Application of Ultrasound in Rheumatic Skin Disorders: Taking Psoriasis as an Example

CME Credits

Jia-Feng Chen[1,2], Tien-Tsai Cheng[1], Ying-Chou Chen[1]*

[1]Division of Rheumatology, Allergy, and Immunology, Department of Internal Medicine, Kaohsiung Chang Gung Memorial Hospital and Chang Gung University, College of Medicine, Kaohsiung, Taiwan, [2]Graduate Institute of Clinical Medical Sciences, Chang Gung University, College of Medicine, Kaohsiung, Taiwan

Equipment and Technique

Rheumatologists often use linear transducers with frequencies of 7.5–15 MHz which are useful for examining joint structures such as the synovium and cartilage. The frequency determines the penetration depth of the ultrasound wave: The higher the frequency, the shallower the depth of penetration, but the better the resolution. To observe superficial soft-tissues structures such as nails or skin, a transducer frequency of at least 10 MHz is recommended to achieve the desired resolution and image quality. The detection of blood flow using ultrasound is also important to semiquantify the level of disease activity.

While performing ultrasonographic examination, the probe is placed perpendicular to the skin surface, and a thick conductive gel is used to avoid skin deformation caused by excessive pressure of the probe. Elastography, the technique used to illustrate soft-tissue elasticity, is performed by applying the external force to the skin. The tissues are squeezed, producing small shear waves. The speed of these waves is proportional to the hardness of the soft tissue. The elastographic image demonstrates the elastic properties of the area of interest. For detailed examination of the skin structure, high frequency or ultrahigh frequency ultrasound is warranted, but it is not easily accessible in clinical practice.

This article introduces the basic application of ultrasound in the differentiation of skin layers using the 4–15 MHz linear transducer, which is commonly available among rheumatologists.

Normal Skin Structure Under Ultrasound

The skin can be divided into three layers: Epidermis, dermis, and hypodermis [Figure 1]. The thickness of the skin varies between patients of differing race and age. The epidermis is rich in keratin, and it presents as a hyperechoic layer. The main component of the dermis is collagen, so it is slightly less hyperechoic than the epidermis. The hypodermis is mostly adipose tissue, and hence, it is hypoechoic compared with the outer layers. If we want to observe the fine epidermis dermis interface, a transducer with higher frequency (>20 MHz) is needed.[1]

Sonographic Appearance of Psoriasis

Psoriasis skin plaques are pathologically characterized by the excessive proliferation of keratinocytes in the epidermis and the infiltration of inflammatory cells into the dermis. The sonographic examination of these plaques reveals a hyperechoic and thickened epidermal layer compared with the adjacent normal skin [Figure 2]. Due to edema and vasodilation, a hypoechoic band is visible between the epidermis and dermis. This band is considered an indicator of the active inflammation of psoriasis;[2,3] however, this phenomenon may also appear in patients with atopic or contact dermatitis. When the keratinocytes of the epidermis are excessively thickened, they may reflect the ultrasound wave, creating acoustic shadows that mask the parts of the dermis [Figure 2]. Increased blood flow in the dermis also reflects the acute inflammation of psoriasis; therefore, color or energy Doppler can be used to detect disease activity or monitor the efficacy of treatment.

Conclusion

The skin manifestations of rheumatic diseases are diverse and challenging to identify in the clinical practice. Based on

Address for correspondence: Dr. Ying-Chou Chen, Division of Rheumatology, Allergy, and Immunology, Department of Internal Medicine, Kaohsiung Chang Gung Memorial Hospital, No. 123, DaPi Road, Niaosong District, Kaohsiung City 83301 Taiwan.
E-mail: r820713@ms13.hinet.net

Received: 07-07-2021 **Accepted:** 27-07-2021 **Available Online:** 23-03-2022

Access this article online

Quick Response Code:

Website: www.jmuonline.org

DOI: 10.4103/jmu.jmu_153_21

How to cite this article: Chen JF, Cheng TT, Chen YC. Application of ultrasound in rheumatic skin disorders: Taking psoriasis as an example. J Med Ultrasound 2022;30:1-2.

Figure 1: The sonographic features of normal skin using a transducer frequency of 15 MHz, demonstrating the layers of epidermis, dermis, hypodermis, fascia, muscle, and bone

their previous experience of joint evaluation by ultrasound, more practitioners are using this modality to examine the skin lesions. Ultrasound allows the practitioner to describe skin's characteristics and measure skin thickness, and elastography is a valuable tool in the clinical diagnosis or assessment of disease activity, especially in scleroderma and psoriasis. This article provides information on the application of ultrasound in the examination of the skin in the hope that more rheumatologists will make the use of this modality in their clinical work.

Financial support and sponsorship

Nil.

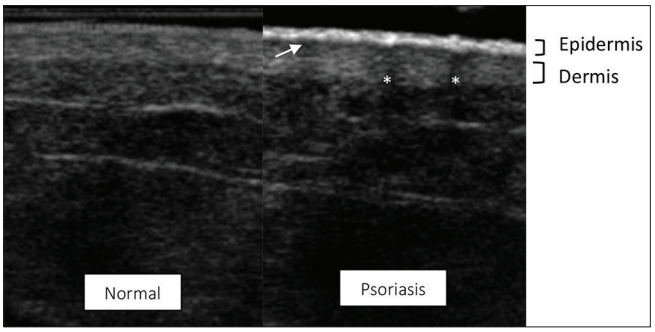

Figure 2: The sonographic features of skin on the thigh in a healthy participant and a participant with psoriasis. In the patient with psoriasis, the epidermis is thickened and more hyperechoic, a hypoechoic band (arrow) is visible between the epidermis and dermis and acoustic shadows (asterisks) are visible beneath two focal areas of epidermal thickening

Conflicts of interest

There are no conflicts of interest.

References

1. Mlosek RK, Malinowska S. Ultrasound image of the skin, apparatus and imaging basics. J Ultrason 2013;13:212-21.
2. Vaillant L, Berson M, Machet L, Callens A, Pourcelot L, Lorette G. Ultrasound imaging of psoriatic skin: A noninvasive technique to evaluate treatment of psoriasis. Int J Dermatol 1994;33:786-90.
3. Di Nardo A, Seidenari S, Giannetti A. B-scanning evaluation with image analysis of psoriatic skin. Exp Dermatol 1992;1:121-5.