs with Chronic Venous Disease

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WHAT THIS PAPER ADDS

Currently, ultrasonography is used only to designate the location and pattern of venous lesions. In turn, modern echotomographs allow excellent morphological evaluation of the cutaneous and subcutaneous layers. Ultrasonography refines visual evaluation of skin changes in legs with venous disorders and may reveal changes not highlighted by clinical examination. Accordingly, skin sonography may contribute to better grading of the severity of venous diseases. In particular, in C2 legs US evidence of skin changes should be considered to identify those legs in which varicose veins are more than just a cosmetic problem.

Background: In daily practice, ultrasonography (US) is used only to designate the location and pattern of venous lesions. Skin US is not performed between routine venous investigations.

Methods: Skin morphology is evaluated by the same probes used for routine Duplex evaluation of superficial veins. US findings from evident skin lesions are comparatively evaluated with those from the surrounding apparently normal skin and from the contralateral leg.

Results: Inflammation and dermal edema can be found in the apparently normal skin of C2 legs. Swollen legs show thickening of the subcutaneous layer as a result of diffuse soaking or anechoic cavities, with or without dermal edema. Chronic hypodermitis is characterized by inflammatory edema in initial phases, and by liposclerosis in advanced cases. Recrudescence of inflammation provokes focal rarefactions of the subcutaneous layer, possibly related to ulcer opening.

Conclusion: In legs with venous disorders, sonography refines clinical evaluation of the skin and may reveal changes not highlighted by inspection. Some of these changes could require further investigation because they have not yet been explained or described. Skin sonography should improve knowledge of the natural history of skin changes, as well as contribute to a better grading of venous diseases severity In particular, US evidence of cutaneous and subcutaneous changes in C2 legs should be considered to stratify the treatment in C2 legs, by identifying those in which varicose veins are not simply a cosmetic problem.

Article history: Received 13 December 2015, Accepted 18 March 2016, Available online XXX

Keywords: Skin sonography, Venous disorders, Varicose veins, Venous ulcer, Lipodermatosclerosis

INTRODUCTION

The clinical assessment of chronic venous disease is currently designated by visual inspection of the legs. In fact, the "C" class of the Clinical-Etiology-Anatomy-Pathophysiology (CEAP) classification is based on the evidence of normal skin or of teleangectasias, varicose veins, edema, pigmentation, lipodermatosclerosis, open or healed ulcers.[1] Also the revised Venous Clinical Severity Score (VCSS) is mainly based on data obtained from physical examination.[2]

In daily practice, ultrasonography (US) is used only to designate the location and pattern of venous lesions, that is the "A" (anatomy) and "P" (pathophysiology) descriptors of the CEAP classification. Even if during venous examinations the probe is moved along the whole limb, US information regarding the morphology of the cutaneous layer (CL, epidermis and dermis) and subcutaneous layer (SCL) is not considered.[3] In fact, skin sonography is not performed between routine venous investigations,[4] even though its potential usefulness has been demonstrated.[5,6] This is probably because most studies focusing on skin morphology in legs with chronic venous disease (CVD) have been accomplished with sophisticated ultra-high frequency probes (20–40 MHz), which are not available in most vascular laboratories. In turn, modern Duplex ultrasound devices allow excellent morphological evaluation of both the CL and SCL, by using the same probes dedicated to routine vascular investigations.[7,8]

Sonography of normal skin

The epidermis appears as a thin hyperechoic band because of the echoes created between the gel and the skin surface[6] (Fig. 1). The papillary dermis (PD) appears as a thin and low-

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1078-5884/

http://dx.doi.org/10.1016/j.ejvs.2016.03.022

Please cite this article in press as: Caggiati A, Ultrasonography of Skin Changes in Legs with Chronic Venous Disease, European Journal of Vascular and Endovascular Surgery (2016), http://dx.doi.org/10.1016/j.ejvs.2016.03.022

