

### Supplementary Text 1. HFUS features and their definitions for skin lesions.

High frequency ultrasound (HFUS) features of normal skin are as follows: (a) the epidermis appears as a hyperechoic line caused by the reflection of the acoustic beam and the dense stratum corneum; (b) the dermis is relatively loose and shows hyperechogenicity, with scattered punctate or linear hypoechoic or anechoic areas, representing skin appendages and blood vessels; (c) the subcutaneous tissue is hypoechoic, and the fibrous connective tissue shows hyperechoic strip or reticular septa (Supplementary Table 1).

#### Layer involvement

This feature provides the location of lesions and reflects the extent of the lesions' involvement.

Involve one layer.—

Lesions are located only in the epidermis, dermis, or subcutaneous tissue.

Involve  $\geq$  Two layers.—

Lesions involve epidermis and dermis, dermis and subcutaneous tissue, or all layers of the skin.

#### Growth pattern

This feature is defined as the overall morphology of a lesion.

Nodular.—

Lesions show regular morphology, such as round, semicircle, or oval.

Crawling.—

The crawling morphology means the lesion grows parallel to the skin, a specific feature of skin lesions.

Irregular.—

Lesions appear lobulated or other irregular morphology.

#### Surface

Surface morphology is usually based on the horizontal plane of the surrounding normal skin as a reference.

Flat.—

The lesions' surface is at the same level as the surrounding normal skin. This feature is common in lesions with crawling morphology or lesions located in subcutaneous tissue.

Convex.—

The lesions' surface is above the surrounding normal skin, and the morphology is regular. This feature is common in convex or large lesions located in the dermis and subcutaneous tissue.

Concave.—

The lesions' surface is lower than the surrounding normal skin, which is equivalent to ulceration.

Irregular.—

The skin on the surface of the lesion is sags and crests.

#### Bottom

The bottom features reflect the invasion of the lesion into the deep tissue.

Convex.—

The lesions' bottom is semicircular and convex to deep tissue, and the morphology is regular.

Flat.—

The lesions' bottom is straight, commonly seen in lesions with crawling growth patterns.

Irregular.—

The lesions' bottom is lobulated, jagged, or exhibits sharp angles.

#### Margin

This feature refers to the interface between the lesion and the adjacent normal tissue.

Well-defined.—

Lesions with well-defined and curvilinear interfaces typically show a round or elliptical shape.

Ill-defined.—

The interfaces of the lesions are difficult to distinguish from adjacent tissue for any reason.

#### Stratum corneum

The outermost layer of the epidermis is the stratum corneum. Abnormal keratinization of stratum corneum, including hyperkeratosis or parakeratosis, are features of many skin lesions that can provide critical information for disease diagnosis.

Normal.—

The stratum corneum appears as a continuous, smooth, and fine linear hyperechoic band without posterior acoustic attenuation.

Abnormal keratosis.—

When abnormal keratosis occurs, the hyperechoic band of the stratum corneum becomes thicker, rough, or wrinkled with various degrees of posterior acoustic attenuation.

Detachment of stratum corneum.—

This feature is defined as the interruption of the hyperechoic band of the stratum corneum, which can be found in two perpendicular planes on HFUS.

#### Echogenicity

Compared with normal subcutaneous fat layer, this feature can reflect the lesions' property to some extent.

Hyperechoic.—

Lesions exhibit increased echogenicity relative to normal subcutaneous fat layer. If a calcification makes it difficult to assess the echogenicity of a lesion, the lesion is considered hyperechoic.

Isoechoic.—

Lesions with similar echogenicity relative to normal subcutaneous fat layer.

Hypoechoic.—

Lesions with decreased echogenicity relative to normal subcutaneous fat layer.

Anechoic.—

Lesions are homogeneous cystic with posterior acoustic enhancement.

### **Internal homogeneity**

This feature refers to the consistency of echogenicity within a lesion, reflecting the complexity of components.

Homogeneous.—

Lesions show single echogenicity.

Heterogeneous.—

Lesions are inhomogeneous and show multiple echogenicities.

### **Hyperechogenicity inside the lesion**

This feature refers to areas of markedly increased echogenicity within a lesion compared to surrounding tissue. Hyperechogenic areas vary in size and shape.

Absent.—

There are no hyperechoic areas inside the lesions.

Punctate.—

This feature is defined as tiny hyperechoic spots equal to or less than 1 mm in diameter.

Strip/Patchy.—

This feature is defined as short-linear or patchy hyperechoic areas inside a lesion.

### **Cystic composition**

Lesions composed entirely or partly of liquid.

Absent.—

There are no anechoic areas inside a lesion.

Present.—

There are anechoic areas inside a lesion.

### **Posterior acoustic feature**

This feature can reflect the property of a lesion and the degree of keratinization.

Normal.—

The posterior echogenicity of a lesion is similar to normal tissue at the same level.

Attenuation.—

The posterior echogenicity of a lesion is decreased compared with normal tissue at the same level.

Enhancement.—

The posterior echogenicity of a lesion is enhanced compared with normal tissue at the same level.

### **Color Doppler flow signals**

This feature refers to the vascularity of skin lesions on color Doppler ultrasound.

Absent.—

There are no color Doppler flow signals inside a lesion.

Present.—

There are color Doppler flow signals inside a lesion.

### **Feeding arteries**

Feeding arteries refers to a thick vessel surrounding or at the bottom of a lesion and branching into the lesion.

Absent.—

No thick vessels branch into the lesion.

Present.—

One or more thick vessels surround or at the bottom of a lesion and branch into the lesion.