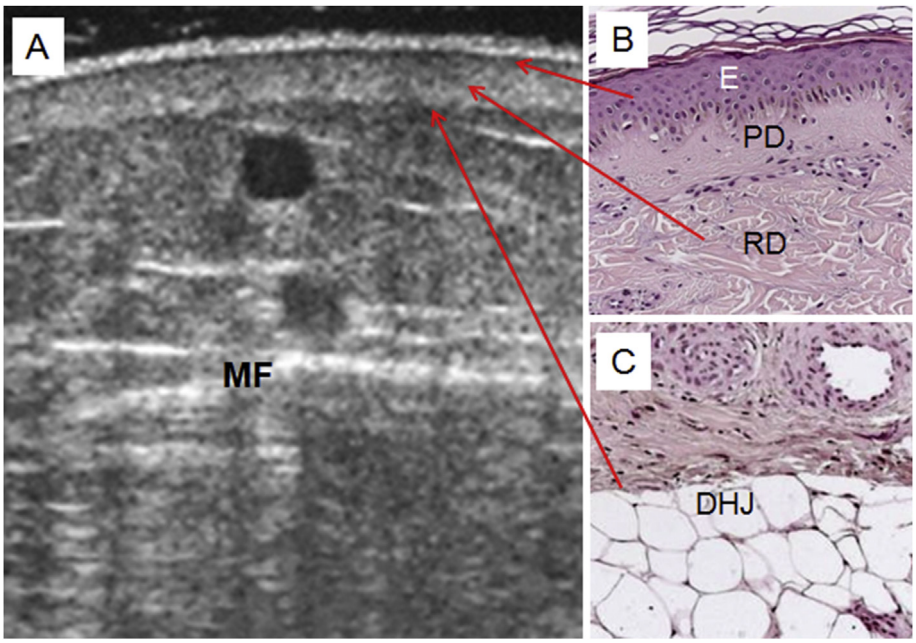

Figure 1. Normal skin. (A) 12 MHz sonography. (B, C) Light microscopy (hematoxylin and eosin, original magnification 20×). E = epidermis; PD = papillary dermis; RD = reticular dermis; MF = muscular fascia; DHJ = dermo-hypodermic junction.

echogenic band parallel to the skin surface, immediately below the hyperechoic epidermis (Fig. 1). It is called the "subendothelial-low-echogenic-band"[9] (SLEB). The hypoechogenicity of the PD is related to its high water content.[9] The reticular dermis (RD) appears as a regular band, with homogeneous thickness and echogenicity (Fig. 1). The echoes from the reticular layer originate from the boundaries between the collagen fibers and the surrounding ground substance and cells.[10] In normal conditions, the dermo-hypodermic junction (D-HJ) appears as an uninterrupted line, easily recognizable thanks to the marked difference in echogenicity of the RD and the SCL.

The subcutaneous tissue consists of hypoechoic fat lobules separated by echolucent connective trabeculae (Fig. 1). The prevalence of adipose tissue makes the SCL markedly less echogenic than the overlying dermis. The thickness of the trabeculae varies greatly among individuals and, within the same subject, according to the investigated area.

The purpose of the present study is to report skin US findings in legs afflicted with CVD as obtained during routine Duplex investigations. Possible clinical implications of skin US in CVD legs are discussed.

METHODS

Technique of US investigation

Skin morphology was evaluated by the same probes used for routine Duplex evaluation of superficial veins (10—14 MHz), with the patient in the lying position to assure leg immobility and muscle relaxation. The probe was gently placed perpendicular to the skin surface. An abundant quantity of gel was mandatory to assure ultrasound transmission avoiding any contact between the probe and the skin. Pads were not used so as not to exert pressure on superficial tissues.

It is important to consider potential circadian variations of skin morphology, with special reference to edema. Accordingly, if serial evaluations of the same patient are planned, these need to be performed at the same horary.[10]

Investigation areas

Skin morphology can be investigated at any level of the limb surface. However, to obtain more significant clinical data, the following protocols were used.

In patients with unilateral venous disease, US findings from homologous areas of the two limbs were comparatively evaluated.

In the presence of evident skin lesions, US was performed at their level and then extended to the surrounding apparently normal skin as well to the homologous area of the contralateral leg.

In the absence of clinically evident changes, skin morphology was comparatively evaluated at the medial face of the leg (inferior and superior third) and of the mid thigh.

To compare skin morphology of different areas of the limbs, only the depth of the field and the focus were changed during the examination. The latter was settled in the upper 2—3 mm to investigate the morphology of the CL. A deeper focus was settled to evaluate the morphology of the SCL. All the other parameters (power, output, frequency, dynamic range, gain-gray scale, filters, monitor brightness, etc.) were unchanged during the examination.

US parameters of evaluation

Skin thickness. Measurements of CL and SCL thickness were performed with digital caliper using standard device software settings. Thickness of the CL was defined as the distance between the epidermal entrance echo and the D-HJ.

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